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Renewable Energy: Background and Issues for the 110th Congress

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Summary

Renewable energy can be used to produce liquid fuels and electricity. A variety of funding, tax incentives, and regulatory policies have been enacted to support renewables as a means for addressing concerns about energy security, air pollution, international competitiveness, and climate change. This report reviews the background for renewables and describes the current congressional debate.

Budget and funding issues are key concerns. The Energy Policy Act of 2005 authorized several new renewable energy demonstration and deployment programs, but most of them have not been funded. Further, the Energy Independence and Security Act of 2007 (P.L. 110-140) authorized several new renewable energy programs that have not yet received appropriations. The Consolidated Appropriations Act for 2008 (P.L. 110-161) increased Department of Energy (DOE) renewable energy funding by $31.4 million (7%). DOE's FY2009 request would further increase renewables funding by $18.3 million (4%).

Tax policies are also at issue. The interaction of the federal renewable energy electricity production tax credit (PTC) with state renewable portfolio standard (RPS) policies has forged a strong incentive for wind energy development. H.R. 5351 passed the House by a vote of 236 to 182. It would extend the PTC for three years past its scheduled expiration at the end of 2008, provide $2 billion for a new category of clean renewable energy (tax credit) bonds, extend for eight years the 30% level for the business solar tax credit, and extend for six years the 30% residential solar tax credit. Further, H.R. 5351 would repeal $17.7 billion in tax subsidies for oil and natural gas, and $400 million for the "Hummer" tax credit loophole, that would be used to offset the cost of the tax incentives for renewable energy ($8.9 billion) and energy efficiency ($7.8 billion). During the first session, the House-passed version of H.R. 6 (and H.R. 3221) proposed a similar repeal of the oil and gas subsidies. The proposal triggered a veto threat from the Administration, and was not included in P.L. 110-140.

The ethanol fuel issue has intensified. Corn ethanol production is rising rapidly, but appears to be causing food price increases. Concerns about rising food prices and apparent limits to the long-term potential for corn ethanol have brought a focus on cellulosic ethanol. Cellulosic sources avoid many limits on corn and appear to have much lower net CO_2 emissions, but they require an extensive and costly conversion process. P.L. 110-140 set a new renewable fuels standard (RFS), which starts at 9.0 billion gallons in 2008 and rises to 36 billion gallons in 2022. H.R. 5351 and the farm bill (H.R. 2419) contain several tax incentives and other provisions for biofuels.

Key policy challenges remain. The PTC and other popular tax incentives are due to expire at the end of 2008. The wind industry says that project time needs could slow development well before then. Further, without revenue offsets from reduced oil and gas subsidies, it is not clear how renewables tax incentive extensions would be supported. Also, the prospects for another RPS initiative are unclear.

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Renewable energy is derived from resources that are generally not depleted by human use, such as the sun, wind, and water movement. These primary sources of energy can be converted into heat, electricity, and mechanical energy in several ways. There are some mature technologies for conversion of renewable energy such as hydropower, biomass, and waste combustion. Other conversion technologies, such as wind turbines and photovoltaics, are already well developed, but they have not achieved the technological efficiency and market penetration that many expect they will ultimately reach. Although geothermal energy is produced from geological rather than solar sources, it is often included as a renewable energy resource (and is treated as such in this report). Commercial nuclear power is not generally considered to be a renewable energy resource.[1]

Despite fluctuating government policies since the 1970s, a combination of incentives and high energy prices has enabled wind energy to gain a toe-hold in electric power markets and allowed ethanol to secure a modest, but growing, presence in motor fuels markets. Congress is now debating whether to provide additional subsidies, incentives, and mandates to further expand renewable energy use. This report describes the background and primary policy issue areas affecting renewable energy, including budget and funding, tax incentives, electricity regulatory initiatives, renewable fuels, and climate change.

History and Background

The energy crises of the 1970s spurred the federal government, and some state governments, to mount a variety of renewable energy policies. These policies included support for research and development (R&D), technology demonstration projects, and commercial deployment of equipment. For renewable energy, these policies included a focus on the production of both liquid fuels and electricity.

Fuels Production

The Energy Tax Act of 1978 established a 4 cents per gallon excise tax exemption for ethanol blended into gasoline. This incentive expired, and was extended, several times during the 1980s and 1990s. In some cases, the incentive

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[1] For further definitions of renewable energy, see the National Renewable Energy Laboratory's website information on "*Clean Energy 101*" at [http://www.nrel.gov/learning/].

was modified at the same time that it was extended.[2] The Energy Policy Act of 1992 extended the excise tax exemption and created a tax deduction for clean-fuel vehicles that included those using 85% ethanol (E85). It also established a requirement that federal, state, and other vehicle fleets include a growing percentage of alternative-fueled vehicles, including those using ethanol. In 2000, the General Accounting Office (GAO)[3] reported that the excise tax exemption and the alcohol fuel tax credits had been the most important incentives for renewable fuels.[4] By the time that the Energy Policy Act of 2005 (EPACT) was enacted, a variety of tax, grant, loan, and regulatory provisions had been established for renewable fuels. This included some 17 programs spanning five agencies. At present, the major tax incentives are a 51 cents per gallon excise tax exemption for ethanol blends, a $1 dollar per gallon tax credit for agri-biodiesel (50 cents per gallon for recycled biodiesel), and the alternative motor vehicle tax credit.[5] However, some believe that the Renewable Fuel Standard (RFS) set by EPACT Section 1501 — which requires that motor fuels contain increasing amounts of renewable fuel each year through 2012 — may now be the most important policy supporting renewable biofuels.[6]

Electricity Production

The Public Utility Regulatory Policies Act (PURPA, Section 210) created a policy framework that required electric utilities to purchase electricity produced from renewable energy sources. PURPA also empowered the states to set the price for such purchases. PURPA aimed to reduce oil use for power production, encourage the use of renewable energy for power production, and to structure a new dimension of competition to help keep electricity prices down. In the early 1980s, under the influence of PURPA regulation, a convergence of federal and state policies launched commercial deployment of wind and solar energy in California. In particular, the development of early wind farms was driven mainly by a combination of federal and state investment tax credits for wind energy.

