Alternative Fuels and Vehicles: Legislative Proposals

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SUMMARY

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Alternative Fuels and Vehicles: Legislative Proposals

Congress continues to pursue broad goals of reducing petroleum-based fuel consumption and greenhouse gas (GHG) emissions in road transportation. Legislative proposals in the 116th Congress—several of which have been reintroduced in the 117th Congress—would have promoted the deployment of alternative fuels (AFs) and alternative fuel motor vehicle (AFV) technologies, including the categories of:

- biofuels for use in conventional or flexible-fuel vehicles;
- electricity and plug-in electric vehicles (PEVs; i.e., battery-electric and plug-in hybrid-electric vehicles);
- hydrogen and fuel cell vehicles (FCVs); and
- zero-emission vehicles (ZEVs; e.g., battery-electric vehicles and FCVs).

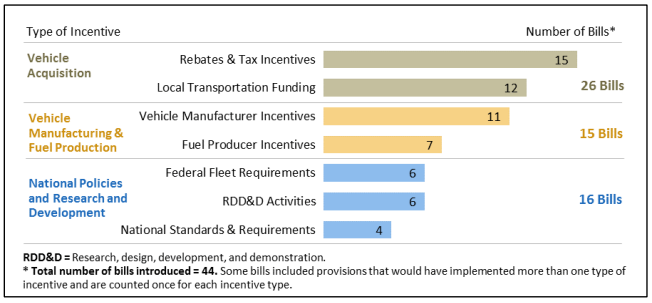
Federal legislation and regulation enacted since the 1970s established agency authorities, energy goals, and fuel economy and emissions standards; defined alternative fuels and vehicles; and enacted federal programs. Major federal programs and incentives include the Corporate Average Fuel Economy (CAFE) standards, production incentives under the Alternative Motor Fuels Act and the Energy Policy Act of 2005, and tax credits for alternative fuel vehicles and new qualified plug-in electric drive motor vehicles.

Several major barriers to the adoption of AFs and AFVs exist. These include certain differences between AFVs and conventional internal combustion engine vehicles (ICEVs), such as the costs of purchase and ownership, as well as driving range and convenience of refueling. Market forces, in particular the price of petroleum fuels, play a role in the adoption of alternative fuels and vehicles, which substitute for ICEVs and the petroleum fuels that run them. Advanced technological challenges also may arise around ensuring the safety of fuel delivery; providing repair and maintenance; and recycling and disposing of consumed lubricating oils, other fluids, and other parts.

Building on existing programs and addressing various barriers to adoption, AF and AFV legislation from the 116th Congress identified by CRS generally falls into three groups of categories (see figure; **Figure 2** for full size).

Some of these policy options have been reintroduced in the 117th Congress or proposed by the Biden Administration, including proposals that would promote the deployment of AFVs through producer and buyer incentives, provide for programs to expand the use of AFVs in buses and other larger vehicles, and to promote the procurement of AFVs for government fleets.

Bills Introduced in the 116th Congress by Incentive Type



Source: CRS from Congress.gov.

Notes: RDD&D = Research, design, development, and demonstration. Some bills included provisions that would have implemented more than one type of incentive and are counted once for each incentive type that is applicable. Includes bills that were enacted and not enacted.

Contents

Figures

Tables

Appendixes

Contacts

Introduction

Congress maintains a continuing interest in reducing petroleum-based fuel consumption and greenhouse gas (GHG) emissions in transportation. In 2019, the transportation sector—mostly motor vehicles—contributed 29% of total U.S. GHG emissions,[1] using primarily petroleum-based fuels, which made up 91% of total fuel consumption.[2] To achieve petroleum consumption and GHG emission reduction goals, Members of Congress introduced numerous legislative proposals that would have promoted the deployment and use of alternative fuels (AFs)—such as biofuels, hydrogen, and electricity—and alternative fuel motor vehicle (AFV) technology—such as flex-fuel, fuel-cell, and electric vehicles (see "Alternative Fuels and Alternative Fuel Vehicles"). The use of alternative fuels and vehicles has the potential to reduce the transportation sector's overall emissions of GHGs, particulate matter, and other air pollutants, by reducing the consumption of petroleum fuels. The potential for any such reduction varies depending on the fuels and vehicles that gain in widespread use compared to their conventional counterparts.[3]

Legislative proposals rely on various approaches to support different aspects of the transportation sector. Some proposals offer tax incentives for the purchase of AFs or AFVs; offer grants or loans for transition of fleets to AFVs; authorize funding for research, design, development, and demonstration (RDD&D) to improve existing technologies and develop new technologies; and/or establish national policies or standards for emissions or vehicle fleet composition. Some of these proposals also seek to incentivize the use of AFs in different classes of vehicles, from light-duty to medium- and heavy-duty.[4] Some proposals would extend or expand previously established programs or policies, while others propose new ones.

Some of these proposals were enacted during the 116th Congress, including provisions to extend existing tax incentives, grant and loan programs, and research and development activities.[5]

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[1] Greenhouse gas (GHG) emissions include carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride. U.S. Environmental Protection Agency (EPA), *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2019*, April 2021, Table 2-10, "U.S. Greenhouse Gas Emissions Allocated to Economic Sectors." When electricity-related emissions are included, the share of transportation emissions remains at 29%. EPA, *Inventory of Greenhouse Gas Emissions*, Table 2-12, "U.S. Greenhouse Gas Emissions by Economic Sector and Gas with Electricity-Related Emissions Distributed."

[2] Fuels include petroleum, natural gas, biomass (e.g., ethanol), and electricity (consisting of retail sales and electrical system energy losses). Department of Energy (DOE), Energy Information Administration (EIA), *Monthly Energy Review*, May 2021, Table 2.5, "Transportation Sector Energy Consumption." Motor vehicles accounted for 77% of total fuel consumption in 2020, including light-duty vehicles, medium- and heavy-duty vehicles, and commercial light trucks, but not bus transportation (included in "other"). EIA, *Annual Energy Outlook 2021* [chart library], "Transportation Sector Consumption by Mode, AEO2021 Reference Case."

[3] Numerous proposals also would promote the installation and use of alternative fuel infrastructure, though such proposals are beyond the scope of this report. For additional information on alternative fuel charging and fueling stations programs and potential deployment issues, see CRS Report R42566, *Alternative Fuel and Advanced Vehicle Technology Incentives: A Summary of Federal Programs*, by Lynn J. Cunningham et al., and CRS Report R45747, *Vehicle Electrification: Federal and State Issues Affecting Deployment*, by Bill Canis, Corrie E. Clark, and Molly F. Sherlock.

[4] *Light-duty vehicles* include passenger cars, pickup trucks, sport utility vehicles (SUVs), and minivans. *Medium-duty vehicles* include refrigerated trucks, school buses, and smaller transit buses. *Heavy-duty vehicles* include large transit buses, tractor-trailer trucks, and construction vehicles. U.S. Department of Transportation (DOT), *Field Operations Guide for Safety/Service Patrols*, "Figure 21. Law Enforcement Vehicle Identification Guide," accessed May 26, 2021, https://ops.fhwa.dot.gov/publications/fhwahop10014/s5.htm#f21.

[5] For more on tax provisions that recently expired or are soon to expire, see CRS Report R46451, *Energy Tax Provisions Expiring in 2020, 2021, 2022, and 2023 ("Tax Extenders")*, by Molly F. Sherlock, Margot L. Crandall-Hollick, and Donald J. Marples.

