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Alternative Fuels and Advanced Technology Vehicles: Issues in Congress

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Brent D. Yacobucci
Specialist in Energy Policy
Resources, Science, and Industry Division

Congressional Research Service

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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.

In the 110th Congress, alternative fuels and advanced technology vehicles have received a good deal of attention, especially in discussions over U.S. energy security. In his January 24, 2007, State of the Union Address, President Bush called for the increased use of renewable and alternative motor fuels to 35 billion gallons annually by 2017. U.S. consumption was roughly five billion gallons in 2006. Therefore, such an initiative would mean a seven-fold increase in the use of these fuels over 11 years.

On December 19, 2007, President Bush signed the Energy Independence and Security Act of 2007 (EISA, P.L. 110-140). EISA requires an increase in renewable fuel consumption to 9.0 billion gallons in 2008 and 36 billion gallons in 2022. Further within the 36-billion-gallon requirement, by 2022 the new law mandates the use of 21 billion gallons of "advanced biofuels," defined as fuel derived from renewable biomass other than corn starch, with 50% lower lifecycle greenhouse gas emissions compared to petroleum fuels.

The 109th Congress passed the Energy Policy Act of 2005 (EPAct 2005, P.L. 109-58), which contains many provisions relevant to alternative fuels and advanced technology vehicles. Among its provisions, the act expanded existing tax incentives for the purchase of advanced vehicles, authorized R&D funding for hydrogen fuel and fuel cells, and required that the nationwide gasoline supply contain a minimum amount of ethanol or other renewable fuel. EPAct 2005 was signed by President Bush on August 8, 2005.

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Introduction

High crude oil and gasoline prices over the past few 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] In spring 2006, high oil 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 fall 2006 and winter 2007, gasoline prices eased somewhat, but in spring 2007 returned to those highs, where they have remained.

Key components of federal policies to reduce fuel 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

On December 19, 2007, President Bush signed the Energy Independence and Security Act of 2007 (EISA, P.L. 110-140).[4] EISA requires an increase in renewable fuel consumption to 9.0 billion gallons in 2008 and 36 billion gallons in 2022. Further, within the 36-billion-gallon requirement, the new law mandates the use of 21 billion gallons of "advanced biofuels," defined as fuel derived from renewable

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[1] For more information on petroleum supply and prices, see CRS Report RL32530, *World Oil Demand and its Effect on Oil Prices*, by Robert Pirog. For more information on legislative proposals to help mitigate high gasoline prices, see CRS Report RL33521, *Gasoline Prices: Issues for the 110th Congress*, by Carl E. Behrens and Carol Glover.

[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.

[4] For more information on EISA, see CRS Report RL34294, *Energy Independence and Security Act of 2007: A Summary of Major Provisions.*

biomass other than corn starch, with 50% lower lifecycle greenhouse gas emissions compared to petroleum fuels.

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 — spurred interest in moving the United States away from petroleum fuels for transportation and toward alternative fuels and advanced vehicle technologies.[5]

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. Under EPAct 1992, a certain percentage — which varies by the type of fleet — of new passenger vehicles purchased for a federal or state agency or alternative fuel provider fleet 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.

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 gasoline 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 2005. Continued pressure on energy prices and concerns over energy security after passage of EPAct 2005 led to continued 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

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[5] For background on alternative fuels, including legislative history, see CRS Report RL30758, *Alternative Transportation Fuels and Vehicles: Energy, Environment, and Development Issues*, by Brent D. Yacobucci. For background on advanced vehicle technologies, see CRS Report RL30484, *Advanced Vehicle Technologies: Energy, Environment, and Development Issues*, by Brent D. Yacobucci.

renewable fuel mandate in EPAct 2005, and significantly tightened federal fuel economy (CAFE) standards.

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.

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, including U.S. dependency on oil imports. In light of this, 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 — has 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 from roughly 25 mpg today.

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, 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.