As the new wind industry developed, two emerging aspects stimulated further policy changes. First, some firms took advantage of the investment tax credits by capturing the tax benefits at the front end and leaving wind machines that operated poorly or not at all. Recognition of this problem eventually led to the creation of a production-oriented tax credit. Second, in order to obtain third party financing, wind

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[2] *A History of Ethanol*. [http://e85.whipnet.net/index.html].

[3] This is now the Government Accountability Office.

[4] GAO. *Petroleum and Ethanol Fuels: Tax Incentives and Related GAO Work.* Letter to Senator Tom Harkin. September 25, 2000. (B-286311) 3 p. [http://www.gao.gov/new.items/rc00301r.pdf].

[5] The 2004 Jobs Bill (P.L. 108-311) revised and extended the excise tax exemption for ethanol, and created the incentives for biodiesel fuel. EPACT extended the ethanol and biodiesel incentives. It also sunset the deduction for clean-fuel vehicles and created a new credit for alternative motor vehicles. For more details see CRS Report RL33572, *Biofuels Incentives: A Summary of Federal Programs*, by Brent Yacobucci.

[6] For more about ethanol fuels, see CRS Report RL33290, *Fuel Ethanol: Background and Public Policy Issues*, by Brent Yacobucci.

farm developers needed to secure agreements for power purchases that fixed the price for a long-term (10 years or more) period. This led the California Public Utility Commission to promote the development of "standard offer" contracts. These contracts reduced investment risk, established stable revenue streams, and helped launch early wind farm developments.

Oil and natural gas prices slumped during the mid-1980s, and declined more steeply in the late 1980s. Meanwhile, Congress let the residential solar investment tax credit expire in 1985. Funding for Department of Energy (DOE) renewable energy R&D programs also declined, reaching a low point in 1990.

In late 1990 and early 1991, the Persian Gulf War re-ignited interest in renewable energy. Other nations, notably Japan and Germany, began to undertake more aggressive policies to subsidize renewables, especially wind and solar technologies. In the United States, Congress began to increase funding for the Department of Energy (DOE) renewable energy R&D program. In 1992, the United States became a signatory of the United Nations Framework Convention on Climate Change (UNFCCC). This action forged a new environmental motive for support of renewable energy. These national interests were reflected in the Energy Policy Act of 1992 (P.L. 102-486). For electricity, this law made permanent the 10% business investment tax credit for solar and geothermal equipment. It also created a new renewable energy electricity production tax credit of 1.5 cents per kilowatt-hour (kwh) for wind farms and closed-loop (energy crop) biomass.

Climate change concerns spurred other industrialized nations to strengthen renewable energy policies and programs. Through the 1990s, concern about global climate change became an increasingly important motive in the European Union (EU), Japan, and other countries for raising renewable energy production goals and providing incentives to support commercial deployment. The Kyoto Protocol set emission reduction targets for carbon dioxide (CO_2) and other greenhouse gases (GHG). After signing the Protocol, these nations intensified their efforts for commercial deployment of renewable energy. In the United States, concern about climate change was largely offset by a concern about the potential effect of the Kyoto CO_2 emission reduction targets on economic growth and competitiveness. As a result of this economic concern, the United States has taken a more limited effort than many other industrialized nations to support renewable energy as a strategy for addressing climate change. The federal government has continued support for existing funding and subsidies. However, aside from the previously mentioned policies, it has not established major new policies and programs like the feed-in tariff in Germany or the European Union's target for producing 20% of its energy from renewables.[7]

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[7] A feed-in tariff directs a utility to purchase electricity generated by renewable energy producers in its service area at a tariff determined by public authorities and guaranteed for a specific period of time. The price and term can vary by technology and over time. For more details, see California Energy Commission, *Notice of IEPR Committee Workshop on "Feed-In" Tariffs*, May 21, 2007. On the Commission's website at [http://www.energy.ca.gov/2007_energypolicy/notices/2007-05-21_committee_workshop.html].

State action on renewable energy has often supplanted federal action or created models for new federal policies. As one example, California has implemented very aggressive programs for renewable energy. In the mid-1990s, the advent of electric industry restructuring led California state policymakers to create a public goods charge on ratepayer electricity use. Part of the resulting revenue was used to fund renewable energy development and deployment programs. Also, California's electricity shortages in 2000 and 2001 prompted the state to expand its renewable energy programs. Motivated by concern over climate change, California has recently adopted more aggressive actions for renewables. This includes a $3 billion solar deployment initiative, and an increase of its renewable portfolio standard to 33% of total electricity production by 2020.

Action in the 110th Congress

Economic and environmental concerns — namely energy security, international competitiveness, high energy prices, air pollution, and climate change — are now driving policy proposals to support renewable energy R&D and market deployment. In the 110th Congress, more than 100 bills have been introduced that would support renewable energy.[8] In the first session, the Energy Independence Act (P.L. 110-140) and the Consolidated Appropriations Act (P.L. 110-161) increased support for renewable energy.[9]

(For more details on the Energy Independence Act, see CRS Report RL34294, *Energy Independence and Security Act of 2007: A Summary of Major Provisions*; for more details on FY2008 appropriations for DOE's renewable energy programs, see CRS Report RL34009, *Energy and Water Development: FY2008 Appropriations*; for more information about renewable energy laws and bills, see CRS Report RL33831, *Energy Efficiency and Renewable Energy Legislation in the 110th Congress*.)

Budget and Funding Issues

EPACT (P.L. 109-58) Implementation

As part of the strategy to address energy security, climate change, and other national interests, the Energy Policy Act of 2005 (EPACT, P.L. 109-58) contained several provisions that authorized new programs and spending for renewable energy. Many of those provisions have either gone unfunded or have been funded below the authorized level.