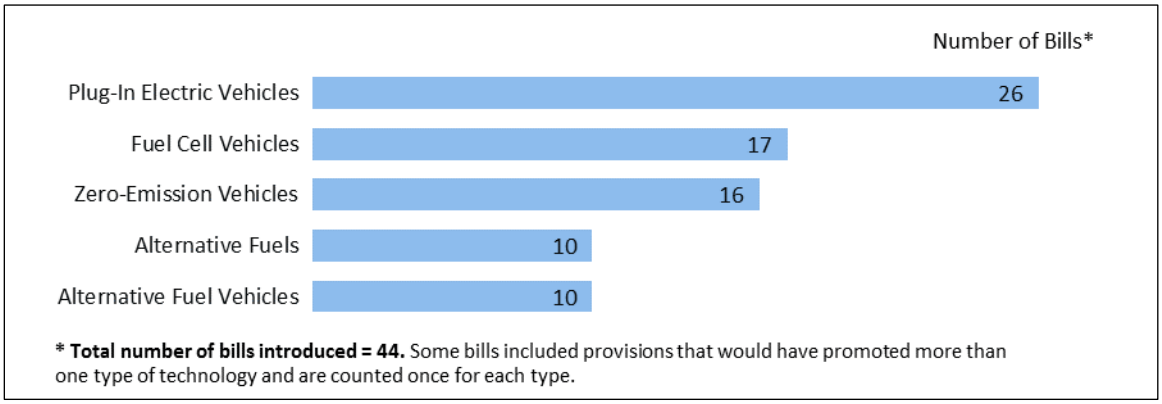
This report examines provisions within legislative proposals that would support the broader deployment of alternative fuels and alternative fuel vehicles; a discussion of relevant enacted legislation, including definitions of alternative fuels and vehicles found in statute; identification of major barriers and obstacles to increasing deployment of AFs and AFVs; and an analysis of legislation introduced in the 116th Congress.

Alternative Fuels and Alternative Fuel Vehicles

CRS identified legislation supporting alternative fuels as defined in the Energy Policy Act of 1992 (EPAct 1992; P.L. 102-486) and subsequent amendments; such fuels are "substantially not petroleum and would yield substantial energy security benefits and substantial environmental benefits."[6] Different policy approaches may be more effective in incentivizing particular types of fuels or technologies. While the goal of AF policies is generally to reduce the use of petroleum through substitution, many alternative fuels are derived in part from petroleum (e.g., fuel blends) or may be produced through the combustion of fossil fuels (e.g., electricity and hydrogen generated from coal or natural gas sources).

Figure 1. Bills Introduced in the 116th Congress by Technology Type

Number of bills that would have promoted each technology type



Source: CRS from Congress.gov.

Notes: Provisions were categorized based on the vehicle or fuel specifically referenced within the text of the legislation. Some bills included provisions that would have promoted more than one type of fuel or vehicle technology and are counted once for each technology type that is applicable. Includes bills that were enacted and not enacted.

Figure 1 summarizes the number of bills introduced in the 116th Congress that would have implemented policies promoting the different types of alternative fuel or vehicle technology. Ten bills included provisions that would have promoted alternative fuels, 10 bills had provisions to promote alternative fuel vehicles broadly, 16 bills included policies to promote zero-emission vehicles (ZEVs) broadly, 26 bills included provisions with electric vehicle-specific policies and programs, and 17 bills had provisions to promote fuel cell vehicles. Following are descriptions for AF and AFV categories referenced in these bills.

Alternative Fuels and Alternative Fuel Vehicles. AFs and AFVs generally include all fuels and vehicles described in this section. Statute and regulation also include coal-derived liquid fuels, liquid fuel blends derived from renewable sources, and other fuels determined by the Department

[6] 42 U.S.C. §13211.

of Energy to be "substantially not petroleum" (e.g., P-series fuels)[7] and that would benefit the general aims of energy security and environmental protection.[8] Depending on the program, AFVs may also include certain hybrid or dual-fuel vehicles not included in other categories, such as hybrid-electric vehicles.[9]

Biofuels and Conventional or Flex-Fuel Vehicles. Ethanol, other alcohols, and biodiesel are derived from biological materials and blended with petroleum-based fuels for use in conventional or internal combustion engine vehicles (ICEVs). E10, a common form of ethanol in transportation fuels, is a blend of 10% ethanol by volume with gasoline for use in light-duty ICEVs.[10] In the United States, ethanol is primarily derived from corn grain but may also be derived from other sources such as sugar cane and wood chips.

E85 contains at least 85% ethanol by volume blended with gasoline or other fuels for use in flex-fuel vehicles (FFV).[11] FFVs have an internal combustion engine and offer the flexibility of using any combination of gasoline and/or E85.

B100, or "neat biodiesel," is 100% biodiesel, a liquid fuel manufactured from vegetable oils or animal fats.[12] B100 is then blended with conventional diesel for use in diesel engines, often at the 5% (B5) or 20% (B20) level.

Electricity and Plug-in Electric Vehicles. Electricity is generated from a variety of sources depending on geographic location of power plants, time of day, and season. It is used to charge batteries stored onboard light-, medium-, and heavy-duty plug-in electric-vehicles (PEVs),[13] which may be dedicated (i.e., battery-electric vehicles) or hybrid (i.e., plug-in hybrid-electric vehicles).[14]

Hydrogen and Fuel Cell Vehicles. Hydrogen is extracted from water and other sources (e.g., natural gas, coal, and biomass), commonly through the processes of steam reforming—a process that combines steam and natural gas—or electrolysis—a process that splits water molecules into hydrogen and oxygen.[15] Hydrogen is then used to power fuel cell vehicles (FCVs), where hydrogen stored in the vehicle is used to generate electricity for operating light-, medium-, and heavy-duty vehicles.[16]

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[7] Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy (EERE), "Alternative Fuel Transportation Program; P-Series Fuels," 64 *Federal Register* 26822, 1999.

[8] 42 U.S.C. §13211(2).

[9] A hybrid-electric vehicle, distinct from a plug-in hybrid-electric vehicle, has a battery that charges through a regenerative charging process rather than via external electricity and requires gasoline to operate. DOE, Alternative Fuels Data Center (AFDC), "Hybrid and Plug-In Electric Vehicles," accessed May 26, 2021, https://afdc.energy.gov/vehicles/electric.html.

[10] AFDC, "Ethanol Fuel Basics," accessed May 26, 2021, https://afdc.energy.gov/fuels/ethanol_fuel_basics.html.

[11] AFDC, "Flexible Fuel Vehicles," accessed May 26, 2021, https://afdc.energy.gov/vehicles/flexible_fuel.html.

[12] Biodiesel was included as an *alternative fuel* by regulation. DOE, "Alternative Fuel Transportation Program," *Federal Register* 61, no. 51 (March 14, 1996): 10622, https://www.govinfo.gov/content/pkg/FR-1996-03-14/pdf/96-5702.pdf. AFDC, "Biodiesel Fuel Basics," accessed May 26, 2021, https://afdc.energy.gov/fuels/biodiesel_basics.html.

[13] AFDC, "Emissions from Hybrid and Plug-In Electric Vehicles," interactive figure, accessed May 26, 2021, https://afdc.energy.gov/vehicles/electric_emissions.html.

[14] AFDC, "Electricity," accessed May 26, 2021, https://afdc.energy.gov/fuels/electricity.html.

[15] AFDC, "Hydrogen," https://afdc.energy.gov/fuels/hydrogen.html. Other processes also can be used to produce hydrogen. For more information on hydrogen production and challenges around hydrogen as an energy source see CRS Report R46436, *Hydrogen in Electricity's Future*, by Richard J. Campbell.

[16] Hydrogen may also be burned in an internal combustion engine, but for various reasons fuel cells are expected to be

Natural Gas and Natural Gas Vehicles. Natural gas is extracted from geologic formations, and is stored for use in transportation as compressed natural gas (CNG) or liquefied natural gas (LNG).[17] CNG, stored in a gaseous state, is suitable for use in light-, medium-, and heavy-duty vehicles. LNG, cooled and stored as a liquid, is suitable for use in medium- and heavy-duty vehicles. CNG and LNG vehicles may have a dedicated configuration or hybrid configuration for use with both natural gas and conventional fuel.

Propane and Propane Vehicles. Propane, or liquefied petroleum gas (LPG), is a byproduct of the production of natural gas or crude oil.[18] LPG may be used in dedicated or dual-fuel vehicles with light-, medium-, or heavy-duty applications.

