Alternative Fuels and Advanced Technology Vehicles: Issues in Congress

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Summary

Alternative fuels and advanced technology vehicles are seen by proponents as integral to improving urban air quality, decreasing dependence on foreign oil, and reducing emissions of greenhouse gases. However, major barriers—especially economics—currently prevent the widespread use of these fuels and technologies. Because of these barriers, and the potential benefits, there is continued congressional interest in providing incentives and other support for their development and commercialization.

Key tax incentives for the use of biofuels, for the expansion of alternative fuel infrastructure, and for the purchase of certain electric vehicles expired at the end of 2011, along with an added duty on certain ethanol imports. Some of these incentives were extended through the end of 2013 although the main tax credit for conventional ethanol—the Volumetric Ethanol Excise Tax Credit (VEETC)—was not extended.

While tax incentives for these fuels have expired or are set to expire at the end of 2013, a mandate to use biofuels in transportation that was expanded by the Energy Independence and Security Act of 2007 (EISA, P.L. 110-140) is set to increase yearly through 2022. In 2012, the RFS required the use of 15.2 billion gallons of ethanol and other biofuels in transportation fuel. Within that mandate, the RFS required the use of 2.0 billion gallons of advanced biofuels, including 8.65 million gallons of cellulosic biofuels (although only about 20,000 gallons of cellulosic fuel were actually registered in the program). For 2013, the RFS mandate is 16.55 billion gallons, including a proposed 14 million gallons of cellulosic fuel. At the end of each year, covered entities must submit credits (called Renewable Identification Numbers, or RINs) equal to their obligations for that year. Cases of fraud in the market for biodiesel RINs has led to criminal prosecutions and the development of quality-assurance guidelines from EPA. Further, recent volatility in the spot market for ethanol RINs has raised additional concerns about implementation of the RFS.

In January 2011, EPA finalized a partial waiver petition from Growth Energy to allow blends of up to 15% ethanol in gasoline (E15): before then ethanol content in all gasoline was limited to 10% (E10). EPA approved the use of E15 in model year 2001 and later passenger cars and light trucks, but prohibited its use in all other applications (e.g., motorcycles, heavy trucks, nonroad engines). Allowing higher blends of ethanol under the Clean Air Act removes one component of the "blend wall," which limits the total amount of ethanol that can be blended in gasoline nationwide; other blend wall components include vehicle and pump certification and warranties, and state and local fire codes and other laws.

Attention has also focused on government-backed loans for the development and deployment of new energy technologies. One such program, the Advanced Technology Vehicles Manufacturing (ATVM) Loan Program, has been controversial as some critics question whether other existing policies, such as stricter vehicle fuel economy standards, already promote the same technologies.

Other potential issues before Congress include how much the federal government should support the expansion of natural gas vehicles and the infrastructure to fuel them, and how much the government should support the deployment of plug-in electric vehicles.

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Introduction

High levels of oil imports and high crude oil and gasoline prices in recent years have led to increased interest in the U.S. fuel supply. Recent congressional interest has focused on alternatives to petroleum, ways to improve the efficiency of the U.S. transportation sector, and ways to improve the stability and security of the petroleum supply and refining sectors.[1] From spring 2006 to summer 2008, high global oil prices (spurred by high demand) and refinery constraints in the domestic gasoline supply pushed U.S. gasoline pump prices to historic highs. In spring 2011, exports of oil from Libya caused a similar spike in oil prices.

Historically, a problem in maintaining interest in alternative fuels and vehicles has been the volatility in oil and gasoline prices. Interest tends to rise as prices rise, and decline as prices dip. Arguably, statutory policies can counterbalance dips in public interest in periods of mixed market signals as seen recently. In fall 2006 and winter 2007, gasoline prices eased somewhat before rising significantly through summer 2008; and after summer 2008, petroleum and gasoline prices fell dramatically. They rose steadily through 2009 and 2010, peaking in spring 2011 before tempering somewhat and remaining relatively stable through 2012.

Along with fuel prices and supply, environmental concerns, especially poor air quality and concerns over the potential effects of climate change, have further raised interest in the development of alternatives to petroleum, as well as ways to use petroleum more efficiently.

Key components of federal policies to reduce petroleum consumption include the promotion of alternatives to petroleum fuels and the promotion of more efficient vehicles. This report provides an overview of current issues surrounding alternative fuels[2] and advanced technology vehicles[3]—issues discussed in further detail in other CRS reports referred to in each section.

Most Recent Developments

Key tax incentives for the use of biofuels, for the expansion of alternative fuel infrastructure, and for the purchase of certain electric vehicles expired at the end of 2011, along with an added duty on certain ethanol imports. Some of these incentives were extended through the end of 2013 by the American Taxpayer Relief Act of 2012 (P.L. 112-240) although the main tax credit for conventional ethanol—the Volumetric Ethanol Excise Tax Credit (VEETC)—was not extended.

While tax incentives for these fuels have expired or are set to expire at the end of 2013, a mandate to use biofuels in transportation that was expanded by the Energy Independence and Security Act of 2007 (EISA, P.L. 110-140) is set to increase yearly through 2022. In 2012, the RFS required the use of 15.2 billion gallons of ethanol and other biofuels in transportation fuel. Within that mandate, the RFS required the use of 2.0 billion gallons of advanced biofuels, including 8.65

[1] For more information on petroleum supply and prices, see CRS Report R42465, *U.S. Oil Imports and Exports*, by Robert Pirog.

[2] Alternative fuels are fuels produced from sources other than petroleum, including natural gas, coal-derived fuels, agriculture-based ethanol and biodiesel, and hydrogen.

[3] Advanced technology vehicles are vehicles that use technologies other than (or in addition to) an internal combustion engine, including electric vehicles, fuel cell vehicles, and hybrids.