Hurricanes along the Gulf Coast in the fall of 2005 led to fuel supply disruptions and high retail prices, raising congressional interest in alternatives to petroleum. In addition, in spring 2006, high crude prices, issues with refining capacity, and concerns about ethanol supply led to high pump prices, further raising concerns about the United States' ability to supply fuel to the transportation sector. As crude oil and gasoline prices returned to historic highs in 2007 and 2008, these supply concerns remain.

Fuel Tax Incentives

There are three key tax incentives for alternative fuels: (1) a tax credit for ethanol of $0.51 per gallon, (2) a tax credit for biodiesel and renewable diesel of $1.00 per gallon ($0.50 for biodiesel made from recycled products), and (3) a credit of $0.50 per gallon for the retail sale of alternative fuels other than ethanol and

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[6] For more information on fuel economy standards, see CRS Report RL33413, *Automobile and Light Truck Fuel Economy: The CAFE Standards.*

biodiesel (e.g., LPG). In addition, there are tax credits for small ethanol and biodiesel producers ($0.10 per gallon).[7]

There is ongoing interest 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. The American Jobs Creation Act of 2004 (P.L. 108-357) replaced a previous excise tax exemption for ethanol-blended fuels with a tax credit of $0.51 per gallon. This credit will expire at the end of 2010.

In addition to the credit for ethanol-blended gasoline, there has been interest in promoting biodiesel fuel. P.L. 108-357 provides a tax credit of $1.00 per gallon for the sale and use of "agri-biodiesel" — biodiesel produced from virgin agricultural products such as soybean or canola oil. There is a smaller credit of $0.50 per gallon for biodiesel produced from recycled grease. Under P.L. 108-357 the biodiesel credit would have expired at the end of 2006, four years before the expiration of the ethanol credit; the Energy Policy Act of 2005 (P.L. 109-58) extended the biodiesel tax credit through 2008. In addition, P.L. 109-58 expanded the credit to include "renewable diesel," which is produced from a different process than biodiesel and results in a fuel with somewhat different chemical characteristics. In recent guidance on the tax credit, the Internal Revenue Service ruled that renewable diesel includes synthetic diesel fuel produced from vegetable oils at petroleum refineries.[8] Most biodiesel producers are small plants, and many biodiesel producers are concerned that this decision could lead to a shift away from biodiesel production to renewable diesel production at large refineries.

Ethanol and MTBE

Outside of tax incentives, ethanol has been of key interest in recent Congresses, especially in its role as an alternative to MTBE (methyl tertiary butyl ether).[9] MTBE and ethanol were used (among other purposes) to meet Clean Air Act requirements that reformulated gasoline (RFG), sold in the nation's worst ozone nonattainment areas, contain at least 2% oxygen (by weight), to improve combustion. Under the RFG program, areas with "severe" or "extreme" ozone pollution (90 counties with a combined population of 64.8 million[10]) must use reformulated gas; areas with less

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[7] For more information on tax and non-tax incentives for ethanol and biodiesel, see CRS Report RL33572, *Biofuels Incentives: A Summary of Federal Programs*, by Brent D. Yacobucci. For a detailed discussion of ethanol tax incentives, see CRS Report RL32979, *Alcohol Fuels Tax Incentives*, by Salvatore Lazzari.

[8] U.S. Internal Revenue Service, *Notice 2007-37: Renewable Diesel*, April 23, 2007.

[9] For additional background on the MTBE issue, see CRS Report RL32787, *MTBE in Gasoline: Clean Air and Drinking Water Issues*, by James E. McCarthy and Mary Tiemann. For information on ethanol, see CRS Report RL33290, *Fuel Ethanol: Background and Public Policy Issues*, by Brent D. Yacobucci.