Zero-Emission Vehicles. This term is used to describe vehicles that emit zero GHGs while being operated. Typically, ZEVs include fuel cell vehicles and battery-electric vehicles, but may also include any other vehicle that similarly emits zero GHGs from the vehicle.[19]

Statutory Foundation of Federal Policies for Alternative Fuels and Vehicles

Federal legislation and regulation enacted since the 1970s form the foundation for AF and AFV policies and programs. These laws and regulations established agency authorities, energy goals, and efficiency and emissions standards; defined alternative fuels and vehicles; and enacted federal programs.[20]

Fuel Economy and Emissions Standards

The Clean Air Act of 1970 (CAA; P.L. 91-604) established initial emissions standards for vehicles and provided the initial authority for the U.S. Environmental Protection Agency (EPA) to regulate emissions standards.[21] The Energy Policy and Conservation Act (EPCA; P.L. 94-163), enacted in 1975, established Corporate Average Fuel Economy (CAFE) standards for new light-duty vehicles (e.g., passenger vehicles and light trucks) and provided the initial authority for the National Highway Traffic Safety Administration (NHTSA) within the Department of Transportation (DOT) to regulate CAFE standards. Amendments to EPCA in the Energy Independence and Security Act of 2007 (EISA; P.L. 110-140) established a schedule for

the preferred technology pathway for passenger vehicles. Until 2005, DOE funded R&D for onboard reforming of hydrogen from petroleum products for fuel cell vehicles. A review panel determined that these technologies were unable to meet previously established targets and recommended shifting focus to onboard hydrogen storage for fuel cell vehicles and hydrogen infrastructure. DOE, *On-Board Fuel Processing Go/No-Go Decision*, DOE Decision Team Committee Report, August 2004, https://www.energy.gov/sites/default/files/2018/02/f49/fcto_2004_go_nogo_onboard_fuel_processing_fcv.pdf.

[17] AFDC, "Natural Gas Fuel Basics," accessed May 26, 2021, https://afdc.energy.gov/fuels/natural_gas.html.

[18] EERE, *Propane Basics*, May 2016, https://afdc.energy.gov/files/u/publication/propane_basics.pdf.

[19] There may be associated upstream emissions from the production of the fuel, particularly if the original energy supply is a fossil fuel.

[20] AFDC, "Key Federal Legislation," accessed May 26, 2021, https://afdc.energy.gov/laws/key_legislation.

[21] Ibid. Additional authorities for regulating vehicle emissions standards are provided by the Clean Air Act Amendments of 1990 (P.L. 101-549).

increasing fuel economy for motor vehicles, mandating at least 35 miles per gallon for model year 2020 compared to about 26.6 miles per gallon in model year 2007.[22]

Incentives for Manufacturers and Producers

In 1988, the Alternative Motor Fuels Act (P.L. 100-494) established an incentive for vehicle manufacturers to meet CAFE standards by producing vehicles that could operate on alternative fuels. At the time, these included ethanol, methanol, and natural gas, which were estimated to produce less carbon dioxide than similar quantities of gasoline or diesel.[23] Alternative fuels were later defined in the Energy Policy Act of 1992 (EPAct 1992; P.L. 102-486), forming part of the basis for defining alternative fuels used by subsequent laws, regulations, and programs. That law also established AFV purchase requirements for federal, state, and certain private vehicle fleets.

The Energy Policy Act of 2005 (EPAct 2005; P.L. 109-58) established new programs and new authorities to promote the production and use of alternative fuels and vehicles. For example, the statute established the Renewable Fuel Standard, which mandated a certain volume of renewable fuel (e.g., ethanol) be blended into transportation fuel nationwide.[24] This mandate was expanded in 2007 by EISA.

Three fuel-related incentives have been established to promote the production of certain biofuels or renewable fuels for use as fuels or to produce fuel blends with gasoline or diesel. These tax incentives have been extended in one- or two-year increments, in some cases retroactively.

EPAct 2005 included a tax credit for biodiesel and renewable diesel mixtures.[25] The tax credit may be claimed by producers or blenders for each gallon of biodiesel or renewable diesel used to produce a biodiesel mixture. This tax credit has been extended through 2022.[26]

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA; P.L. 109-59) established tax credits for alternative fuels and alternative fuel mixtures.[27] The tax credit may be claimed by producers for each gallon of certain alternative fuels used as a fuel or suppliers for each gallon of alternative fuels blended with gasoline or diesel for use as a fuel. These tax credits were extended through December 31, 2021.[28]

The second generation biofuel producer credit[29] is designed to spur production of second generation biofuels—liquid fuels produced from renewable biological materials. The tax credit

[22] The 2007 legislation was the last time Congress legislated CAFE standards; subsequent changes after 2010 were regulatory. For more on fuel efficiency and greenhouse gas standards, see CRS Report R45204, *Vehicle Fuel Economy and Greenhouse Gas Standards: Frequently Asked Questions*, by Richard K. Lattanzio, Linda Tsang, and Bill Canis, and CRS In Focus IF10871, *Vehicle Fuel Economy and Greenhouse Gas Standards*, by Richard K. Lattanzio, Linda Tsang, and Bill Canis.

[23] 102 Stat. 2441 Sec. 2. Methanol produced from natural gas or biomass was estimated to produce less carbon dioxide than similar quantities of gasoline or diesel, or methanol produced from coal.

[24] For more on the Renewable Fuel Standard see CRS Report R43325, *The Renewable Fuel Standard (RFS): An Overview*, by Kelsi Bracmort and CRS Report R44045, *The Renewable Fuel Standard (RFS): Waiver Authority and Modification of Volumes*, by Kelsi Bracmort.

[25] 26 U.S.C. §6426(c).

[26] P.L. 116-94.

[27] 26 U.S.C. §6426(d) and 26 U.S.C. §6426(e).

[28] P.L. 116-94.

[29] 26 U.S.C. §40(b)(6). AFDC, "Second Generation Biofuel Producer Tax Credit," accessed May 26, 2021, https://afdc.energy.gov/laws/10515.

may be claimed by the producer for each gallon of fuel sold for specified uses. This tax credit was extended through January 1, 2022.

The federal government also has implemented other policies to promote adoption of alternative fuel technologies, which are periodically reauthorized by Congress. These include the EPA Diesel Emissions Reduction program and private activity bonds issued by the Department of Transportation.[30]

Incentives for Vehicle Purchasers

Tax incentives have been implemented to incentivize consumer purchases of certain AFVs.

Buyers of fuel cell vehicles (FCVs) may be eligible for a tax credit of up to $8,000 (26 U.S.C. §30B), for FCVs purchased by December 31, 2021.[31] Eligibility for FCVs originated with the tax credit for alternative motor vehicles, enacted in 2005,[32] along with advanced lean-burn technology vehicles, hybrid vehicles, and other alternative fuel vehicles, with distinct limitations for each vehicle type.[33] Vehicles other than FCVs must have been purchased by December 31, 2010, in order to qualify for the tax credit. In addition, for hybrid vehicles and advanced lean-burn technology vehicles, the credit was capped at 60,000 vehicles per manufacturer, after which the credit phased out.[34]

Buyers of PEVs may be eligible for a tax credit up to $7,500 (26 U.S.C. §30D). The tax credit for new qualified plug-in electric drive motor vehicles was enacted in 2008, designed as a short-term subsidy to introduce consumers to new technology.[35] The full credit is capped at 200,000 per vehicle manufacturer, after which the credit is phased out.[36] As of January 2020, Tesla and General Motors surpassed this cap and the tax credit is not currently available for purchasers of those vehicles.

Other Policies and Programs

The federal government also supports research, design, development, and demonstration projects for alternative fuel technologies. Congress also has periodically reauthorized a number of funding programs. These projects and programs are funded through the annual appropriations process. One such program is the Department of Energy's Clean Cities program, which supports local

[30] CRS In Focus IF11331, *The Diesel Emissions Reduction Act (DERA) Program*, by Richard K. Lattanzio. DOT, Federal Highway Administration (FHA), "Private Activity Bonds (PABs)," May 26, 2021, https://www.fhwa.dot.gov/ipd/finance/tools_programs/federal_debt_financing/private_activity_bonds/.

[31] P.L. 116-260.

[32] Energy and Policy Act of 2005 (P.L. 109-58).

[33] Generally, advanced lean burn vehicles have internal combustion engines that incorporate technology that "achieves at least 125% of the 2002 model year city fuel economy." Energy and Policy Act of 2005 (P.L. 109-58). Hybrid vehicles may include hybrid-electric vehicles, but exclude vehicles that qualify for other tax credits such as plug-in hybrid-electric vehicles.

[34] The credit decreases by percentage over five calendar quarters after the credit is claimed on the 60,000th qualifying vehicle.