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In January 2011, EPA finalized a partial waiver petition from Growth Energy to allow blends of up to 15% ethanol in gasoline (E15): before then ethanol content in all gasoline was limited to 10% (E10). EPA approved the use of E15 in model year 2001 and later passenger cars and light trucks, but prohibited its use in all other applications (e.g., motorcycles, heavy trucks, nonroad engines). Allowing higher blends of ethanol under the Clean Air Act removes one component of the "blend wall," which limits the total amount of ethanol that can be blended in gasoline nationwide; other blend wall components include vehicle and pump certification and warranties, and state and local fire codes and other laws. Because of concerns by some stakeholders over the potential for E15 to damage existing engines and infrastructure, EPA's decision has been challenged in federal court, although a major case has been dismissed because the appeals court determined that the plaintiffs did not have standing to challenge the decision. Bills have been introduced in the 112th and 113th Congresses that would limit EPA's authority to implement the E15 waiver.

Background and Analysis

Congressional Interest

Legislative Background

A combination of issues—the oil crises of the 1970s, the rise in awareness of environmental issues, concerns over energy security, increasing vehicle emissions, and high gasoline prices—have spurred interest in moving the United States away from petroleum fuels for transportation and toward alternative fuels and advanced vehicle technologies.

The Energy Policy Act of 1992

The 102nd Congress passed the Energy Policy Act of 1992 (EPAct 1992, P.L. 102-486). Among other provisions, this law requires the purchase of alternative fuel vehicles by federal agencies, state governments, and alternative fuel providers.[4] Under EPAct 1992, a certain percentage—which varies by the type of fleet (i.e., federal, state, or fuel provider)—of new passenger vehicles must be capable of operating on alternative fuels, including ethanol, methanol, natural gas, or propane. EPAct 1992 established a tax credit for the purchase of electric vehicles, as well as tax deductions for the purchase of alternative fuel and hybrid vehicles.

[4] Alternative fuel providers are businesses that sell or distribute alternative fuels.

The Energy Policy Act of 2005

There was little congressional action on energy policy through the late 1990s. In light of high fuel prices in the early 2000s, continued growth in domestic and global petroleum demand, and other energy policy concerns, Congress began working on comprehensive energy legislation in 2001. In the 107th Congress, an energy bill stalled in conference. The 108th Congress continued the debate over energy legislation. The conference report (H.Rept. 108-375) included provisions on vehicle tax credits, amendments to vehicle purchase requirements under the Energy Policy Act of 1992, a requirement that motor fuels contain ethanol or other renewable fuels, and tax credits for ethanol and biodiesel fuels. However, this bill also stalled. Many of these topics were addressed in the 109th Congress by the Energy Policy Act of 2005 (EPAct 2005, P.L. 109-58), which was signed by President Bush on August 8, 2005.

The Energy Independence and Security Act of 2007

Continued pressure on energy prices and concerns over energy security after passage of EPAct 2005 led to further discussion of energy policy in the 110th Congress. On December 19, 2007, President Bush signed the Energy Independence and Security Act of 2007 (EISA, P.L. 110-140). Among other provisions, EISA expanded the renewable fuel mandate in EPAct 2005, significantly tightened federal fuel economy (CAFE) standards, and established the Advanced Technology Vehicles Manufacturing (ATVM) Loan Program.

The 2008 Farm Bill

Biofuels—fuels produced from renewable organic matter, especially agricultural products and wastes, are seen by proponents as a key strategy for increasing energy security, promoting environmental quality, and raising farm incomes. Therefore, the 2002 and 2008 Farm Bills (P.L. 107-171 and P.L. 110-246, respectively) included titles to promote biofuels and other farm-based energy supplies. The 2002 Farm Bill established programs to promote the development of biofuels and biorefineries; the 2008 Farm Bill expanded on these programs, and expanded existing biofuels tax credits to promote the development of cellulosic fuels—fuels produced from woody or fibrous materials such as perennial grasses, fast-growing trees, and agricultural and municipal wastes.

The American Recovery and Reinvestment Act of 2009

The American Recovery and Reinvestment Act of 2009 (ARRA, P.L. 111-5) includes several key provisions supporting alternative fuels and advanced technology vehicles. These include tax credits for the purchase of small electric vehicles, grants to states, localities, and other entities to replace older diesel engines with new, clean diesel or alternative fuel engines, and grants to battery manufacturers and part suppliers to develop batteries and system components for advanced vehicles (e.g., hybrids, plug-in electric vehicles).

The Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010

Tax credits for biodiesel and renewable diesel production and blending had expired at the end of 2009. Credits for ethanol production and blending, as well as a duty on ethanol imports from most

countries, were set to expire at the end of 2010. The Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010 (P.L. 111-312) extended those incentives through the end of 2011.

The American Taxpayer Relief Act of 2012

The American Taxpayer Relief Act of 2012 (P.L. 112-240) extended many alternative fuel and advanced technology vehicle incentives through the end of 2013, including retroactive extensions for some credits that had expired at the end of 2011. The law extended the production tax credit, accelerated refinery depreciation cellulosic biofuels, and expanded the incentives to include algae-based biofuels. The law also extended (retroactively) credits for the production of biomass-based diesel fuels and for the use of certain alternative fuels (including natural gas propane). It also extended the credit for the purchase of certain electric vehicles and for the installation of alternative fuel infrastructure. The main tax credit for conventional ethanol—the Volumetric Ethanol Excise Tax Credit (VEETC)—was not extended.[5]

Other Legislation

Other laws affecting alternative fuel and advanced technology vehicles include the Energy Policy and Conservation Act (P.L. 94-163), which established fuel economy standards for passenger cars and light trucks;[6] the 1990 Amendments to the Clean Air Act (P.L. 101-549), which require cities with significant air quality problems to promote low emission vehicles; highway authorization bills, including P.L. 109-59 and P.L. 105-178, which established and reaffirmed tax incentives for ethanol and other fuels; and numerous laws that authorize federal research and development on alternative fuels, advanced technologies, and enabling infrastructure, such as alternative fuel pumps. The Emergency Economic Stabilization Act of 2008 (P.L. 110-343) modified and extended key tax incentives for biodiesel and other alternative fuels.

Current Issues

Recent events have renewed interest in alternative fuels and advanced vehicles. For example, high pump prices for gasoline and diesel fuel have raised concerns over fuel conservation and energy security, despite declines in U.S. oil imports in recent years. In light of these concerns, there is growing interest in more efficient vehicles or vehicles that abandon the use of petroleum altogether. This is especially true as the rapid growth in the sales of light trucks—these include sport utility vehicles (SUVs), mini-vans, and pickups, which tend to have lower fuel economy than passenger cars—through the mid-2000s lowered the overall fuel economy of the new vehicle fleet. EISA requires an increase in fuel economy from passenger cars and light trucks to 35 miles per gallon (mpg) combined in 2020, up from roughly 24 mpg in 2007.