[10] As classified under the old 1-hour ozone standard that was replaced with a new, 8-hour (continued...)

severe ozone pollution may opt into the program as well, and many have. In all, portions of 17 states and the District of Columbia use RFG, and about 30% of the gasoline sold in the United States is RFG, according to the Environmental Protection Agency (EPA).[11]

Before amendment by the Energy Policy Act of 2005, the Clean Air Act required that RFG contain at least 2% oxygen by weight.[12] Refiners met this requirement by adding a number of ethers or alcohols, any of which contains oxygen and other elements. Until about 2003, the most commonly used oxygenate was MTBE because it was cheaper and easier to use than competing oxygenates. In 1999, 87% of RFG contained MTBE, a number reduced to about 46% in 2004, according to EPA. MTBE has also been used since the late 1970s in non-reformulated gasoline as an octane enhancer, at lower concentrations. As a result, gasoline with MTBE has been used throughout the United States, whether or not an area has been subject to RFG requirements.

MTBE contamination creates taste and odor problems in water at very low concentrations, and some animal studies indicate MTBE may pose a cancer risk to humans. MTBE leaks, generally from underground gasoline storage tanks, have been implicated in numerous incidents of ground water contamination. For these reasons, 25 states have taken steps to ban or limit its use, according to the Renewable Fuels Association.[13] The most significant of the bans (in California and New York) took effect at the end of 2003, leading many to suggest that Congress revisit the issue to modify the oxygenate requirement and set more uniform national requirements regarding MTBE and its potential replacements, principally ethanol.

Support for eliminating the oxygenate requirement on a nationwide basis was widespread among states, the petroleum industry, and some environmental groups. In general, these stakeholders concluded that gasoline can meet the same low-emission performance standards as RFG without the use of oxygenates. But agricultural interests presented a potential obstacle to enacting legislation to remove the oxygen requirement. According to the U.S. Department of Agriculture (USDA), roughly 20% of the nation's corn crop was used in 2006/2007 to produce the competing oxygenate, ethanol.[14] If MTBE use were reduced or phased out, but the oxygen requirement remained in effect, ethanol use would have soared, increasing demand for corn. Conversely, if the oxygen requirement were repealed, not only would MTBE use decline, but so, likely, would demand for ethanol. Thus, some

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[10] (...continued)
standard in 2004.

[11] U.S. Environmental Protection Agency (EPA), Office of Transportation Air Quality (OTAQ), *Staff White Paper: Study of Unique Gasoline Blends ("Boutique Fuels"), Effects on Fuel Supply and Distribution and Potential Improvements,* October 2001.

[12] In the case of MTBE, this equates to roughly 11% by volume.

[13] Renewable Fuels Association, "New Jersey Bans MTBE," *Ethanol Report*, Issue #226, July 15, 2005.

[14] USDA estimates the in 2007/2008, that percentage will increase to 24%. U.S. Department of Agriculture, Economic Research Service, *Feed Outlook*, January 15, 2008.

Members of Congress and governors from corn-growing states took a keen interest in MTBE legislation and related oxygenate requirements.

To help promote the market for ethanol if the oxygen standard were eliminated, a renewable fuels standard (RFS) was suggested. This would require that all gasoline contain ethanol or other renewable fuel. This concept was supported by agricultural interests, the oil industry, and some environmental groups. Opponents included states that do not produce ethanol, due to fears that the mandate could raise gasoline prices.

The Energy Policy Act of 2005 (P.L. 109-58) contains numerous MTBE and ethanol provisions. It repealed the Clean Air Act requirement to use MTBE or other oxygenates. In place of this requirement, the law established a renewable fuels standard. Under the RFS, annual gasoline supply is required to contain 7.5 billion gallons of ethanol or other renewable fuel by 2012. To prevent "backsliding" on air quality, the law requires that reductions in emissions of toxic substances achieved by RFG be maintained, and it authorizes funds for MTBE cleanup.[15] The Energy Independence and Security Act of 2007 (P.L. 110-140) expanded this mandate, requiring the use of 9.0 billion gallons of renewable fuels in transportation fuel[16] in 2008, and 36 billion gallons in 2022.

Cellulosic Biofuels

Ethanol, the most significant 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 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 easily fermented into alcohol, while cellulose must be broken down into sugars or starches through enzymatic or thermochemical processes before fermentation.