[35] The credit for PEVs was established by the Energy Improvement and Extension Act of 2008, enacted as Division B of P.L. 110-343. As first enacted, the credit was to phase out once 250,000 credit-eligible vehicles were sold. The PEV phase-out threshold was changed from a 250,000 vehicle limit to a 200,000 vehicle per manufacturer limit in the American Recovery and Reinvestment Act of 2009 (P.L. 111-5).

[36] The credit decreases by percentage over five calendar quarters after the 200,000th qualifying vehicle is purchased. For more on the tax credit see CRS In Focus IF11017, *The Plug-In Electric Vehicle Tax Credit*, by Molly F. Sherlock.

efforts to reduce petroleum use in transportation, including deployment of alternative fuels and vehicles.[37]

For a full list of existing programs, see CRS Report R42566, *Alternative Fuel and Advanced Vehicle Technology Incentives: A Summary of Federal Programs*, by Lynn J. Cunningham et al.

Discussion of Major Barriers to Adoption

New technologies typically face a number of barriers to industrial and consumer adoption. In the United States, ICEVs and petroleum fuels benefit from a history as the dominant technology in road transportation that has facilitated, among other things, familiarity among consumers and vast infrastructure for production, distribution, and fueling. As a result, broad deployment and adoption of alternative fuels and vehicles face an incumbent technology with a variety of advantages. Some policymakers have sought to address the commercialization barriers faced by AFs and AFVs through legislation and policy. Some of these efforts were undertaken in the 116th Congress. The following sections describe some of these barriers.

Vehicle Cost

Vehicle cost comprises the upfront cost to purchase a new or used vehicle (to be paid at the point of sale or via payment plan) and the costs of use and maintenance over its lifetime (e.g., refueling, maintenance, periodic parts replacement). While a higher upfront cost for some AFVs may be offset by lower fuel costs over the lifetime of the vehicle depending on the comparative price of petroleum, higher upfront costs may impose a barrier to consumer acceptance. Due to existing consumer tax credits that tend to target PEVs, greater focus on PEVs in proposed legislation, and limited availability of FCVs nationwide, this section focuses more on PEVs.

In the case of new electric vehicle purchases, one study determined the price at which respondents would consider purchasing an electric vehicle to be $35,765 in the United States (and $36,000 on average globally).[38] For comparison, the average price of a new car in the United States was $25,826 in 2019,[39] and many smaller new ICEVs retail for under $20,000. Tax incentives can help overcome the higher upfront cost of AFVs by lowering the cost to consumers; however, the benefit of such tax incentives may only be accessible to consumers with a tax liability to apply the credit since it is not a refundable tax credit. For the 2018 tax year, 80% of those claiming the tax credit for new qualified plug-in electric vehicles had an adjusted gross income of $100,000 or more.[40] Manufacturers may also increase prices when consumers receive tax credits, such that the benefits of the tax credit are shared between the buyer and the seller.[41]

[37] EERE, *Clean Cities: Building Partnerships to Cut Petroleum Use in Transportation*, DOE/G0-102020-5515, January 2021, https://afdc.energy.gov/files/u/publication/clean_cities_coalitions_overview.pdf.

[38] Castrol, *Accelerating the EVolution*, 2020, p. 17, https://www.castrol.com/content/dam/castrol/master-site/en/global/home/technology-and-innovation/electric-vehicle-adoption/accelerating_the_evolution_study.pdf.

[39] Domestic price of passenger cars sold in the United States, not including vans, SUVs, or light trucks. Oak Ridge National Lab (ORNL), *Transportation Energy Data Book*, "Table 11.13. Average Price of a New Car," 38th ed., August 2020.

[40] For comparison, taxpayers with an adjusted gross income of $100,000 or more made up 19% of all tax payers in 2018. Internal Revenue Service, *SOI Tax States—Individual Statistical Tables by Size of Adjusted Gross Income*, Table 3.3 "All Returns: Tax Liability, Tax Credits, and Tax Payments, by Size of Adjusted Gross Income, Tax Year 2018 (Filing Year 2019)," https://www.irs.gov/statistics/soi-tax-stats-individual-statistical-tables-by-size-of-adjusted-gross-income.

[41] Media reports suggest that Tesla reduced vehicle prices when the tax credit expired, suggesting that Tesla was able to

Grants and loans for state and local fleet managers support fleet acquisition of AFVs, but some federal programs are competitive and funding may be limited. Once purchased, the costs of use and maintenance depend on individual driving patterns and local costs of fuel (e.g., liquid fuels, electricity). Annual fuel cost data suggest that PEVs—ranging from $450 to $2,450 in annual fuel costs—may be cheaper to own than gasoline vehicles—ranging from $700 to $4,900.[42] Electric vehicles may also require less maintenance due to fewer moving parts in the electric drivetrain and fewer lubricants and other fuels.[43]

Vehicle Performance

Driving range between refueling stops and the convenience of refueling are additional consumer concerns, especially with respect to PEVs,[44] which typically have shorter driving ranges than ICEVs.[45] One survey reported that 60% of respondents made at least one driving trip longer than 200 miles without making stops, which may inform consumer expectations for AFVs.[46] While some RDD&D is focused on increasing driving ranges, some studies suggest that driving ranges offered by PEVs are sufficient to meet the average daily driving needs of most consumers in the United States.[47]

Fuel cell and flex-fuel vehicles have a refueling time comparable to ICEVs, which can take several minutes to fill up an empty tank. Meanwhile, a PEV may take less than an hour or more than 12 hours depending on the battery capacity and type of charging equipment.[48]

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capture some of the benefit of the tax credit. See Jack Stewart, "Tesla's $7,500 Tax Credit Goes Poof, but Buyers May Benefit," *Wired*, January 2, 2019, https://www.wired.com/story/tesla-tax-credit-price-cut/.

[42] DOE and EPA, FuelEconomy.gov, *Fuel Economy Guide: Model Year 2020,* datafile, https://www.fueleconomy.gov/feg/download.shtml.

[43] AFDC, "Maintenance and Safety of Hybrid and Plug-In Electric Vehicles," accessed May 26, 2021, https://afdc.energy.gov/vehicles/electric_maintenance.html.

[44] In a 2021 survey, 60% of respondents cited range as a top concern. OC&C Strategy Consultants (OC&C), *Battery Late Than Never*, April 12, 2021, https://www.occstrategy.com/en/our-insights/our-insight/id/6276/battery-late-than-never. In a 2019 survey, 51% of respondents cited longer driving ranges would increase their interest in PEVs. Consumer Reports and Union of Concerned Scientists, *Electric Vehicle Survey Findings and Methodology*, July 2019, https://advocacy.consumerreports.org/wp-content/uploads/2019/07/ConsumerReports-UnionofConcernedScientists-2019-EV_Survey-7.17.19.pdf. According to a Volvo study, 58% of all respondents cited "running out of power" as a top concern. The Drive, "Americans Cite Range Anxiety, Cost as Largest Barriers for New EV Purchases: Study," February 26, 2019, https://www.thedrive.com/news/26637/americans-cite-range-anxiety-cost-as-largest-barriers-for-new-ev-purchases-study.

[45] AFDC, "All-Electric Vehicles," accessed May 26, 2021, https://afdc.energy.gov/vehicles/electric_basics_ev.html. The median driving range for gasoline vehicles was 412 miles for model year 2016. EERE, "Fact #939: August 22, 2016 All-Electric Vehicle Ranges Can Exceed Those of Some Gasoline Vehicles," https://www.energy.gov/eere/vehicles/fact-939-august-22-2016-all-electric-vehicle-ranges-can-exceed-those-some-gasoline. The median driving range for electric vehicles was 259 miles on a single charge for model year 2020. EERE, "FOTW #1167, January 4, 2021: Median Driving Range of All-Electric Vehicles Tops 250 Miles for Model Year 2020," https://www.energy.gov/eere/vehicles/articles/fotw-1167-january-4-2021-median-driving-range-all-electric-vehicles-tops-250.

[46] OC&C, *Battery Late Than Never*.

[47] As an example, based on 2017 data, a PEV with a driving range of 120 miles (e.g., Volkswagen e-Golf) was sufficient to meet the average daily driving needs of 96% of U.S. drivers where 87% of U.S. drivers had an average daily driving distance of less than 60 miles. The International Council on Clean Transportation, "Five Things You Know About EVs That Aren't Exactly True," December 2, 2020, https://theicct.org/cards/stack/explaining-electric-vehicles.