Ongoing technological developments in hybrid vehicles, ethanol fuel, fuel cells, and hydrogen fuel have raised key policy questions. These questions include whether more generous tax incentives for hybrid and/or fuel cell vehicles should be established or whether to reduce

[5] For more information on tax incentives, see CRS Report R42566, *Alternative Fuel and Advanced Vehicle Technology Incentives: A Summary of Federal Programs*, by Lynn J. Cunningham et al.

[6] For more information on fuel economy standards, CRS Report R42721, *Automobile and Truck Fuel Economy (CAFE) and Greenhouse Gas Standards*, by Brent D. Yacobucci, Bill Canis, and Richard K. Lattanzio.

government's role in vehicle and fuel markets, the costs and environmental impacts associated with production of ethanol or hydrogen as major transportation fuels, and whether research and development funds should be focused on such potentially high-risk technologies as fuel cells or on near-term technologies, such as hybrids.

Gasoline prices have spiked and the gasoline supply system has faced disruptions several times in recent years, driven by various factors, including

- hurricanes along the Gulf Coast in the fall of 2005;
- high crude prices, issues with refining capacity, and concerns about ethanol supply in spring 2006;
- historic high crude oil and gasoline prices in 2007 and 2008; and
- gasoline prices that, after declining during the recession, rose rapidly through the first half of 2011 and have remained high since then.

These price surges and supply disruptions raised congressional interest in alternatives to petroleum. Coupled with concerns over the environmental impact of petroleum and other fossil fuels, congressional interest in alternatives remains strong.

Fuel Tax Incentives

Through the end of 2011, there were three key tax incentives for alternative fuels: (1) a tax credit for conventional ethanol of $0.45 per gallon,[7] (2) a tax credit for biodiesel and renewable diesel of $1.00 per gallon,[8] and (3) a credit of $0.50 per gallon for the retail sale of alternative fuels other than ethanol and biodiesel (e.g., LPG). In addition, there were tax credits for small ethanol and biodiesel producers ($0.10 per gallon), and a tax credit for the production of cellulosic biofuels (up to $1.01 per gallon, depending on the fuel).[9] All of these credits had expired by the end of 2011 except for the cellulosic fuel credit, which was set to expire at the end of 2012. The American Taxpayer Relief Act extended most of these incentives through the end of 2013 (in some cases, retroactively for 2012), although the main conventional ethanol tax credit was not extended.

In general, there is ongoing interest among some stakeholders in tax incentives for the production and purchase of alternative fuels. Supporters of this approach argue that the market favors conventional fuels, and that the widespread infrastructure and nearly ubiquitous use of conventional fuels in automobiles makes it difficult for alternative fuels to compete without economic incentives. Opponents argue that with a wide array of federal programs—including a mandate to use biofuels in gasoline and diesel fuel, and increasingly tight fuel economy standards—tax incentives are unnecessary.

[7] Through 2008, the tax credit was valued at $0.51 per gallon. The 2008 Farm Bill lowered the credit to $0.45 per gallon in the first year after U.S. ethanol supply exceeded 7.5 billion gallons. Through October 2008, annual U.S. ethanol consumption had already exceeded 7.8 billion gallons: Renewable Fuels Association, *The Industry - Statistics*, 2008 Monthly U.S. Fuel Ethanol Production/Demand, Washington, DC, http://www.ethanolrfa.org/industry/statistics/.

[8] Through 2008, the credit for biodiesel produced from recycled materials was $0.50 per gallon. EESA eliminated the distinction between biodiesel fuels produced from different feedstocks.

[9] For more information on tax and non-tax incentives for ethanol and biodiesel, see CRS Report R42566, *Alternative Fuel and Advanced Vehicle Technology Incentives: A Summary of Federal Programs*, by Lynn J. Cunningham et al.

The Renewable Fuel Standard (RFS)[10]

The Energy Policy Act of 2005 (EPAct 2005, P.L. 109-58) established a federal requirement that motor fuel suppliers (e.g., petroleum refiners, blenders) supply an increasing amount of renewable fuels. The Energy Independence and Security Act of 2007 (EISA, P.L. 110-140) expanded the mandate, requiring the use of 36 billion gallons of renewable fuels by 2022.

On February 3, 2010, the Environmental Protection Agency (EPA) finalized rules for the expanded RFS—often referred to as "RFS2."[11] As mandated by EISA, the rule required the use of 12.95 billion gallons of renewable fuels in transportation fuels in 2010. Most of this mandate was met using ethanol produced from corn, although within the larger RFS mandate, there are carve-outs for cellulosic biofuels, biomass-based diesel substitutes, and other advanced biofuels. For 2013, the overall mandate is 16.55 billion gallons.

One area of controversy is EPA's conclusion about the greenhouse gas impacts of biofuels. As part of its expansion of the RFS, EISA requires that all advanced biofuels, as well as conventional biofuels from new refineries, have reduced greenhouse gas emissions relative to petroleum fuels. In its proposed rule, EPA found that many fuel pathways did not meet the threshold requirements in EISA. However, its methodology was criticized by biofuels supporters. In the final rule, EPA modified its methodology to reflect some of those comments. However, some biofuels opponents counter that the final rules went too far in the opposite direction.[12]

A key component of the expanded RFS is a requirement starting in 2010 that a growing portion of the RFS be met using cellulosic biofuels (see "Cellulosic Biofuels" below). Under EISA, the cellulosic biofuel mandate begins at 100 million gallons in 2010 and increases to 16 billion gallons by 2022. However, EPA concluded that U.S. production capacity will be well below 100 million gallons in 2010: Using its authority under EISA to waive parts of the RFS, EPA set the cellulosic biofuel mandate at 6.5 million gallons (ethanol equivalent) for 2010.[13]

> While we proposed that the cellulosic biofuel standard would be set at the EISA specified level of 100 million gallons for 2010, based on analysis of information available at this time, we no longer believe the full volume can be met.... we have found that many of the projects that served as the basis for the proposal have been put on hold, delayed, or scaled back. At the same time, there have been a number of additional projects that have developed and are moving forward.... the timing for many of the projects indicates that while few will be able to provide commercial volumes for 2010, an increasing number will come on line in 2011, 2012, and 2013.... 5 million gallons (6.5 million ethanol equivalent) represents a reasonable, yet achievable level for the cellulosic standard for 2010.[14]

[10] For more information on the RFS, see CRS Report R40155, *Renewable Fuel Standard (RFS): Overview and Issues*, by Randy Schnepf and Brent D. Yacobucci.