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[15] For a detailed comparison of the renewable fuels legislation, see CRS Report RL32865, *Renewable Fuels and MTBE: A Comparison of Selected Provisions in the Energy Policy Act of 2005 (P.L. 109-58 and H.R. 6)*, by Brent D. Yacobucci, Mary Tiemann, and James E. McCarthy.

[16] While the original mandate in P.L. 109-58 covered only gasoline, the expanded mandate applies to all transportation fuels.

Alternatively, biomass can be converted into synthesis gas,[17] 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; and a mandate that gasoline contain at least 250 million gallons 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 emissions than petroleum fuels. 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.

Ethanol Imports

Corn growers and ethanol producers are supportive of the renewable fuels standard because of its implications for higher corn and ethanol prices. However, concern over ethanol imports is growing among some stakeholders. Because of lower production costs and the availability of government incentives, 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) receives, most imports are 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 negates the tax incentive for covered imports and has been a significant barrier to fuel ethanol imports.

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

However, under certain conditions imports of ethanol from Caribbean Basin Initiative (CBI) countries are granted duty-free status.[18] This is true even if the ethanol was produced in a non-CBI country. In this scenario, the ethanol is produced in another country (historically Brazil or a European country), dehydrated in a CBI country, then shipped to the United States. In recent years, these imports have reached as high as 5% of the U.S. ethanol market. This avenue for imported ethanol to avoid the tariff has been 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.

In addition to the concerns over imports of duty-free ethanol from CBI countries, there is growing concern that a large portion of ethanol otherwise subject to the duties is being imported duty-free through a "manufacturing drawback."[19] If a manufacturer imports an intermediate product, then exports the finished product or a similar product, then that manufacturer may be eligible for a refund (drawback) of up to 99% of the duties paid. There are special provisions for the production of petroleum derivatives.[20] In the case of fuel ethanol, the imported ethanol is used as a blending component in gasoline, and jet fuel (considered a like commodity) is exported to qualify for the drawback.[21] Some critics estimate that as much as 75% or more of the duties were eligible for the drawback in 2006. Therefore, critics question the effectiveness of the ethanol duties and the CBI exemption.

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 duty drawback provisions or the CBI preference.

Vehicle Purchase Requirements

The Energy Policy Act of 1992 established mandatory alternative fuel vehicle purchase requirements for various vehicle fleets.[22] Under the law, 75% of the passenger vehicles purchased by federal and state vehicle fleets must be capable of

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

[19] For more information on drawbacks, see U.S. Customs Service, *Drawback: A Refund for Certain Exports*, Washington, February 2002.

[20] 19 U.S.C. 1313(p).

[21] Peter Rhode, "Senate Finance May Take Up Drawback Loophole As Part Of Energy Bill," *EnergyWashington Week*, April 18, 2007.

[22] 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.

operating on alternative fuels; 90% of the vehicles purchased by alternative fuel providers[23] must be alternative fuel vehicles.[24]

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 since 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, many agencies have 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.[25]

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. In addition, the Secretary of Energy is required 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,[26] and fuel cell vehicles, in addition to those alternative fuel vehicles already allowed.

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

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

[24] For more information on vehicle purchase requirements, see CRS Report RL30758, *Alternative Transportation Fuels and Vehicles: Energy, Environment, and Development Issues*, by Brent D. Yacobucci.

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

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

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 (68 *Federal Register* 10319).

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 is 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 varies depending on the technology.[27]

In the case of hybrid and advanced diesel vehicles, the number of vehicles eligible for the credit is limited for each vehicle manufacturer. Starting the second calendar quarter after a manufacturer sells the 60,000th vehicle eligible for the credit, the credit for that manufacturer's vehicles is reduced. Currently, only Toyota and Honda have sold enough vehicles to trigger a phaseout. For Toyota (and Lexus) hybrids purchased after September 30, 2006, the credit was reduced by 50%; the credit was reduced to 25% for vehicles purchased after March 31, 2007, and is zero for vehicles purchased after September 30, 2007. Honda's phaseout began January 1, 2008, and the credit for Honda vehicles will reach zero on January 1, 2009. Other manufacturers have yet to hit the 60,000 vehicle mark.[28]

Biodiesel

Biodiesel is a synthetic diesel fuel produced from oils, including soybean and canola oils, animal fats, and recycled cooking grease.[29] It can be blended with conventional diesel fuel and used in diesel engines with few or no modifications. Further, with some engine modifications, it 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

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[27] For more information on vehicle tax incentives, see CRS Report RS22351, *Tax Incentives for Alternative Fuel and Advanced Technology Vehicles*, by Brent D. Yacobucci.