Loan Guarantee Program. Title 17 of EPACT created a DOE loan guarantee program for certain energy technologies that could improve energy

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[8] For a comprehensive list of renewable energy bills, see CRS Report RL33831, *Energy Efficiency and Renewable Energy Legislation in the 110th Congress*, by Fred Sissine.

[9] For a side-by-side comparison of the omnibus bills, see CRS Report RL34135, *Omnibus Energy Efficiency and Renewable Energy Legislation*, by Fred Sissine.

security, curb air pollution, and reduce greenhouse gas emissions.[10] Innovative renewable energy power plants and fuel production facilities would be eligible for a federal loan guarantee covering up to 80% of construction costs.[11]

EPACT Framework for Loan Guarantee Program. Many view this program as a key element of EPACT that addresses climate change and supports the commercial development of biofuels, such as cellulosic ethanol. The law authorizes DOE to issue loan guarantees to eligible projects that:

> ... avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases ... [and] ... employ new or significantly improved technologies as compared to technologies in service in the United States at the time the guarantee is issued.[12]

Title 17 provides broad authority for DOE to guarantee loans that support early commercial use of advanced technologies, if "there is reasonable prospect of repayment of the principal and interest on the obligation by the borrower."[13] The emphasis on "early commercial use only" distinguishes the program from other DOE activities that are focused on research, development, and demonstration. Further, DOE states that the program will support the goals of the President's Advanced Energy Initiative.[14]

Loan Guarantee Program Regulations. In October 2007, DOE issued final loan guarantee regulations.[15] The regulations provide that DOE may issue guarantees for up to 100% of the amount of the loan, subject to the EPACT limitation that DOE may not guarantee more than 80% of the total cost for an eligible project. Under the final rule, if DOE issues a guarantee for 100% of a debt instrument, the loan must be issued and funded by the Treasury Department's Federal Financing Bank. DOE says that it intends to issue loan guarantees only if borrowers and project sponsors pay the "credit subsidy cost" for any loan guarantee they receive.[16]

Subsidy Cost. The subsidy cost is the expected long-term liability to the federal government in issuing the loan guarantee, excluding the administrative cost.[17]

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[10] Information about the DOE Loan Guarantee Program is available at [http://www.lgprogram.energy.gov/index.html].

[11] The program authorization applies to other types of innovative energy-related technologies, including nuclear, coal, energy efficiency, vehicles, carbon sequestration, and pollution control equipment.

[12] EPACT (P.L. 109-58). Section 1703(a).

[13] EPACT (P.L. 109-58). Section 1702(d).

[14] DOE. *FY2009 Congressional Budget Request*. Vol. 2. February 2008. p. 329.

[15] The process began with a proposed rule on May 16, 2007, which was followed by a comment period. The final rule is at [http://www.lgprogram.energy.gov/lgfinalrule.pdf].

[16] DOE. *FY2009 Request*, p. 330.

[17] The Federal Credit Reform Act [Section 502(5A)] defines the subsidy cost as "the (continued...)

Title 17 specifies that DOE must receive either an appropriation for the subsidy cost or payment of that cost by the borrower. No funds have been appropriated for the subsidy cost of loan guarantees. DOE anticipates that the project borrower (sponsor) will pay this cost. Thus, DOE says it does not plan to use taxpayer funds to pay for the credit subsidy cost of the loan guarantees.[18]

Energy Independence Act Provisions. Two provisions of the law (P.L. 110-140) expand the range of facilities eligible for loan guarantees. Section 134 amended EPACT Title 17 to direct that DOE establish a loan guarantee program for facilities that manufacture "fuel efficient vehicles or parts of those vehicles, including electric drive vehicles and advanced diesel vehicles." Section 135 allows DOE, under certain conditions, to establish a loan guarantee program for the construction of facilities that manufacture advanced vehicle batteries and battery systems. Eligible parties would include manufacturers of advanced lithium ion batteries, manufacturers of hybrid electrical systems and components, and software designers.

Program Funding. DOE Loan Guarantee Program funding is shown in **Table 1.** In FY2006, DOE used about $500,000 from three separate appropriation accounts to fund start-up activities for $2 billion in loan guarantee authority.[19] The FY2007 continuing appropriations bill (P.L. 110-5, H.J.Res. 20) provided $7 million from DOE's Departmental Administration Account for program operating costs. Also, P.L. 110-5 raised the loan guarantee program authority to $4 billion, and required that DOE prepare a rulemaking to implement the program.[20]

Table 1. DOE Loan Guarantee Program Funding
($ millions)

FY2006 Apprn.	FY2007 Apprn.	FY2008 Apprn.	FY2009 Request
$0.5	$7.0	$4.5	$19.9

Source: GAO; and *DOE FY2009 Congressional Budget Request,* vol. 2, p. 329.

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[17] (...continued)
estimated long-term cost to the government of a direct loan or a loan guarantee, calculated on net present value basis, excluding administrative costs." The Director of the Office of Management and Budget is responsible for coordinating the estimation of subsidy costs. For more discussion of subsidy costs, see CRS Report RL30346, *Federal Credit Reform: Implementation of the Changed Budgetary Treatment of Direct Loans and Loan Guarantees,* by James M. Bickley.

[18] *DOE FY2009 Request,* p. 329-330.

[19] Government Accountability Office (GAO). *Observations on Actions to Implement the New Loan Guarantee Program for Innovative Technologies.* (GAO-07-798T) p. 2.

[20] DOE issued the proposed rule on May 16, 2007. [http://www.lgprogram.energy.gov/NOPR-fr-5-16-07.pdf].