[11] U.S. Environmental Protection Agency, *EPA Finalizes Regulations for the National Renewable Fuel Standard Program for 2010 and Beyond*, EPA-420-F-10-007, Washington, DC, February 2010, http://www.epa.gov/otaq/renewablefuels/420f10007.htm.

[12] Steven Mufson, "A Boost for Corn-Based Ethanol?," *Washington Post*, February 4, 2010, p. A15.

[13] For more information on EPA's waiver authority, see CRS Report RS22870, *Waiver Authority Under the Renewable Fuel Standard (RFS)*, by Brent D. Yacobucci.

[14] U.S. Environmental Protection Agency, *Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard; Final Rule*, EPA-HQ-OAR-2005-0161, Washington, DC, February 3, 2010, p. 14, http://www.epa.gov/otaq/renewablefuels/rfs2-preamble.pdf.

In November 2010 EPA finalized the required fuel levels for 2011, including the cellulosic biofuel mandate.[15] For 2011, EPA established a cellulosic mandate of 6.6 million gallons, well below the 250 million gallons scheduled in EISA.[16] For 2012, EPA similarly lowered the mandate, from 500 million gallons to 8.65 million gallons.[17] However, this lowered mandate was challenged in court, and in January 2013 the U.S. Court of Appeals for the District of Columbia vacated that rule as virtually no commercial-scale cellulosic biofuels have had been registered with EPA to date.[18] For 2013, EPA has proposed a cellulosic mandate of 14 million gallons; for the 2013 rule EPA argues that commercial-scale cellulosic biofuel production capacity will actually come on line early in 2013, allowing for rapid growth in U.S. production. [19]

Ethanol "Blend Wall"[20]

Until recently, ethanol concentration in gasoline was limited to 10% (E10) for all applications. This limit has been driven by four key factors: (1) regulation of fuel additives under EPA's implementation of the Clean Air Act; (2) vehicle and engine warranties and certification; (3) design and certification of existing infrastructure to deliver motor fuels (e.g., gasoline storage tanks, fuel pumps, etc.); and (4) state and local codes and regulations, including fire codes.

Because of these limitations, the total volume of ethanol that can be blended into U.S. gasoline is limited to roughly 14 billion to 15 billion gallons. However, by 2014 (or perhaps earlier), the RFS mandates will exceed this "blend wall." To meet the requirements of the RFS, gasoline suppliers will need to blend ethanol above 10%, or will need to use other avenues for supplying renewable fuels (e.g., using significantly more E85—85% ethanol and 15% gasoline—in vehicles designed for its use; increasing the use of biodiesel and renewable diesel in diesel fuel). Because of these concerns, various stakeholders are pushing for EPA to allow higher-level ethanol blends—E15, E20, or higher.

On March 6, 2009, Growth Energy (on behalf of 52 U.S. ethanol producers) applied to EPA for a waiver from the current Clean Air Act limitation of 10%. The application requested an increase in the maximum concentration to 15% (E15). In September 2010, EPA approved the use of E15 in model year (MY) 2007 and newer passenger vehicles, but deferred a decision on MY2001-MY2006 vehicles. In January 2011, EPA expanded the waiver to include MY2001 and later vehicles. Because EPA determined there was insufficient data to alleviate concerns over

[15] U.S. Environmental Protection Agency, *EPA Finalizes 2011 Renewable Fuel Standards*, Washington, DC, November 2010, http://www.epa.gov/otaq/fuels/renewablefuels/420f10056.htm.

[16] For more information on current cellulosic biofuel production capacity and the cellulosic mandate, see CRS Report R41106, *Meeting the Renewable Fuel Standard (RFS) Mandate for Cellulosic Biofuels: Questions and Answers*, by Kelsi Bracmort.

[17] EPA, "Regulation of Fuels and Fuel Additives: 2012 Renewable Fuel Standards," 77 *Federal Register* 1320, January 9, 2012.

[18] In 2012, roughly 20,000 gallons of cellulosic biofuel were registered with EPA's Moderated Transaction System (EMTS), as opposed to the 8.5 million gallons of fuel required under the vacated rule. EPA, *2012 RFS2 Data*, Washington, DC, February 7, 2013, http://www.epa.gov/otaq/fuels/rfsdata/2012emts.htm.

[19] EPA, "Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards; Proposed Rule," 78 *Federal Register* 9282-9306, February 7, 2013.

[20] For more information on the blend wall, see CRS Report R40445, *Intermediate-Level Blends of Ethanol in Gasoline, and the Ethanol "Blend Wall,"* by Brent D. Yacobucci.

emissions performance in older vehicles, as well as motorcycles, heavy trucks, and non-road engines, the agency denied a waiver for the use of E15 in those vehicles and engines.

To grant the waiver, the petitioner must establish to EPA that the increased ethanol content will not "cause or contribute to a failure of any emission control device or system" to meet emissions standards. EPA is to consider short- and long-term (full useful life) effects on evaporative and exhaust emissions from various vehicles and engines, including cars, light trucks, and non-road engines.

In addition to the emissions control concerns, other factors affecting consideration of the blend wall include vehicle and engine warranties and the effects on infrastructure. Currently, few automakers warrant their vehicles to use gasoline with higher than 10% ethanol.[21] Small engine manufacturers similarly limit the allowable level of ethanol. Because of concerns over potential equipment damage, a group of vehicle and engine manufacturers challenged in court EPA's initial decision to allow E15 in newer vehicles.[22] Potential concerns with older, "legacy" vehicles and equipment include the potential for higher ethanol concentrations to lead to corrosion of seals and other components, corrosion of fuel tanks, higher operating temperatures for some engines (e.g., smaller non-road engines), and higher emissions of some pollutants.