[48] Level 1 charging through 120 volts of alternating current (AC) delivers 2 to 5 miles of driving range per hour, level 2 through 240 volts AC delivers 10 to 20 miles of range per hour, and direct current (DC) fast charging (i.e., level 3) delivers 120 to 240 miles of range per hour. AFDC, "Developing Infrastructure to Charge Plug-In Electric Vehicles,"

In addition to technology improvements, investment in expansion of existing AF refueling infrastructure may address these concerns. Access to numerous reliable refueling stations may mitigate some range anxiety and soften expectations that AFVs provide the same driving range and refueling experience as ICEVs. A discussion of provisions regarding infrastructure falls outside of the scope of this report.[49]

Other performance characteristics that may pose barriers to deployment and adoption of AFVs include reliability and safety of vehicles, maintenance infrastructure compared to conventional vehicles, and overall driving experience compared to conventional vehicles.[50]

Fuel Prices and Consumer Preferences

Historically, the price of oil has demonstrated a certain volatility, increasing and decreasing in response to changes in global demand and supply, geopolitical events, and other worldwide events, including the 2020 COVID-19 global pandemic.[51] Studies and reports have documented observations that changes in fuel prices are followed by changes in market shares for smaller light-duty vehicles (i.e., passenger cars) versus larger light-duty vehicles (i.e., light trucks). According to a report from the Congressional Budget Office, increases in gasoline prices have been followed by decreased sales of light trucks and increased sales of passenger cars, which generally have higher fuel economy;[52] conversely, decreases in gasoline prices have been followed by sales of each vehicle type returning to levels before price increases. This trend was later observed in 2015, when a decrease in gasoline prices correlated with an increase in sales of light trucks (e.g., SUVs) and a decrease in passenger car sales.[53]

It may follow that fuel prices play a role in the adoption of alternative fuels and vehicles, which substitute for petroleum fuels; however, a 2020 analysis found that vehicle choices may be more strongly associated with certain driver characteristics than with fuel efficiency or fuel prices, particularly over the long term.[54] EPA data shows that the production share of light trucks has

accessed May 26, 2021, https://afdc.energy.gov/fuels/electricity_infrastructure.html.

[49] For additional information on PEV infrastructure see CRS Report R45747, *Vehicle Electrification: Federal and State Issues Affecting Deployment*, by Bill Canis, Corrie E. Clark, and Molly F. Sherlock.

[50] In a 2021 survey, 26% of respondents cited concerns over the reliability or the "risk of breaking down" of PEVs. OC&C, *Battery Late Than Never*. In a 2019 survey, 20% of respondents cited concerns over "performance capability" of PEVs, particularly the ability of PEVs to provide a "'responsive' driving experience." The Drive, "Americans Cite Range Anxiety."

[51] Global economic lockdowns pushed oil prices from approximately $60 per barrel at the beginning of 2020 down to approximately $20 per barrel in April; oil prices approached $50 per barrel by the end of 2020. EIA, Petroleum and Other Liquids, WTI Spot Prices, May 26, 2021, https://www.eia.gov/dnav/pet/pet_pri_spt_s1_m.htm. For more on oil and gasoline prices, see CRS Insight IN11246, *Low Oil Prices and U.S. Oil Producers: Policy Considerations*, by Phillip Brown and Michael Ratner, and CRS Insight IN11311, *U.S. Gasoline Prices: No Driving, No Benefits to Consumers*, by Michael Ratner.

[52] Light trucks includes pick-up trucks, minivans, and SUVs. Congressional Budget Office (CBO), "Gasoline Prices and Vehicle Markets," chap. 2 in *Effects of Gasoline Prices on Driving Behavior and Vehicle Markets* (Washington, DC: U.S. Government Printing Office, 2008).

[53] From January to August 2015, nearly 600,000 more light trucks (including SUVs) were sold compared to the same period in 2014, and 168,000 fewer passenger cars were sold. Eric Morath, "Gas-Price Drop Takes Americans' Interest in Fuel Economy Down with It," *The Wall Street Journal*, September 4, 2015, https://www.wsj.com/articles/BL-REB-33972. Benjamin Leard, Virginia McConnell, and Yichen Zhou, "Fleet Vehicles and U.S. Fuel Economy: How Do Fuel Prices Affect Vehicle Purchase Decisions for Big Buyers?" *Resources*, April 6, 2018.

[54] Driver characteristics include driving patterns, age, and education. Arik Levinson and Lutz Sager, *Who Values Future Energy Savings? Evidence from American Drivers*, National Bureau of Economic Research Working Paper Series, December 2020, p. 37, https://www.nber.org/system/files/working_papers/w28219/w28219.pdf.

increased to more than 50% for model year 2019 compared to approximately 25% for model year 1985.[55] This overall trend is predicted to continue as consumer preferences change and manufacturers adjust their vehicle lineups.[56] Market-based policies may be used to promote alternative fuels and vehicles, but precise outcomes may be difficult to predict.

Other Challenges

As the variety and number of alternative fuels and vehicles increases, challenges may arise around ensuring the safety of fuel delivery, providing repair and maintenance, and recycling and disposing of consumed lubricating oils, other fluids, and other parts. For example, batteries from plug-in electric vehicles are costly and require valuable minerals to produce.[57] Continued research and development on batteries may yield additional options for reuse and recycling.[58] Another example concerns the safety and efficiency of hydrogen delivery.[59] Hydrogen poses a potential risk of pipeline deterioration, which may result in leakage during transportation.

Proposed Legislation in the 116th Congress

What follows is a discussion of legislation in 2019 and 2020. Each section summarizes bills introduced in the 116th Congress that were identified as containing AF and AFV provisions. **Figure 2** summarizes the number of bills containing provisions that would have implemented each incentive type. Overall, 15 bills would have implemented policies pertaining to tax incentives or rebates for the purchase of an alternative fuel vehicle, while 12 bills would have implemented policies pertaining to grant or loan programs for bus acquisition, and 11 bills would have implemented policies supporting manufacturing incentives.

[55] EPA, *The 2020 EPA Automotive Trends Report*, "Figure ES-2. Production Share and Fuel Economy by Vehicle Type," January 2021.

[56] Tom Voelk, "Rise of SUVs: Leaving Cars in Their Dust, With No Signs of Slowing," *New York Times*, March 21, 2020, https://www.nytimes.com/2020/05/21/business/suv-sales-best-sellers.html; Chester Dawson, "As Demand for Small Cars Weakens, More Auto Makers Drop Them From U.S. Lineups," *Wall Street Journal*, January 13, 2019, https://www.wsj.com/articles/as-demand-for-small-cars-weakens-more-auto-makers-drop-them-from-u-s-lineups-11547391601.

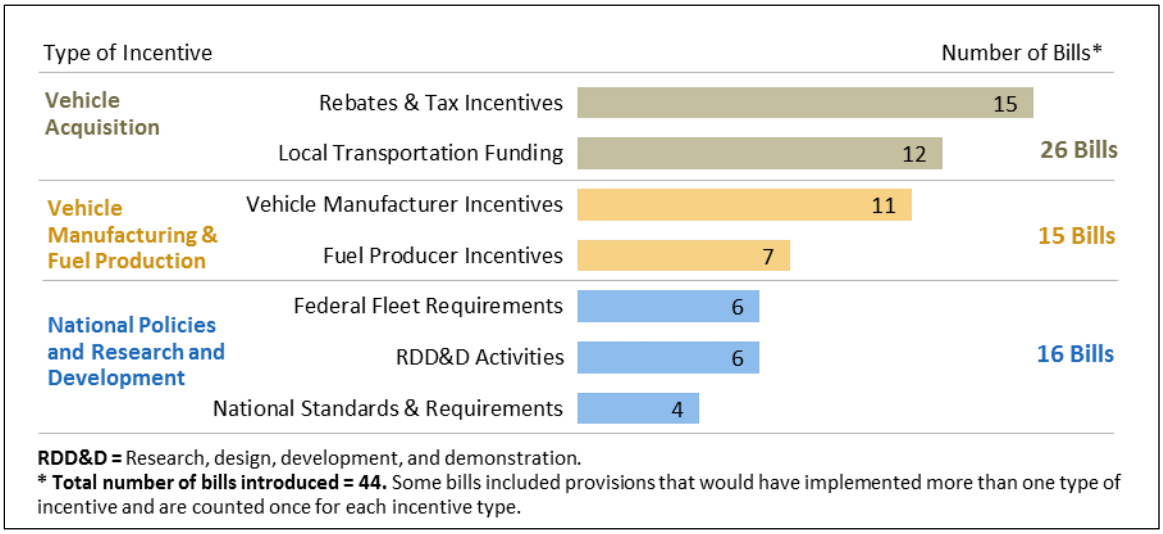
[57] Further, some of those minerals are not available or produced in large quantities in the United States resulting in U.S. reliance on foreign sources for these minerals. This might create a weakness in the U.S. automotive supply chain.