At both House and Senate energy committee hearings on the DOE FY2008 budget request, concerns were raised that the Loan Guarantee Program had not been implemented. DOE stated that, beginning in FY2008, the administrative activities for the Loan Guarantee Program Office would be funded in a separate discrete appropriation account entitled "Innovative Technology Loan Guarantee Program."[21]

For FY2009, DOE requests $19.9 million for the Innovative Technology Loan Guarantee Program. This funding would cover administrative and operational expenses to support personnel and associated costs. DOE expects that the amount requested will be offset by collections authorized by EPACT (§1702[h]).[22] The FY2008 Consolidated Appropriations Act directed DOE to issue $38.5 billion in new loan guarantee authority through the end of FY2009.[23] The FY2009 DOE request seeks to extend that authority through the end of FY2011. Specifically, DOE's request calls for $20.0 billion of the $38.5 billion to be available through FY2010 to support renewables and certain other projects.[24] The remaining $18.5 billion would be available through FY2011 to support nuclear power facilities.[25]

First Round of Project Solicitations. In February 2007, the FY2007 Continuing Appropriations Resolution (P.L. 110-5) provided $4 billion in authority for loan guarantees. In May 2007, DOE announced a solicitation for the first round of projects. Eligible categories of renewable energy projects included biomass, solar, wind, and hydropower.[26] In October 2007, DOE announced that it was inviting 16 pre-applicants to submit full loan guarantee applications.[27] Among the 16 pre-applicants, eight proposed renewable energy projects. There are six biofuels projects, of which four involve cellulosic ethanol fuel production facilities and two involve biodiesel fuel production facilities. Also, there are two solar projects. One involves concentrated solar-thermal technology, and the other involves the manufacture of thin-film solar photovoltaic equipment.

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[21] DOE. *FY2009 Congressional Budget Request, Budget Highlights*. February 2008. p. 52.

[22] DOE. *FY2009 Congressional Budget Request, Budget Highlights*. February 2008. p. 329. Section 1702(h) states that "DOE shall charge and collect fees for guarantees in amounts the Secretary determines are sufficient to cover applicable administrative expenses."

[23] The $38.5 billion of new authority is provided in addition to the $4.0 billion in authority set by the FY2007 appropriations bill. Thus, the two years of appropriations provide for a combined total of $42.5 billion in loan guarantee authority.

[24] The other projects include uranium enrichment, coal-based power, advanced coal gasification, and electricity delivery.

[25] DOE. *FY2009 Congressional Budget Request,* Vol 2. February 2008. p. 330.

[26] The other eligible categories were hydrogen, advanced fossil energy (coal), carbon sequestration, electricity delivery and energy reliability, alternative fuel vehicles, industrial energy efficiency, and pollution control equipment.

[27] DOE. *DOE Announces Final Rule for Loan Guarantee Program*. (Press Release) October 4, 2007. [http://www.lgprogram.energy.gov/press/100407.html]

Biofuels and Other New Program Authorizations. Several biofuels programs authorized by EPACT have not been funded, including sugar cane ethanol (§208), biodiesel (§757), advanced biofuels (§1514), and cellulosic ethanol (§942, §1511, §1512). Unfunded biomass provisions include forest biomass (§210), biomass research and development (§941g), and bioenergy (§971d). Additionally, residential and small business renewable rebates (§206c) and insular areas (§251, §252) have not been funded. Provisions for technologies that would address climate change by reducing greenhouse gas emissions (§1601, §1602) also remain unfunded. Distributed energy (§921) and renewable energy (§931) are funded below authorized levels.

FY2009 DOE Budget

Energy Efficiency and Renewable Energy. The President's 2008 State of the Union address set out goals to strengthen energy security and confront global climate change, and stated that "... the best way to meet these goals is for America to continue leading the way toward the development of cleaner and more energy-efficient technology."[28] As part of that effort, the Administration proposes to continue its support for the Advanced Energy Initiative (AEI, an element of the American Competitiveness Initiative), which "aims to reduce America's dependence on imported energy sources." The AEI includes hydrogen, biofuels, and solar energy initiatives that are supported by programs in EERE.[29]

According to the FY2009 budget document, the Hydrogen Initiative has a "long-term aim" of developing hydrogen technology that will help the Nation achieve a "cleaner, more secure energy future."[30] Further, current research aims to "enable industry to commercialize a hydrogen infrastructure and fuel cell vehicles by 2020." The Biofuels Initiative seeks to make cellulosic ethanol cost competitive by 2012 using a wide array of regionally available biomass sources. The Solar America Initiative aims to "... accelerate the market competitiveness of photovoltaic systems using several industry-led consortia which are focused on lowering the cost of solar energy through manufacturing and efficiency improvements."[31] Further, the *Budget* states that there is a goal to make solar power "cost-competitive with conventional electricity by 2015."[32]

As **Table 3** shows, DOE's FY2009 request seeks $1,255.4 million for the EERE programs. Compared to the FY2008 appropriation, the FY2009 request would reduce

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[28] The White House. State of the Union 2008. [http://www.whitehouse.gov/news/releases/2008/01/print/20080128-13.html].

[29] U.S. Executive Office of the President, *Budget of the United States Government, Fiscal Year 2007*, Appendix, p. 390. Also see DOE, *FY2007 Congressional Budget Request: Budget Highlights*, p. 41.

[30] U.S. Executive Office of the President, *Budget of the United States Government, Fiscal Year 2009*, Appendix, p. 393.

[31] U.S. Executive Office of the President, *Budget of the United States Government, Fiscal Year 2009*, Appendix, p. 393.

[32] *U.S. Budget*, p. 59.

EERE funding by $467.0 million, or 27.1%. Three proposed cuts would comprise most of this reduction. First, the request would eliminate $186.7 million in Congressionally-Directed Assistance. Second, it would reduce Facilities construction spending by $57.3 million.[33] Third, the request would cut $227.2 million in funding to terminate the Weatherization Assistance Program. At February 2008 hearings on the FY2009 DOE budget request, concerns were raised about DOE's proposed termination of that program.[34]

For renewable energy technologies, **Table 3** shows that — compared to the FY2008 appropriation — the key increases are for Biomass Energy ($26.8 million) and Geothermal Energy ($10.2 million). The key decreases are for Water/Hydrokinetic Power (-$6.9 million) and Solar Energy (-$12.3 million). Overall, funding for renewable energy technologies would increase by $20.7 million (4.6%). For deployment programs, the main increase is for the Asia Pacific Partnership ($7.5 million).[35] Also, the request would terminate the Renewable Energy Production Incentive (-$5.0 million).[36]

For energy efficiency technologies, **Table 3** shows that — compared to the FY2008 appropriation — the main increase is for Buildings ($14.8 million) and the only decrease is for Industrial programs (-$2.3 million). Overall, energy efficiency technologies would increase by $22.7 million (5.6%). For deployment programs, the main increase is for State programs ($5.9 million). Also, the request seeks to terminate the Weatherization Program (-$227.2 million).