The waiver also has implications for fueling infrastructure. For example, most gasoline distribution systems (e.g., gas pumps, storage tanks) are designed to dispense up to E10. While some of these systems may be able to operate effectively on E15 or higher, their warranties/certifications would likely need to be updated. Further, many current state laws prohibit the use of blends higher than E10.

In EPA granting a waiver only for newer vehicles, a key question is how fuel pumps might be labeled to keep owners from using E15 in older vehicles and other equipment. Along with the waiver decision, EPA proposed new pump labeling rules to indicate which gasoline pumps dispense E15, which the agency finalized June 23, 2011. A related question is whether fuel suppliers would even be willing to sell E15 if some of their customers may not use it.

[21] For example, General Motors has approved the use of E15 in its model year (MY) 2012 and later vehicles, while Ford has approved E15 for MY2013 and later vehicles. Porsche approves the use of E15 in MY2001 and later cars. Robert L. Darbelnet, President and CEO, American Automobile Association, "Suspend Sale of E15 Gasoline," *The Hill*, December 13, 2012.

[22] *Alliance of Automobile Manufacturers et al v. United States Environmental Protection Agency* (United States Court of Appeals for the District of Columbia Circuit). Docket No. 10-1414. For the plaintiff's arguments, see Outdoor Power Equipment Institute, *Fact Sheet: E-15 Partial Waiver Legal Challenge*, December 17, 2010, http://members.opei.org/news/detail.dot?id=12146. The case was later dismissed because the appeals court ruled that the plaintiffs did not have standing to sue because none of them had been injured *in fact* since little or no E15 has entered into commerce and thus no vehicles or engines have been harmed by its use.

Cellulosic Biofuels[23]

Ethanol, the most widely used biofuel in the United States, is usually produced from corn. However, corn is a key animal feed, and is also used for human consumption. Further, corn is a resource-intensive crop, requiring significant use of chemical fertilizers and generally grown on prime farmland. There is growing interest in developing biofuels that require less energy to produce and have a smaller environmental footprint.

Biofuels produced from cellulosic materials such as fast-growing trees, prairie grasses, or agricultural wastes/byproducts are seen as a potential strategy for reducing the environmental impact of biofuels while expanding the United States' ability to displace petroleum fuels. The potential supply of these feedstocks is abundant, which is why it is expected that future expansion of the U.S. biofuels industry will be in this area.

However, breaking down cellulose and converting it into fuel requires complex chemical processing. Starches (such as corn) and sugars (such as cane sugar) are relatively easily fermented into alcohol, while cellulose must be broken down into sugars or starches through enzymatic or thermochemical processes before fermentation. Alternatively, biomass can be converted into synthesis gas,[24] which can then be used to produce fuels. Regardless of the pathway, processing cellulose into fuels is currently prohibitively expensive relative to other conventional and alternative fuel options. Therefore, R&D has focused on lowering the costs of enzymatic and other processing techniques.

Further, questions remain about the feasibility of these fuels, as well as the ultimate environmental footprint—many of the proposed feedstocks have never been grown on a large scale. Therefore, R&D is also focused on increasing the yield of potential biofuel crops, developing harvesting techniques, and finding ways to limit the environmental impact of dedicated energy crops.

The Energy Policy Act of 2005 included provisions to promote the development of cellulosic biofuels. These include an authorization for increased research and development funding at the Department of Energy; grants, loans, and loan guarantees for the development of cellulosic biofuels; per-gallon incentives for the first 1 billion gallons of domestic production;[25] and a mandate that gasoline contain a minimum amount of cellulosic ethanol annually starting in 2013.

On December 20, 2006, President Bush signed the Tax Relief and Health Care Act of 2006 (P.L. 109-432). Among other provisions, this tax law established a 50% depreciation allowance for cellulosic ethanol plants placed in service before January 1, 2013, subject to certain limitations.

The Energy Independence and Security Act of 2007 expanded the renewable fuel mandate in EPAct 2005, and established specific requirements for "advanced biofuels"—defined as fuels produced from feedstocks other than corn starch, and with 50% lower lifecycle greenhouse gas

[23] For more information on cellulosic biofuels, see CRS Report RL34738, *Cellulosic Biofuels: Analysis of Policy Issues for Congress*, by Kelsi Bracmort et al, and CRS Report R41106, *Meeting the Renewable Fuel Standard (RFS) Mandate for Cellulosic Biofuels: Questions and Answers*, by Kelsi Bracmort.

[24] A mixture of hydrogen and carbon monoxide that can be used to produce a variety of chemicals and fuels.

[25] On December 15, 2009, the Department of Energy finalized a rule establishing the incentive program. U.S. Department of Energy, "Final Rule: Production Incentives for Cellulosic Biofuels; Reverse Auction Procedures and Standards," 74 *Federal Register* 52867-52873, October 15, 2009.

emissions than petroleum fuels. (See "The Renewable Fuel Standard (RFS)" above.) Of the 36 billion gallons of renewable fuel required in 2022, 21 billion gallons must be advanced biofuels; within that mandate, there are specific carve-outs for cellulosic biofuels and biomass-based diesel fuels. The 2008 Farm Bill established a tax credit of up to $1.01 per gallon for the production of cellulosic biofuels.

Renewable Identification Numbers (RINs)[26]

The RFS is a market-based compliance system in which obligated parties (generally refiners and/or terminal operators) must submit credits to cover their obligations. These credits—Renewable Identification Numbers, or RINs—are effectively commodities that can be bought or sold like other commodities. For each gallon of renewable fuel in the RFS program, one RIN is generated. Each RIN is a 38-digit number, with blocks of digits corresponding to various data, including the year the RIN was generated, the producer of the fuel, and the type of fuel. RINs are valid for use in the year they are generated and the following year.

From the beginning of the RFS program, there have been concerns with RIN generation and the RIN market. As the RINs are essentially numbers in a computerized account, there have been errors and opportunities for fraud. Because of concerns over transposed digits, invalid characters, allegations of double-counting (intentional or unintentional) and other errors and inaccuracies, when EPA finalized rules for the RFS2, EPA also established a new in-house trading system in an effort to address these concerns. All RIN transactions must be cleared through this in-house system, called the EPA Moderated Transaction System (EMTS). From the beginning of the RFS2 EPA has maintained that all due diligence remains the duty of obligated parties. Under this "buyer beware" system those purchasing or receiving RINs must certify their validity on their own, and they are responsible for any fraudulent RINs they pass on to other buyers or submit to EPA for compliance.