[58] EERE, "Batteries," accessed May 26, 2021, https://www.energy.gov/eere/vehicles/batteries.

[59] For additional information, see CRS Report R46436, *Hydrogen in Electricity's Future*, by Richard J. Campbell.

Figure 2. Bills Introduced in the 116th Congress by Incentive Type

Number of bills with a provision promoting each type of incentive



Source: CRS from Congress.gov.

Notes: RDD&D = Research, design, development, and demonstration. Some bills included provisions that would have implemented more than one type of incentive and are counted once for each incentive type that is applicable. Includes bills that were enacted and not enacted.

Vehicle Acquisition

One type of policy tool proposed in legislation in the 116th Congress was a compensatory incentive for the purchase and use of alternative fuels and vehicles. Tax incentives, rebates, grants, and loans lower the costs for replacing or retrofitting ICEVs with alternative fuel vehicles. These incentives targeted individual drivers, as well as state and local transit and school bus operators.

A number of legislative actions supporting the purchase and use of alternative fuels and alternative fuel vehicles were introduced in the 116th Congress. The Consolidated Appropriations Act, 2021 (H.R. 133, P.L. 116-260) extended the alternative motor vehicle credit for the purchase of fuel cell vehicles through December 31, 2021. Other introduced bills included a number of vehicle acquisition provisions that would have amended existing tax incentives, expanded the applicability for existing programs, or established entirely new programs. **Table 1** includes key provisions for vehicle acquisition included in legislation introduced in the 116th Congress, but which were not enacted.

Table 1. Key Provisions for Vehicle Acquisition

Introduced and Not Enacted in the 116th Congress

Provision	Bills
Would have established a $4,500 voucher for the purchase/lease of a new PEV assembled in the United States, containing at least 45% content of U.S. or Canadian origin	American Cars, American Jobs Act of 2019 (H.R. 2510/S. 683)

Provision	Bills
Would have extended (by date) and/or expanded (by increasing or eliminating the phaseout threshold) the tax credit for PEVs (varies by bill)	Affordable American-made Automobile Act (H.R. 5393) Clean Energy For America Act (S. 1288) Clean Energy Innovation and Deployment Act of 2020 (H.R. 7516) Driving America Forward Act (H.R. 2256/S. 1094) Electric Credit Access Ready at Sales (CARS) Act of 2019 (H.R. 2042/S. 993) GREEN Act of 2020 (H.R. 7330) Moving Forward Act (H.R. 2)
Would have amended the tax credit for PEVs to increase the credit amount or allow transfer to a financing entity	Affordable American-made Automobile Act (H.R. 5393)
Would have amended the tax credit for PEVs to include previously-owned PEVs	Affordable American-made Automobile Act (H.R. 5393)
Would have established a new tax credit for previously-owned PEVs	Affordable EVs for Working Families Act of 2019 (H.R. 5161) GREEN Act of 2020 (H.R. 7330) Moving Forward Act (H.R. 2)
Would have extended the alternative motor vehicle credit for FCVs (finite period or indefinitely)	Clean Energy for America Act (S. 1288) Tax Extender and Disaster Relief Act of 2019 (S. 617) Taxpayer Certainty and Disaster Tax Relief Act of 2019 (H.R. 3301) To amend the Internal Revenue Code of 1986 to permanently extend the qualified fuel cell motor vehicles credit (H.R. 1929)
Would have established a tax credit for fuel-efficient vehicles and a fee on "gas-guzzlers"	Efficient Vehicle Leadership Act of 2019 (H.R. 7862)
Would have reauthorized the Clean School Bus program; would amend the definition to include electric vehicles	Clean Commute for Kids Act of 2019 (H.R. 2906) Leading Infrastructure for Tomorrow's America Act (H.R. 2741) Moving Forward Act (H.R. 2)
Would have increased the grant amounts for the Clean School Bus program	Clean Commute for Kids Act of 2019 (H.R. 2906) Leading Infrastructure for Tomorrow's America Act (H.R. 2741)
Would have established the Clean School Bus Grant program to replace diesel buses with electric or fuel cell buses	Clean School Bus Act of 2019 (H.R. 3973/S. 1750)
Would have amended formula grants for buses and bus facilities and low- or no-emissions grants (ZEVs only)	INVEST in America Act (H.R. 7095) Moving Forward Act (H.R. 2)
Would have established grants, loan guarantees, and other investment tools for electric, hydrogen, and "clean" transportation programs and deployment (e.g., school buses)	America's Clean Future Fund Act (S. 4484)
Would have authorized loans for fixed bus route operators to acquire electric or fuel cell buses	Community Health and Clean Transit Act of 2019 (S. 2403) Community Health and Clean Transit Act of 2020 (H.R. 8447)

Provision	Bills
Would have established grants for energy efficiency improvements at public schools (e.g., purchase or lease of zero-emission school buses and other operational vehicles)	Renew America's Schools Act of 2019 (H.R. 3322/S. 1890)
Would have formally authorized the Clean Cities program for competitive awards for projects (e.g., purchase and use of alternative fuels and vehicles)	Leading Infrastructure for Tomorrow's America Act (H.R. 2741) Moving Forward Act (H.R. 2)
Would have extended funding for grants for transit buses and bus facilities of low or no emissions	Low or No Emission Bus Access Act of 2020 (S. 3373)
Would have established a National Climate Bank from which to provide low- and zero-interest loans for schools, municipalities, and nonprofits to acquire ZEVs	National Climate Bank Act (H.R. 5416)

Source: CRS from Congress.gov.

Notes: EVs = electric vehicles. FCVs = fuel cell vehicles. PEVs = plug-in electric vehicles, to include battery-electric and plug-in hybrid-electric vehicles. ZEVs = zero-emission vehicles.

Rebates and Tax Incentives for Individual Taxpayers

Tax incentives for AFVs were included in many bills in the 116th Congress. Numerous Members sought to expand the overall applicability of the tax credit for PEVs. Several Members proposed legislation that would have expanded the tax credit to target certain taxpayers that otherwise may not be receiving the full benefit. Another option would be to allow the credit to be transferred to a financing entity, which would allow low- and moderate-income taxpayers to capture more of the value of the credit for which they might not otherwise be eligible. Another proposal could expand the credit to include previously-owned PEVs (or establish a new tax incentive specifically for previously-owned PEVs) that could offer another option for lowering the cost of PEVs for more taxpayers.

Beyond tax incentives, one provision would have established a voucher for the purchase or lease of a new PEV. As a voucher, this incentive is independent of income and tax liability and would have broad applicability.

Funding for Local Transportation

Legislation introduced in the 116th Congress included a number of grants and loans programs that would have provided assistance to states and localities seeking to transition away from diesel fuel for public transportation and school bus fleets. Members sought to amend the applicability of the Clean School Bus program, which provides grants for replacing school buses, to add electricity and remove ultra low-sulfur diesel as eligible fuel types.[60] Other bills would have expanded transit funding for alternative fuel buses, including zero-emission buses, and related infrastructure. Some bills would have set a zero-emission requirement on new bus acquisitions.

Nationally, programs such as DOE's Clean Cities program provide assistance at the local level for states, local governments, and other public transportation operators working to adopt alternative fuels. Clean Cities' efforts have yielded results in increasing the number of alternative fuel

[60] EPA, "Reducing Diesel Emissions from School Buses," May 26, 2021, https://www.epa.gov/dera/reducing-diesel-emissions-school-buses.

vehicles and the number of vehicle miles traveled on alternative fuels.[61] Legislation introduced in the 116th Congress would have continued the efforts of Clean Cities and programs like it by authorizing grant programs for statewide transportation electrification and by authorizing loans for bus operators at the state and local level to acquire electric buses.