Weatherization Program funding has often been a source of tension between Congress and the Administration. In 2001, the Administration launched an initiative to increase DOE Weatherization Program funding by $1.2 billion over 10 years.[37] The DOE request took a big jump for FY2002, and subsequent requests increased steadily — though modestly — through FY2005. For each of those fiscal years, the final appropriation was somewhat lower than the request. In FY2006, both trends reversed. The FY2006 request was well below the FY2005 request, and requests

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[33] Facilities funding for construction tends to be provided in a lump sum. No major construction projects would be cancelled as a result of this proposed reduction.

[34] The Senate Committee on Energy and Natural Resources held a hearing on the DOE *FY2009 Budget Request* on February 6, 2008. [http://energy.senate.gov/public/index.cfm?FuseAction=Hearings.Hearing&Hearing_ID=1673]. The House Committee on Energy and Commerce held its hearing on February 7, 2008. [http://energycommerce.house.gov/cmte_mtgs/110-fc-hrg.020708.DOEBudget.shtml].

[35] *DOE Request*, p. 482-483. The Asia Pacific Partnership (APP) is a multinational undertaking that the federal government supports through several agencies. The Department of State is the lead agency for APP. DOE's request for APP in FY2009 would support new renewable power generating capacity, best manufacturing practices for targeted industries, and best design and construction practices for buildings and efficient appliance standards.

[36] For a brief discussion of the Renewable Energy Production Incentive, see the section on Clean Renewable Energy (Tax Credit) Bonds, below.

[37] The White House. *National Energy Policy*. Report of the National Energy Policy Development Group. May 2001. p. 2-12. [http://www.whitehouse.gov/energy/National-Energy-Policy.pdf].

continued to decline annually through FY2008. Also, for FY2006 through FY2008, the final appropriations exceeded the request each year. For FY2009, the DOE request seeks to terminate the Program, citing a higher benefit-cost ratio for technology programs than for the Weatherization Program.[38] A major study of the program's benefits and costs in 1989 was published in 1993. In 2007, DOE launched a plan for a comprehensive review of program benefits and costs based on data collected during program year (PY) 2006.[39]

Electricity Delivery and Energy Reliability. The FY2009 request includes $134.0 million for the Office of Electricity Delivery and Energy Reliability (OE). Compared to the FY2008 appropriation, the FY2009 request would reduce funding by $4.6 million, or 3.3%.

FY2009 Department of Agriculture (USDA) Request

The FY2009 budget document states that the Administration's 2007 farm bill proposal "... provides more than $1.6 billion in new renewable energy funding and targets programs to cellulosic ethanol projects."[40] In its FY2009 request document, the USDA states that, "While discretionary funding is not being requested, the Administration's farm bill proposal includes funding for renewable energy/energy efficiency loans and grants, and biomass research and development grants.[41] (For more details, see CRS Report RL34130, *Renewable Energy Policy in the 2007 Farm Bill*.)

Tax Credit Issues (H.R. 5351)

On February 12, 2008, the House Committee on Ways and Means approved the proposed Renewable Energy and Energy Conservation Tax Act of 2008.[42] This bill is similar to H.R. 2776,[43] which the House passed during the first session — but it

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[38] DOE states that "EERE's Energy Efficiency portfolio has historically provided approximately a 20 to 1 benefit to cost ratio. In comparison, Weatherization has a benefit cost ratio of 1.53 to 1." DOE, *FY 2009 Congressional Budget Request*, vol. 3, p. 44.

[39] The 1993 study and the 2007 plan are discussed in DOE. Oak Ridge National Laboratory. *National Evaluation of the Weatherization Assistance Program: Preliminary Evaluation Plan for Program Year 2006.* February 2007. p. 1.

[40] *FY2009 Budget of the U.S. Government*. Appendix. p. 120.

[41] USDA. *FY2009 Budget Summary and Annual Performance Plan*. February 2008. p. 44. [http://www.obpa.usda.gov/budsum/fy09budsum.pdf].

[42] House Committee on Ways and Means. *H.R. 5351 Renewable Energy and Energy Conservation Tax Act of 2008.* February 25, 2008. This document has a summary and cost estimate for each provisions of the bill. [http://waysandmeans.house.gov/media/pdf/110/februarybillsummary.pdf].

[43] The Joint Committee on Taxation published a description of the provisions in H.R. 2776. It is available at [http://www.house.gov/jct/x-35-07.pdf].

was not sent to the Senate.[44] On February 27, 2008, the House passed H.R. 5351 by a vote of 236-182.[45]

H.R. 5351 would extend or re-establish several tax incentives that would support renewable electricity production, biofuels production, transportation efficiency and conservation, buildings efficiency, and equipment efficiency. The bill proposes four incentives for electricity production: the production tax credit, two solar investment tax credits, and new clean energy (tax credit) bonds. Also, the bill proposes several incentives for biofuels. The proposed incentives in H.R. 5351 would include $8.9 billion in renewable energy production (electricity and fuels) tax incentives and $7.8 billion in energy efficiency (transportation and buildings/equipment) tax incentives. The renewable energy incentives would include $6.6 billion for the renewable energy electricity production tax credit (PTC), $634 million for residential solar tax credits, $621 million for business solar (and fuel cell) credits, and $640 million for clean renewable energy (tax credit) bonds.[46] (For more about the background and debate on the renewable energy incentives, see the discussion below. For more details about the energy efficiency incentives, see CRS Report RL33831, *Energy Efficiency and Renewable Energy Legislation in the 110th Congress.*)

The bill proposes to offset the cost of the incentives primarily by reducing two subsidies for oil and natural gas production. There would also be some offset derived from a provision to close the "Hummer" tax credit loophole.