In late 2011 and early 2012, EPA issued Notices of Violations (NOVs) to three companies that the agency alleges fraudulently generated a combined 140 million biodiesel RINs in 2010 and 2011. Two of those cases have led to criminal convictions. Because of these RIN fraud cases, EPA is looking at establishing a system whereby RINs can be certified by third parties registered with EPA. In January EPA proposed a Quality Assurance Plan program, including providing obligated parties—in some cases—with an "affirmative defense" if RINs are later found to be fraudulent. Under that affirmative defense, obligated parties would not be liable for civil penalties under the Clean Air Act for the use of such RINs. However, invalid RINs would need to be replaced with valid RINs by either the original generator of the RINs, the third-party certifier, or the current RIN holder. EPA expects to finalize the rules in July 2013, but has allowed auditors to "pre-register" (four companies were registered with EPA as of mid-March 2013).

The price of undifferentiated renewable fuel RINs (mostly representing corn ethanol) increased dramatically in the first quarter of 2013. Spot prices for ethanol RINs averaged between $0.07 and $0.08 per gallon in the first weeks of January. However, in the second week of March 2013, ethanol RINs averaged roughly $0.90 per gallon—a ten-fold increase.[27] Since, then prices have

[26] For more information, see CRS Report R42824, *Analysis of Renewable Identification Numbers (RINs) in the Renewable Fuel Standard (RFS)*, by Brent D. Yacobucci.

[27] "Ethanol & Gasoline Component Spot Market Prices," *OPIS Ethanol and Biodiesel Information Service*, January 14, 2013, March 18, 2013, and April 1, 2013.

dropped somewhat, averaging between about $0.60 and $0.70 per gallon in the last week of March. It is unclear what is driving the increase. The sudden escalation may be due to concerns over the blend wall, a reduction in output from U.S. ethanol producers in the first quarter, and that the RFS mandates will be binding in 2013 or 2014 possibly leading to a scarcity of RINs.[28] Some stakeholders have also raised concerns that market speculation may be playing a role in the recent volatility.

Ethanol Imports

Corn growers and ethanol producers are supportive of the renewable fuel standard because of its implications for higher corn and ethanol prices. However, concern over ethanol imports has grown among some stakeholders. Because of lower production costs and the availability of government incentives, depending on world commodity prices, ethanol prices in Brazil and some other countries can be significantly lower than in the United States. To offset the U.S. tax incentive that all ethanol (imported or domestic) received through the end of 2011, most imports were subject to a relatively small 2.5% ad valorem tariff, but more significantly an added duty of $0.54 per gallon. This added duty effectively negated the tax incentive for covered imports[29] and had been a significant barrier to fuel ethanol imports. However, the added duty expired with the tax incentive, and the prospects for reinstating either policy seem unlikely.

Before the duty expired, under certain conditions imports of ethanol from Caribbean Basin Initiative (CBI) countries were granted duty-free status.[30] This was true even if the ethanol was produced in a non-CBI country. In this scenario, the ethanol was produced in another country (historically Brazil or a European country), dehydrated in a CBI country, then shipped to the United States. In prior years these imports reached as high as 5% of the U.S. ethanol market. This avenue for imported ethanol to avoid the tariff was criticized by some stakeholders, including some Members of Congress. With the establishment of a renewable fuel standard, as well as high U.S. gasoline and ethanol prices, there may be more interest in importing ethanol, either through CBI countries or directly from ethanol producers.

The likelihood of increased ethanol imports from Brazil may grow in coming years as the RFS requires the use of more advanced biofuels, which would include Brazilian sugarcane ethanol. If targets in the RFS for cellulosic biofuels are not met (see "Cellulosic Biofuels"), the mandate for other advanced biofuels could further expand. Also, the Low Carbon Fuel Standard established in California could further increase demand for sugarcane ethanol and other low-carbon biofuels.

On December 20, 2006, President Bush signed the Tax Relief and Health Care Act of 2006 (P.L. 109-432). Among other provisions, the act extended the duty on imported ethanol through December 31, 2008, but did not address the CBI preference. The 2008 Farm Bill further extended the duty through December 31, 2010, and the 2010 tax package (P.L. 111-312) extended it through December 31, 2011. The added duty on imported ethanol has since expired.

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[28] "Soaring RIN Values Unleash New Interest in Evolving Market," *OPIS Ethanol and Biodiesel Information Service*, vol. 10, no. 10 (March 11, 2013), pp. 3-4.

[29] When the $0.54 duty was established, the tax incentive for conventional ethanol was also equivalent to $0.54 per gallon. Since then, the incentive for conventional ethanol has decreased (to $0.45 per gallon currently), while the duty has remained at $0.54 per gallon.

[30] For more information on ethanol imports from CBI countries, see CRS Report RS21930, *Ethanol Imports and the Caribbean Basin Initiative (CBI)*, by Brent D. Yacobucci.

Vehicle Purchase Requirements

The Energy Policy Act of 1992 established mandatory alternative fuel vehicle purchase requirements for various vehicle fleets.[31] Under the law, 75% of the passenger vehicles purchased by federal and state vehicle fleets must be capable of operating on alternative fuels; 90% of the vehicles purchased by alternative fuel providers must be alternative fuel vehicles.[32]

The alternative fuel vehicle provisions of EPAct 1992 have been criticized as ineffective because, while EPAct 1992 requires the purchase of vehicles capable of operating on alternative fuels, it did not mandate the use of alternative fuels. In most cases, the vehicles purchased to meet the requirement are dual-fuel vehicles (i.e., they can operate on either a conventional fuel or an alternative fuel). Those vehicles are primarily fueled using gasoline, because gasoline tends to be less expensive and more widely available than alternative fuels because the infrastructure to provide alternative fuels is limited compared with the existing infrastructure for gasoline and diesel fuel.