Vehicle Manufacturing and Fuel Production

A variety of incentives for manufacturers and fuel producers included in bills introduced in the 116th Congress would have supported alternative fuel adoption by promoting the supply of alternative fuels and AFVs in order to meet demand or potentially induce demand. With the passage of the Further Consolidated Appropriations Act, 2020 (P.L. 116-94) and the Consolidated Appropriations Act, 2021 (P.L. 116-260), various tax incentives for producers of liquid fuels (including the tax credit for biodiesel or renewable diesel mixtures, the tax credits for alternative fuel and alternative fuel mixtures, and the second generation biofuel producer credit) were extended to the end of either 2021 or 2022. **Table 2** includes key provisions for vehicle manufacturers and fuel producers included in legislation introduced in the 116th Congress, but which were not enacted.

Table 2. Key Provisions for Vehicle Manufacturers and Fuel Producers

Introduced and Not Enacted in the 116th Congress

Provision	Bills
Would have established a Clean Fuel Production credit for transportation fuels	Clean Energy for America Act (S. 1288)
Would have expanded private activity bonds to include electric vehicle manufacturing and battery manufacturing facilities	Affordable American-made Automobile Act (H.R. 5393)
Would have amended the Domestic Manufacturing Conversion Grant program to include PEVs	Moving Forward Act (H.R. 2) NO EXHAUST Act of 2020 (H.R. 5545) USA Electrify Forward Act (H.R. 5558)
Would have amended the Advanced Technology Vehicles Manufacturing Incentive program to include heavy-duty vehicles that emit zero GHGs	Advanced Technology Vehicles Manufacturing Program Reform Act (H.R. 5860) Moving Forward Act (H.R. 2) NO EXHAUST Act of 2020 (H.R. 5545) USA Electrify Forward Act (H.R. 5558)
Would have established a tax credit for manufacturers of zero-emission heavy vehicles (e.g., plug-in electric and fuel cell vehicles)	GREEN Act of 2020 (H.R. 7330) Green VAN Act of 2019 (H.R. 5162) Moving Forward Act (H.R. 2)
Would have established a tax credit for manufacturers of zero-emission buses (e.g., plug-in electric and fuel cell buses)	Green Bus Tax Credit Act of 2019 (H.R. 5163)
Would have established a pilot program for grants for electrification of diesel refrigerated vehicles	FREEZER Trucks Act of 2019 (H.R. 5256) Moving Forward Act (H.R. 2)

[61] "At the national level, [the Vehicle Technologies Office] develops partnerships and provides technical assistance and analysis, information resources, and online tools and data. At the local level, [Clean Cities] coalitions leverage these resources to create networks of local stakeholders and provide technical assistance to fleets implementing alternative and renewable fuels, idle-reduction measures, fuel economy improvements, and emerging transportation technologies." EERE, "About Clean Cities," accessed May 2021, https://cleancities.energy.gov/about/.

Source: CRS from Congress.gov.

Notes: GHGs = greenhouse gases. PEVs = plug-in electric vehicles, to include battery-electric and plug-in hybrid-electric vehicles.

A range of proposed and enacted measure also promoted vehicle manufacturing. The Advanced Technology Vehicles Manufacturing Loan program also was reauthorized in P.L. 116-260. Proposed legislation focused primarily on medium- and heavy-duty vehicles. Alternative fuel medium- and heavy-duty vehicles are more challenging to design and produce than light-duty vehicles due to their size, while also having higher associated manufacturing costs.[62] Bills would have focused on increasing the deployment of medium- and heavy-duty ZEVs (e.g., plug-in electric and fuel cell). Some policy proposals would have amended existing grants and loans programs to include or focus on PEVs. Other proposals would have established tax incentives for manufacturers of zero-emission heavy vehicles.

National Policies and Research and Development

Proposals introduced in the 116th Congress also included a range of less direct policy options in support of increased deployment of alternative fuels and vehicles. National standards and requirements can serve as complements to tax incentives and other compensatory incentives. Research, development, demonstration, and deployment projects have the potential to yield more efficient manufacturing or deployment methods for existing technology, as well as facilitate the development of new technology.

Table 3. Key Provisions for National Policies and Research and Development

Introduced and Not Enacted in the 116th Congress

Provision	Bills
Would have established a national zero-emission standard for light-duty vehicles (100% of sales by 2040 or earlier)	Zero-Emission Vehicles Act of 2019 (H.R. 2764/S. 1487) Zero-Emission Vehicles Act of 2020 (H.R. 8635/S. 4823)
Would have established a national strategic action plan to reduce GHG emissions, including a target not to exceed 20% of 2005 emissions in transportation	Moving Towards a Safe Climate Act (H.R. 6171)
Would have established a zero-emission requirement for public buses purchased with FTA funds	Green Bus Act of 2019 (H.R. 2164)
Would have established requirements for federal fleet acquisitions for new light-duty vehicles (100% AFVs by 2025) and new medium- and heavy-duty vehicles (50% AFVs by 2050)	Moving Forward Act (H.R. 2) NO EXHAUST Act of 2020 (H.R. 5545)
Would have required 100% ZEVs for new federal fleet light-duty vehicles by 2050	NO EXHAUST Act of 2020 (H.R. 5545)
Would have required federal fleet acquisitions of new medium- and heavy-duty vehicles to be zero-emission, whenever possible	Moving Forward Act (H.R. 2)

[62] "The upfront costs for electric trucks remain a primary barrier to investment in electric trucks … models indicate that the total cost of ownership for an average electric truck can be lower than a diesel or natural gas equivalent with adequate incentives." Center for Climate and Energy Solutions, "Insights on Electric Trucks for Retailers and Trucking Companies," February 2020, p. 1, https://www.c2es.org/document/insights-on-electric-trucks-for-retailers-and-trucking-companies/.

Provision	Bills
Would have established federal fleet emissions reduction goals to achieve 100% reductions by 2050 compared to 2015	Moving Forward Act (H.R. 2) NO EXHAUST Act of 2020 (H.R. 5545)
Would have required federal fleet consumption of alternative fuel to reach 85% of annual total by 2050	Moving Forward Act (H.R. 2)
Would have required 100% PEVs or ZEVs for the USPS fleet by 2040	Moving Forward Act (H.R. 2) Postal Vehicle Modernization Act (H.R. 7969)
Would have required DOD acquisitions for non-tactical vehicles to be zero-emission and would establish a petroleum consumption goal (50% of 2005 consumption by 2030)	To direct the Secretary of Defense to phase-in zero-emission non-tactical vehicles and reduce the petroleum consumption of the Department of Defense Federal fleet, and for other purposes (H.R. 6932)
Would have authorized RDD&D activities for vehicle technologies (to reduce or eliminate petroleum use and emissions)	Flexible Grid Infrastructure Act of 2019 (S. 1740) Vehicle Innovation Act of 2019 (H.R. 2170/S. 1085)
Would have authorized RDD&D activities for energy storage (including batteries used in PEVs)	BATTERY Act of 2020 (H.R. 8232) Reducing the Cost of Energy Storage Act of 2019 (S. 1741)
Would have established a fund to support certain RDD&D activities for technologies that reduce or eliminate GHG emissions, including FCVs and PEVs	Climate Action Rebate Act of 2019 (H.R. 4051/S. 2284)

Source: CRS from Congress.gov.

Notes: AFVs = alternative fuel vehicles. DOD = Department of Defense. DOE = Department of Energy. FCVs = fuel cell vehicles. FTA = Federal Transit Administration. GHG = greenhouse gas. PEVs = plug-in electric vehicles, to include battery-electric and plug-in hybrid-electric vehicles. RDD&D = research, design, development, and demonstration. USPS = U.S. Postal Service. ZEVs = zero-emission vehicles.