House Floor Debate

During the House floor debate,[47] opponents of H.R. 5351 argued that the proposed repeal of oil and natural gas subsidies (§301 and §302) would raise gasoline prices and lead to higher energy costs generally. Further, they contended that such a repeal would cause a decline in oil industry jobs. Also, some opponents argued that the proposed 35% cap on the renewable energy production tax credit (PTC) would

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[44] In the engrossment of H.R. 3221, the adopted rule (H.Res 615) provided that the text of H.R. 2776, as passed (221-189) by the House, be added at the end of H.R. 3221as Division B, and H.R. 2776 was tabled. After informal House-Senate negotiations over the House-passed bill (H.R. 3221) and the Senate-passed bill (Senate amendment to H.R. 6), the House passed (235-181) a substitute amendment to the Senate amendment to H.R. 6. The House substitute contained virtually all of the tax incentives in H.R. 2776. Senate floor action to adopt the House substitute failed on a cloture vote (53-42). The ensuing Senate amendment (S.Amdt. 3850) did not include the tax incentives. This bill was adopted by both chambers and enacted as P.L. 110-140.

[45] H.Res. 1001 provided the rule that brought the bill to the floor.

[46] The Joint Committee on Taxation scores the estimated costs of the tax provisions at [http://www.house.gov/jct/x-20-08.pdf]. The Congressional Budget Office provides a summary of the scored costs at [http://www.cbo.gov/ftpdocs/90xx/doc9001/hr5351.pdf].

[47] Congressional Record. February 27, 2008. p. H1091-H1131.

severely impair the ability of the credit to stimulate the development of new wind farms.[48]

Proponents argued that the repeal would focus mainly on the five largest oil companies, which have recently made historical record-breaking profits and, thus, do not need the subsidies. Further, they contended that the subsidies currently favor conventional fuels and that the bill would help to bring support into a more equal balance. Proponents also argued that the incentives would spur the development of greater numbers of "green jobs" and help reduce greenhouse gas emissions.[49] (For more details about the proposed revenue offsets, see CRS Report RL33578, *Energy Tax Policy: History and Current Issues.*)

Renewable Energy Electricity Production Tax Credit (PTC)

Electricity produced by certain renewable energy facilities is eligible for an income tax credit based on production. Eligible facilities include those that produce electricity from wind, closed-loop biomass, open-loop biomass (including agricultural livestock waste nutrients), geothermal energy, solar energy, small irrigation power, landfill gas, and trash combustion. The credit's expiration date refers to the deadline for a facility to be placed into initial operation. Once a facility is qualified, a taxpayer may claim the credit annually over a 10-year period that commences on the facility's placed-in-service date.[50]

Background and History. The PTC was established by federal law (P.L. 102-486) in 1992.[51] The credit was originally set at 1.5 cents/kwh and is adjusted annually for the previous year's inflation rate.[52] Since 1992, it has expired and been reinstated three times, and it has been extended two other times.[53] In August 2005, the Energy Policy Act of 2005 (P.L. 109-58, §1301) extended the PTC for two years,

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[48] The Administration has threatened to veto the bill, stating its opposition to repeal of the oil industry subsidies and to proposals for clean renewable energy (tax credit) bonds and qualified energy conservation bonds. Executive Office of the President. *Statement of Administration Policy on H.R. 5351.* February 26, 2008. 2 p. [http://www.whitehouse.gov/omb/legislative/sap/110-2/saphr5351-r.pdf].

[49] Many of these points were also stated in a letter from the Speaker of the House to the President. Office of the Speaker. *Pelosi, Hoyer, Clyburn and Emanuel Send Letter to White House on House-Passed Energy Legislation.* Press Release. February 28, 2008. 2 p. [http://speaker.house.gov/newsroom/pressreleases?id=0544].

[50] U.S. Joint Committee on Taxation. *Description and Technical Explanation of the Conference Agreement of H.R. 6, Title XIII, "The Energy Tax Incentives Act of 2005."* July 28, 2005. p. 16. [http://www.house.gov/jct/x-60-05.pdf].

[51] Section 1914 of the Energy Policy Act of 1992 (EPACT92, P.L. 102-486).

[52] The adjustment is set retrospectively, after inflation data is available for the previous calendar year.

[53] The most recent expiration occurred during 2004.

through the end of calendar year 2007.[54] Also, the credit was expanded to include incremental hydropower and to increase the credit duration to 10 years for open-loop biomass, geothermal, solar, small irrigation power, and municipal solid waste. The Tax Relief Act of 2006 (P.L. 109-432, §201) extended the PTC for one additional year, through the end of 2008.

Current Status. In 2007, the credit stood at 2.0 cents/kwh for claims against 2006 taxes. To illustrate the credit's significance, this 2.0 cents/kwh represented about one-third of wind production costs in 2006. As **Table 4** shows, half credit (valued at 1.0 cents/kwh in 2006) was provided for electricity produced by facilities that used open-loop biomass, small irrigation water flows, incremental hydropower, or landfill gas from municipal solid waste. In application, the credit may be reduced for facilities that receive certain other federal credits, grants, tax-exempt bonds, or subsidized energy financing. The amount of credit that may be claimed is phased out as the market price of electricity exceeds certain threshold levels.[55]

Revenue Effects. Claims for the PTC were less than $1 million in 1993 and 1994. **Table 5** shows that credit claims started growing more rapidly in 1995 and increased sharply, though erratically, from 1999 through 2004. Wind farm developments accounted for more than 90% of the dollar value of PTC claims through 2004.[56] Assuming the credit's availability for new projects ends as scheduled in 2008, the table shows that the claims for 2005 through 2010 are estimated to increase substantially (in current year dollars) relative to past levels.