In addition, despite the vehicle purchase mandate, in previous years many agencies failed to meet their statutory obligation. As a result, in 2002 the Center for Biological Diversity filed a lawsuit with the U.S. District Court for the Northern District of California. In July 2002, the court ruled that several federal agencies failed to meet their quotas and ordered those agencies to prepare reports on their compliance with EPAct, which those agencies have completed.[33] Since that time, most agencies have complied with the requirement; in FY2007, the most recent year data are available, all covered federal fleets met the requirement.[34]

The Energy Policy Act of 2005 (Section 701) modified the requirements for EPAct 1992 compliance. All dual-fuel vehicles purchased to meet the EPAct quotas are required to operate on alternative fuels, unless an agency is granted a waiver by the Secretary of Energy. However, it is unclear whether this requirement will significantly affect federal agency alternative fuel use. The Secretary of Energy is required under the law to conduct a study of the effectiveness of the EPAct requirements. Further, Section 703 of EPAct 2005 allows state and fuel provider fleets to petition the Department of Energy (DOE) to waive the vehicle purchase requirement if the fleet certifies other fuel-saving measures (e.g., using higher-efficiency conventional vehicles or hybrids).

On January 28, 2008, President Bush signed the National Defense Authorization Act for Fiscal Year 2008 (P.L. 110-181). Among other provisions, the law amends the definition of "alternative fuel vehicle." Under the new definition, fleets covered by EPAct 1992 will be granted credits for the purchase of hybrid, advanced diesel,[35] and fuel cell vehicles, in addition to those alternative fuel vehicles already allowed.

[31] For purposes of compliance with EPAct 1992, a covered vehicle fleet is one operated by an agency or company in a metropolitan area with at least 20 passenger vehicles in one location.

[32] For more information on vehicle purchase requirements, see the Federal Energy Management Program's Fleet Management program at http://www1.eere.energy.gov/femp/program/fedfleet_requirements.html.

[33] Center for Biological Diversity v. Abraham, N.D. Cal., No. CV-00027.

[34] U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, *Federal Fleet Compliance with EPACT and E.O. 13149/E.O. 13423,* Fiscal Years 2000 through 2007.

[35] Light-duty diesel vehicles that meet specified emissions standards.

In addition to the requirements for federal, state, and fuel provider fleets, EPAct 1992 grants the DOE the authority to extend the requirements to local government and private fleets. However, as of 2002, DOE had not made a determination on requirements for local and private fleets. As part of the above lawsuit, the Center for Biological Diversity also asked the court to force DOE to promulgate new rules. In ruling on the above case, the U.S. District Court for the Northern District of California ordered DOE to establish a timeline for a new rulemaking. DOE compiled a timeline and, on March 4, 2003, it issued a rulemaking determining that such a program would not promote the goals of EPAct, neither reducing dependence on foreign oil nor leading to greater use of alternative fuel vehicles.[36]

The American Recovery and Reinvestment Act of 2009 (H.R. 1) appropriated $300 million to the General Services Administration for the purchase of vehicles with high fuel economy, including hybrid, plug-in hybrid, and pure electric vehicles.

On January 24, 2007, President Bush signed Executive Order 13423. Among other provisions, this order requires federal agencies to use commercially available plug-in hybrid electric vehicles (PHEVs). On October 5, 2009, President Obama signed Executive Oder 13514, which sets government-wide fuel savings and greenhouse gas reduction goals and affirms the vehicle acquisition goals set in E.O. 13423.

Vehicle Purchase Tax Incentives

Some supporters of alternative fuel and advanced technology vehicles argue that tax incentives for the purchase of vehicles and fuels are more effective than any purchase mandate. In addition to the mandatory purchase requirements, EPAct 1992 established tax incentives for the purchase of electric vehicles and "clean-fuel vehicles," including alternative fuel and hybrid vehicles. The Energy Policy Act of 2005 (Section 1341) significantly expanded and extended the vehicle purchase incentives, establishing tax credits for the purchase of fuel cell, hybrid, alternative fuel, and advanced diesel vehicles. For passenger vehicles, the credit was worth as much as $3,400 for hybrids and advanced diesels, and as much as $4,000 for alternative fuel vehicles, depending on vehicle attributes. The expiration date for the incentives also varied depending on the technology, with only the fuel cell vehicle tax credit currently available.[37]

The Emergency Economic Stabilization Act of 2008 established a tax credit for the purchase of plug-in vehicles, both pure electric vehicles and plug-in hybrids (i.e., gasoline/electric hybrid vehicles that can fuel on gasoline or be recharged from the electric grid.) For passenger vehicles, the credit is a maximum of $7,500, depending on the vehicle's battery capacity.

The American Recovery and Reinvestment Act of 2009 (P.L. 111-5) significantly modified the plug-in credits: the law eliminated the credit for vehicles above 14,000 pounds after 2009; established a credit of up to $2,500 for two-wheeled, three-wheeled, and low-speed four-wheeled plug-in vehicles; and established a credit of up to $4,000 for the conversion of existing vehicles to run on battery power (the credit for conversion kits has since expired). The law also allows purchasers to claim the plug-in, alternative fuel vehicle, and hybrid tax credits even if they are

[36] 68 *Federal Register* 10319.

[37] The credits for hybrid and advanced diesel vehicles expired at the end of 2009. Credits for alternative fuel vehicles expired at the end of 2010. For more information on vehicle tax incentives, CRS Report R42566, *Alternative Fuel and Advanced Vehicle Technology Incentives: A Summary of Federal Programs*, by Lynn J. Cunningham et al.

subject to the Alternative Minimum Tax (AMT)—previously, taxpayers subject to the AMT could not claim these credits. Eligibility for the tax credit for plug-in passenger vehicles phases out once a manufacturer has produced 200,000 vehicles eligible for the credit; for two-wheeled, three-wheeled, and low-speed vehicles the credit expires at the end of 2013.

Biodiesel and Renewable Diesel

Biodiesel and renewable diesel are synthetic diesel fuels produced from vegetable oils, including soybean and canola oils, animal fats, and recycled cooking grease. They can be blended with conventional diesel fuel and used in diesel engines with few or no modifications. Further, with some engine modifications, they can be used in a nearly pure form. Because biodiesel can displace conventional diesel without the use of new (and in many cases costly) vehicles, there is growing interest in its use. Further, because it can be produced from agricultural products, farmers (especially soybean and canola farmers) and some environmentalists have a keen interest in its development as a way to promote rural economies, reduce agricultural wastes, and limit greenhouse gas emissions. However, biodiesel production is currently expensive: wholesale biodiesel from virgin oils can cost up to two times more than conventional No. 2 diesel; biodiesel from recycled grease is less expensive but still costs considerably more than conventional diesel.