[28] For more information on the hybrid vehicle tax credit, see Internal Revenue Service, *Summary of the Credit for Qualified Hybrid Vehicles*, at [http://www.irs.gov/newsroom/article/0,,id=157632,00.html], updated December 11, 2007.

[29] For more information on biodiesel, see CRS Report RL32712, *Agriculture-Based Renewable Energy Production*, by Randy Schnepf, and CRS Report RL30758, *Alternative Transportation Fuels and Vehicles: Energy, Environment, and Development Issues*, by Brent D. Yacobucci.

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 production have generated interest in providing tax incentives for biodiesel, in the form of either a production tax credit or an excise tax exemption, 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 biodiesel production costs, the costs of soybean oil and other oils would need to decrease substantially.

As was stated above, the American Jobs Creation Act provides a tax credit of up to $1.00 per gallon for the sale and use of "agri-biodiesel" — biodiesel from virgin agricultural products. The credit is $0.50 per gallon for biodiesel from recycled grease. In addition, the law provides an excise tax credit for biodiesel blends (i.e., biodiesel and conventional diesel). Producers are 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. While these tax credits generally do not make biomass-based diesel fuels less expensive than conventional diesel, they do help make them more cost-competitive.

Hydrogen and Fuel Cells

Over the past few years, interest has grown substantially in hydrogen fuel and fuel cells.[30] 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.[31]

Because of the potential benefits from hydrogen and fuel cells, and because of the existing technical and cost barriers to their commercialization, the Bush

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[30] For background information on hydrogen and fuel cells, see CRS Report RL32196, *A Hydrogen Economy and Fuel Cells: An Overview*, by Brent D. Yacobucci and Aimee E. Curtright.

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

Administration has strongly supported research and development (R&D). In January 2002, the Administration announced the FreedomCAR initiative, which promotes cooperative R&D between the "Big Three" American auto manufacturers (Chrysler, Ford, and General Motors) and the federal government. While the partnership is conducting research on many technologies, hydrogen and fuel cell vehicles are 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.[32] The Energy Policy Act of 2005 authorizes a total of $3.3 billion through FY2010 for fuel cell and hydrogen R&D.[33]

Opponents of the initiatives argue 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 are becoming increasingly popular in the United States. Hybrids combine a gasoline (or diesel) engine with an electrical motor system to improve efficiency.[34] 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. By January 2008, Ford, General Motors, Honda, Nissan, Mazda, and Toyota offered vehicles with hybrid powertrains. At the present time, only hybrid passenger cars, SUVs, and pickups are available in the United States, but hybrid versions of other vehicle models and classes are expected in the near future.

Because of their energy and environmental benefits, some states have provided drivers of hybrid vehicles an exemption from high occupancy vehicle (HOV) lane requirements. Under TEA-21 (which expired on September 30, 2003), states had the authority to grant HOV exemptions for so-called "Inherently Low Emission Vehicles" (ILEVs). The ILEV standard requires that a vehicle have no evaporative

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[32] 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.

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

[34] For more information on hybrid vehicles, see CRS Report RL30484, *Advanced Vehicle Technologies: Energy, Environment, and Development Issues*, by Brent D. Yacobucci.

emissions, a standard that is not met by any current hybrid. However, because of the reduced emissions and improved fuel economy of hybrid vehicles, there has been congressional interest in explicitly granting states the right to exempt them from HOV lane requirements. While not addressing hybrids directly, the final version of the highway 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 expanded the incentives for the purchase of hybrid vehicles (see "Vehicle Purchase Tax Incentives," above).

For Additional Reading

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