Impact on Resource Development. The PTC, combined with other policies, has had a positive though erratic effect on the growth of the wind energy industry. In contrast, it has had very little effect on baseload renewables, such as geothermal and biomass energy, and it has had virtually no effect on solar energy development. The following sections discuss PTC impacts in more detail.

Impact of Boom-Bust Cycle on Wind Energy Industry. Coupled with rising energy costs, R&D advances, and a variety of state policies, the PTC has stimulated significant growth in wind capacity over the past 10 years.[57] However, the PTC expirations in 2000, 2002, and 2004 caused annual capacity growth to fall sharply in those years, by as much as 80% relative to the previous year. After each

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[54] A detailed description of the PTC appears in the report *Description and Analysis of Certain Federal Tax Provisions Expiring in 2005 and 2006*, by the Joint Tax Committee, at [http://www.house.gov/jct/x-12-05.pdf].

[55] The reductions and phase-out are described in IRS Form 8835. *Renewable Electricity, Refined Coal, and Indian Coal Production Credit.* 2006. p. 2. [http://www.irs.gov/pub/irs-pdf/f8835.pdf].

[56] Personal communication with Curtis Carlson, Office of Tax Policy, Department of the Treasury. March 2007.

[57] U.S. Congress. Senate. Committee on Finance. *Clean Energy: From the Margins to the Mainstream.* Hearing held March 29, 2007. Testimony of Ryan Wiser, p. 5. [http://finance.senate.gov/sitepages/hearing032907.htm].

expiration, the PTC was reinstated for one- to two-year periods.[58] In 2005, one wind industry representative testified:

> Unfortunately ... two plus one plus one plus one does not necessarily equal five predictable years. Instead, it represents not the sum total of years the credit has been in place, but rather periods of uncertainty, when new wind construction stopped, jobs were eliminated, and costs were driven up. Business thrives on the known and fails on the unknown. The unpredictable nature of the credit has prevented the needed investment in U.S.-based facilities that will drive economies of scale and efficiencies.[59]

In 2007, one renewable energy analyst echoed this observation, testifying that the frequent credit expiration, and short-term nature of reinstatements and extensions, have led to several adverse impacts on wind industry growth. The variability of the credit has caused the growing demand for wind power to be "compressed into tight and frenzied windows of development. This cycle of boom-and-bust has resulted in under-investment in manufacturing capacity in the United States and variability in equipment and supply costs." It may also have caused under-investment in transmission planning and development, further restricting growth.[60]

The American Wind Energy Association has recently noted that the cycle of decline in wind industry activity actually starts about eight months before a PTC expiration date.[61] Representatives of the wind industry have testified that the cycle of peak manufacturing production demands followed by cutbacks "would be eliminated if a long-term PTC extension was in effect."[62] Opponents of the PTC say that the credit was created to provide temporary economic assistance to help the renewable electricity production industry get started. Further, they say that the PTC was not intended to be a permanent subsidy. Despite 15 years of subsidies, wind still apparently cannot compete without the PTC, opponents note.

Very Limited Impact on Other Renewables. Geothermal power facilities are physically and operationally more like conventional coal-fired power plants than wind machines. There is usually one large, highly capital-intensive plant that uses heat to produce base-load power.[63] However, industry testimony suggests that identifying a suitable geothermal resource is similar to prospecting for oil or natural

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[58] Senate Finance Committee, *Clean Energy*, Testimony of Ryan Wiser p. 5.

[59] U.S. Congress. House. Committee on Ways and Means. *Tax Credits for Electricity Production from Renewable Sources.* Hearing held May 24, 2005. Testimony of Dean Gosselin, FPL Energy. p. 25-26. [http://waysandmeans.house.gov/hearings.asp?formmode=detail&hearing=411].

[60] Senate Finance Committee, *Clean Energy*, Testimony of Ryan Wiser, p. 7.

[61] American Wind Energy Association (AWEA). *Legislative Priorities: Production Tax Credit Extension.* [http://www.awea.org/legislative/].

[62] House Ways and Means Committee, *Tax Credits for Renewables*, Testimony of Dean Gosselin, p. 25.

[63] These facilities are often 10 megawatt (mw) to 100 mw in capacity, compared with wind machines that usually range from 2 mw to 5 mw.

gas. The costs and risks of exploration for geothermal are as high or higher than those for the oil and gas industry, and the ability to attract financing is far more difficult. Once a resource is verified, permitting and construction can take three to five years or more. Since 1992, there has been very limited development of new geothermal facilities.[64]

In 2005, EPACT increased the amount of the PTC available to geothermal facilities from half to full credit. However, the PTC's short windows of availability have made the credit largely ineffective as an incentive for the geothermal industry. Industry representatives have noted that the largest projects "may not go forward because they face unacceptable risks trying to meet the rigid deadline ... [or to avoid] taking an all-or-nothing gamble on future extensions of the credit."[65] The geothermal industry says a PTC extension of 10 years or more could be sufficient to stimulate a higher level of sustained industry growth.[66]

Representatives of biomass, hydropower, and landfill gas industries say their facilities are more like geothermal facilities than wind machines and, thus, also require a longer-term PTC period. In 2005 testimony, EIA offered a similar observation:

> Short-term extensions of the PTC are likely to have limited impact on qualifying technologies like biomass and geothermal, which have relatively long development periods, even if the credit were large enough to make them economical.[67]

The PTC has been even less valuable for solar energy equipment. Most solar electricity equipment comes as small, widely distributed units that are designed mainly for on-site use, not for power sales to the grid.[68] These aspects make the PTC less valuable for solar than the business and residential investment tax credits (ITC).[69] Due to rules against multiple tax credit use, solar equipment cannot qualify for both the PTC and ITC, and so owners must choose one or the other. Representatives of the solar industry have indicated a clear preference for ITC over PTC.[70] Even with the PTC, solar is too expensive for utility-scale application.