The cost barriers for biodiesel and renewable diesel production have generated interest in providing tax incentives, in the form of either production tax credits or excise tax exemptions, or both. Further there is interest in developing new technologies to help reduce production costs. However, the organic oils used as raw materials are one of the largest costs in production. Therefore, to significantly reduce production costs, the costs of soybean oil and other oils would need to decrease substantially, or less costly feedstocks would need to be developed.

As was stated above, the American Jobs Creation Act, as amended, provided a tax credit of up to $1.00 per gallon for the sale and use of biodiesel. In addition, the law provided an excise tax credit for biodiesel blends (i.e., biodiesel and conventional diesel). Producers were eligible for one credit or the other, but not both (see "Fuel Tax Incentives" above). These credits were set to expire at the end of 2006; the Energy Policy Act of 2005 (P.L. 109-58) extended these credits through 2008. Further, EPAct 2005 established a credit of $0.10 per gallon for small agri-biodiesel producers, and a $1.00-per-gallon credit for "renewable diesel"—diesel fuel produced from biomass through a different process than the biodiesel production process. The Emergency Economic Stabilization Act (P.L. 110-343) further extended these credits through the end of 2009. The credits lapsed in 2010, but the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010 (P.L. 111-312) extended the credits through the end of 2011, and made the extension retroactive to all of 2010. The American Taxpayer Relief Act (P.L. 112-240) further extended the credit through the end of 2013, retroactive for 2012.

Hydrogen and Fuel Cells

Over the past several years, interest has grown substantially in hydrogen fuel and fuel cells. Hydrogen fuel can be produced using any energy source, and has thus been touted as a way to limit dependence on energy imports. Further, when hydrogen is used in a fuel cell (a device that produces electricity by converting hydrogen to water), mostly heat and water are produced, drastically reducing or eliminating vehicle emissions. However, hydrogen fuel production is currently very expensive, as are fuel cells. In addition, depending on the original fuel source, overall fuel-cycle emissions can be a key concern.[38]

Because of the potential benefits from hydrogen and fuel cells, and because of the existing technical and cost barriers to their commercialization, the Bush Administration strongly supported research and development (R&D). In January 2002, the Bush Administration announced the FreedomCAR initiative, which promoted cooperative R&D between the "Big Three" American auto manufacturers (Chrysler, Ford, and General Motors) and the federal government. While the partnership conducted research on many automotive technologies, hydrogen and fuel cell vehicles were a key focus. Further, in his January 2003 State of the Union address, President Bush announced the Hydrogen Fuel Initiative, which increased federal spending on hydrogen fuel and stationary fuel cell R&D. Overall, the President requested $1.8 billion between FY2004 and FY2008 for both initiatives, including a $720 million increase in funding from earlier appropriations. Over that time, Congress appropriated a total of $1.4 billion for the initiatives.[39] The Energy Policy Act of 2005 authorized a total of $3.3 billion through FY2010 for fuel cell and hydrogen R&D.[40]

Opponents of the initiatives argued that hydrogen fuel and fuel cells may never be commercialized and that the initiatives draw funding away from near-term technologies such as hybrid vehicles. Further, some argue that research and development alone will not reduce petroleum dependence and that Congress should instead consider tightening fuel economy standards for all vehicles. As noted earlier, Congress did tighten fuel economy standards for all vehicles in the Energy Independence and Security Act of 2007 (P.L. 110-140).

Hybrid Vehicles

Hybrid gasoline/electric (and diesel/electric) vehicles have become increasingly popular in the United States. Hybrids combine a gasoline (or diesel) engine with an electrical motor system to improve efficiency. If their use becomes more widespread, they could help improve the overall efficiency of the vehicle fleet and could help limit oil consumption. Further, they could do so without significant changes to existing infrastructure, which has been a key barrier to the expanded use of alternative fuel vehicles.

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[38] For example, depending on the fuel and technology used, processing fossil fuels into hydrogen could lead to significantly higher emissions of toxic compounds and carbon dioxide.

[39] Congress agreed to increase funding for hydrogen and fuel cell research from $185 million in FY2003 to $266 million in FY2004, $305 million in FY2005, $335 million in FY2006, $335 million for FY2007, and approximately $400 million for FY2008.

[40] For more information on the Bush Administration's initiatives, see CRS Report RS21442, *Hydrogen and Fuel Cell Vehicle Research and Development (R&D): FreedomCAR and the President's Hydrogen Fuel Initiative*, by Brent D. Yacobucci.

Because of their energy and environmental benefits, some states have provided drivers of hybrid vehicles an exemption from high occupancy vehicle (HOV) lane requirements. While not addressing hybrids directly, the final version of the 2005 surface transportation reauthorization act (P.L. 109-59) permits states to exempt certain high-efficiency vehicles from HOV restrictions.

Further, as was stated above, the Energy Policy Act of 2005 and the Emergency Economic Stabilization Act of 2008 expanded the incentives for the purchase of hybrid and plug-in hybrid vehicles (see "Vehicle Purchase Tax Incentives" above).

Advanced Technology Vehicles Manufacturing (ATVM) Loan Program[41]

In addition to more stringent fuel economy standards, EISA also established a program to provide direct federal loans for the establishment of new facilities or retooling of existing facilities in the United States to produce highly fuel efficient vehicles. The Advanced Technology Vehicles Manufacturing (ATVM) Loan Program, administered by DOE's Loan Programs Office, has authority to provide up to $25 billion in direct loans to automakers and parts suppliers to build, expand, or re-equip plants for production of vehicles with at least 25% higher fuel economy than comparable MY2005 vehicle. The program been controversial as some critics question whether other existing policies, such as stricter vehicle fuel economy standards, already promote the same technologies, and whether the ATVM program effectively subsidizes compliance with those standards. The Government Accountability Office has also questioned whether DOE has the technical expertise to assess the loan applications it has received and evaluate the performance of projects it has approved.

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