Federal Fleet Requirements

These policies also include proposals that apply specifically to the federal fleet, consisting of 658,000 vehicles all across the country.[63] As possibly the largest civilian fleet operator in the country, the federal government can contribute to demand for existing technology, which may result in benefits (e.g., larger scale production may reduce costs per vehicle) for smaller entities and nonfederal consumers.[64] The enactment of the CHARGE Act (P.L. 116-160) in 2020 requires the General Services Administration to issue guidance establishing that agencies may use federal government credit cards to charge federal PEVs at commercial stations, and the National Defense Authorization Act for Fiscal Year 2021 (P.L. 116-283) authorized a pilot program for purchasing AFVs in the Department of Defense. Other policies for federal fleets would have established government-wide standards for vehicle acquisitions, alternative fuel consumption, and GHG emissions.

National Standards and Requirements

Proposals for national requirements would have targeted emissions reductions and specifically promoted ZEVs (e.g., PEVs and fuel cell vehicles), setting a long-term goal for tax incentives,

[63] U.S. General Services Administration, *Federal Fleet Report FY 2020*, https://www.gsa.gov/policy-regulations/policy/vehicle-management-policy/federal-fleet-report.

[64] Government Fleet, "Federal vs. State and Local Fleets," May 14, 2018, https://www.government-fleet.com/301786/federal-vs-state-local-fleets.

grants, loans, and other programs. A national standard requiring 100% ZEV sales by 2040 would have established a need for an increase in the supply of ZEVs, complementing the tax incentives and other funding programs that are designed to induce the demand for zero-emission and other alternative fuel vehicles.

Research and Development

Research, design, development, and demonstration projects have the potential to yield scalable benefits to deployment efforts for alternative fuels and vehicles. In the 116th Congress, the Consolidated Appropriations Act, 2021 (P.L. 116-260) authorized broad sustainable transportation research and development at DOE in the Offices of Hydrogen and Fuel Cell Technologies, Vehicles Technologies, and Bioenergy Technologies. Other proposals would have authorized RDD&D for projects designed to reduce petroleum use and emissions in transportation, and RDD&D specifically for energy storage technology (e.g., PEV batteries). These proposals indicate an interest in identifying solutions to certain challenges specific to transportation electrification, while supporting innovation in transportation more broadly.

The outcomes from RDD&D have the potential to impact many aspects of alternative fuel adoption. RDD&D can be used to discover cheaper materials and efficiencies in production that may contribute to an overall decrease in manufacturing costs that can be reflected in the prices available to consumers.

Policy Proposals in the 117th Congress

New and previously proposed policy options have been introduced by Congress and proposed by the Biden Administration since the start of the 117th Congress.

Some bills from the 116th Congress have been reintroduced, including the Clean School Bus Act of 2021 (H.R. 1344/S. 506), Electric CARS Act of 2021 (H.R. 1271/S. 395), GREEN Act of 2021 (H.R. 848), Postal Vehicle Modernization Act (H.R. 1636), and USA Electrify Forward Act (H.R. 1879).

The CLEAN Future Act (H.R. 1512), introduced in March 2021, and referred to the House Committee on Energy and Commerce and other committees, would promote ZEVs through authorization of a pilot program to electrify refrigerated vehicles, reauthorize the Clean School Bus Program, formally authorize the Clean Cities program, and reauthorize the Diesel Emissions Reduction program, among other provisions.[65] Similar provisions are included in the LIFT America Act (H.R. 1848).

In an executive order, President Biden called for a plan to facilitate procurement of ZEVs for fleets at all levels of government with an emphasis on American- and union-made vehicle manufacturing.[66]

The Biden Administration's proposed American Jobs Plan would promote domestic production of PEVs and batteries, offer consumer incentives for the purchase of PEVs, and offer grant and incentive programs for the installation of 500,000 PEV chargers by 2030. The plan also commits

[65] House Committee on Energy and Commerce, "E&C Leaders Introduce the CLEAN Future Act, Comprehensive Legislation to Combat the Climate Crisis," March 2, 2021, https://energycommerce.house.gov/newsroom/press-releases/ec-leaders-introduce-the-clean-future-act-comprehensive-legislation-to.

[66] Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad," 86 *Federal Register* 7619, January 27, 2021.

to replacing 50,000 diesel transit vehicles, electrifying 20% of school buses, and electrifying the federal fleet.[67]

[67] The White House, "FACT SHEET: The American Jobs Plan," press release, March 31, 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan/.

Appendix. Legislation Introduced in the 116th Congress

The following table lists all bills cited throughout the report. Legislation is listed in alphabetical order by bill name, with enacted legislation listed first.

Table A-1. Legislation Introduced in the 116th Congress

Bill Name (Bill Number)	Votes/Hearings
CHARGE Act (H.R. 8191/S. 2193)	Enacted 10/1/2020, P.L. 116-160
Consolidated Appropriations Act, 2021 (H.R. 133)	Enacted 12/27/2020, P.L. 116-260
Further Consolidated Appropriations Act, 2020 (H.R. 1865)	Enacted 12/20/2019, P.L. 116-94
National Defense Authorization Act FY2021 (H.R. 6395)	Enacted 12/20/2019, P.L. 116-283
Advanced Technology Vehicles Manufacturing Program Reform Act (H.R. 5860)	
Affordable American-made Automobile Act (H.R. 5393)	
Affordable EVs for Working Families Act of 2019 (H.R. 5161)	
American Cars, American Jobs Act of 2019 (H.R. 2510/S. 683)	
America's Clean Future Fund Act (S. 4484)	
BATTERY Act of 2020 (H.R. 8232)	
Clean Commute for Kids Act of 2019 (H.R. 2906)	Subcommittee markup, 1/9/2020
Clean Energy For America Act (S. 1288)	
Clean Energy Innovation and Deployment Act of 2020 (H.R. 7516)	
Clean School Bus Act of 2019 (H.R. 3973/S. 1750)	
Climate Action Rebate Act of 2019 (H.R. 4051/S. 2284)	
Community Health and Clean Transit Act of 2019 (S. 2403)	
Community Health and Clean Transit Act of 2020 (H.R. 8447)	
Driving America Forward Act (H.R. 2256/S. 1094)	
Efficient Vehicle Leadership Act of 2019 (H.R. 7862)	
Electric Credit Access Ready at Sale (CARS) Act of 2019 (H.R. 2042/S. 993)	
Flexible Grid Infrastructure Act of 2019 (S. 1740)	
FREEZER Trucks Act of 2019 (H.R. 5256)	
GREEN Act of 2020 (H.R. 7330)	
Green Bus Act of 2019 (H.R. 2164)	
Green Bus Tax Credit Act of 2019 (H.R. 5163)	
Green VAN Act of 2019 (H.R. 5162)	
INVEST in America Act (H.R. 7095)	
Leading Infrastructure for Tomorrow's America Act (H.R. 2741)	Committee hearings, 5/22/2019
Low or No Emission Bus Access Act of 2020 (S. 3373)	

Bill Name (Bill Number)	Votes/Hearings
Moving Forward Act (H.R. 2)	Passed House on 7/31/2020, 217-197
Moving Towards a Safe Climate Act (H.R. 6171)	
National Climate Bank Act (H.R. 5416)	
NO EXHAUST Act of 2020 (H.R. 5545)	Subcommittee markup, 1/9/2020
Postal Vehicle Modernization Act (H.R. 7969)	
Reducing the Cost of Energy Storage Act of 2019 (S. 1741)	Subcommittee hearings, 7/9/2019
Renew America's Schools Act of 2019 (H.R. 3322/S. 1890)	
Tax Extender and Disaster Relief Act of 2019 (S. 617)	
Taxpayer Certainty and Disaster Tax Relief Act of 2019 (H.R. 3301)	
To amend the Internal Revenue Code of 1986 to permanently extend the qualified fuel cell motor vehicles credit (H.R. 1929)	
To direct the Secretary of Defense to phase-in zero-emission non-tactical vehicles and reduce the petroleum consumption of the Department of Defense Federal fleet, and for other purposes (H.R. 6932)	
USA Electrify Forward Act (H.R. 5558)	
Vehicle Innovation Act of 2019 (H.R. 2170/S. 1085)	
Zero-Emission Vehicles Act of 2019 (H.R. 2764/S. 1487)	(H.R. 2764/S. 1487) (H.R. 8635/S. 4823)
Zero-Emission Vehicles Act of 2020 (H.R. 8635/S. 4823)	

Source: CRS from Congress.gov.

Notes: FCV = fuel cell vehicle. FTA = Federal Transit Administration. PEV = plug-in electric vehicle.

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