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[64] U.S. Congress. Senate. Committee on Energy and Natural Resources. *Implementation of Provisions of the Energy Policy Act of 2005.* Hearing held July 11, 2006. Testimony of Karl Gawell, Geothermal Energy Association (GEA). p. 95. [http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=109_senate_hearings&docid=f:30004.pdf].

[65] Senate Energy Committee, *Implementation of EPACT*, Testimony of GEA, p. 92-93.

[66] Personal communication with Karl Gawell, Geothermal Energy Association, April 6, 2007.

[67] House Ways and Means Committee, *Tax Credits for Renewables*, Testimony of Dr. Howard Gruenspect for the Energy Information Administration (EIA), p. 10.

[68] Also, solar energy equipment has high capital costs and low capacity factors.

[69] House Ways and Means Committee, *Tax Credits for Renewables*, EIA Testimony, p. 6-9.

[70] House Ways and Means Committee, *Tax Credits for Renewables*, Testimony of Chris (continued...)

Combined Impact with State Renewable Portfolio Standards. After its creation in 1992, the PTC was virtually unused until states began to establish renewable portfolio standard (RPS) policies.[71] State RPS action began in the mid-1990s.[72] Since then, an increasing number of states have implemented an RPS. **Table 5** shows the trend depicting the close correlation between rising PTC claims and the growing number of states with an RPS. Since the late 1990s, many have noted that the combined effect of the PTC with state RPS policies has been a major spur to wind energy growth.[73]

Credit Design Issues. The variability in tax credit availability has led to erratic growth in energy production, and it has caused the U.S. wind industry to become more dependent on European equipment due to stronger European requirements for renewables.[74] Despite these problems, wind has been the main beneficiary of the credit. A related issue is that the PTC has not been effective at stimulating the development of other renewable energy facilities, which generally need a longer period of credit availability. The main proposal to address the variable impact on wind and the lack of impact on other renewables is the enactment of a longer-term PTC extension. The wind industry prefers an extension of five years or more.

On occasion, the PTC has been expanded to include a broader range of renewable energy resources. So another potential credit design issue is whether the credit should be expanded again to include equipment that uses other renewable resources, such as tidal, wave, and ocean thermal energy.

Extend the Credit to Achieve a Five-Year Period or More. At least two studies have attempted to assess the potential results of a longer-term PTC extension. In one study, EIA examined a 10-year extension and found that wind power would continue to show the largest projected gains.[75] Landfill gas, geothermal, and biomass were also projected to experience some capacity expansion. EIA estimated a 7-fold

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[70] (...continued)
O'Brien for the Solar Energy Industries Association (SEIA), p. 47-49.

[71] EIA, *AEO2005*, p. 58.

[72] Iowa first established a renewable energy requirement in 1983. However, most states did not consider an RPS until after electricity restructuring policies appeared in the mid-1990s. The following section of this report discusses state RPS activity in greater detail.

[73] DOE. Energy Information Administration (EIA). *Annual Energy Outlook 2006.* (Section on "State Renewable Energy Requirements and Goals: Update Through 2005.) p. 27. Further discussion of the importance of the PTC to RPS is presented in the section under Renewable Portfolio Standard entitled "Federal Support for State RPS Policies."

[74] Senate Finance Committee, *Clean Energy*, Testimony of Ryan Wiser, p. 7-9.

[75] Prior to the PTC extension in EPACT05, EIA examined an extension from the end of 2005 through the end of 2015. The extension included all resources covered by the PTC at that time at the values that were in place then. EIA. *Annual Energy Outlook 2005 (AEO2005)*. p. 60.

increase for wind, a 50% increase for biomass, and a 20% increase for geothermal facilities.[76]

In 2007, DOE's Lawrence Berkeley National Laboratory (Berkeley Lab) reported the results of a study that examined the potential benefits of extending the PTC for 5 to 10 years. Relative to a projection with continued cycles of one-year to two-year extensions, it found that the installed cost of wind could be reduced by 5% to 15%. Additional benefits could include better transmission planning and enhanced private R&D spending. Also, Berkeley Lab estimated that a 10-year extension could increase the domestic share of manufactured wind equipment from the current level of 30% to about 70%.[77] The Joint Committee on Taxation has estimated that the three-year extension of the credit's placed-in-service deadline in H.R. 5351 would reduce tax revenue to the U.S. Treasury by about $6.6 billion over the 10-year duration of credit claims.[78]

In 2007 testimony, MidAmerican Energy Company suggested that a 5-to-10 year PTC extension would also be the best way to encourage baseload renewables, such as geothermal and biomass. Such an extension, it said, would provide long-term certainty to utilities, independent project developers, and manufacturers. To address budget-related cost concerns for a PTC extension, Mid-American suggested that a long-term extension could be coupled with a gradual phase-down of the credit to 1.5 cents/kwh. Alternatively, if the credit extension were set at something less than five years, Mid-American proposed that a conditional second deadline could be set up that would extend the placed-in-service eligibility period. That extension would require an offsetting reduction in the credit period, the length of time over which credit claims could be filed. The conditions required for an extension to a secondary placed-in-service deadline are that the project must be under construction and have signed power sales contracts before the initial credit expiration date and it must bring the project online before the secondary placed-in-service deadline. For example, if the secondary deadline were set as one year past the initial placed-in-service deadline, a project that met those conditions would be eligible to receive the credit, but only for nine years instead of ten.[79]

PTC Extension Debate. The PTC is set to expire at the end of 2008. In the 110th Congress, section 101of H.R. 5351 would extend the credit for three years, to the end of 2011.[80] Also section 102 would expand the credit to include equipment

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[76] House Ways and Means Committee, *Tax Credits for Renewables*, EIA Testimony, p. 10.

[77] Senate Finance Committee, *Clean Energy*, Testimony of Ryan Wiser, p. 8-10.

[78] Joint Committee on Taxation. *Estimated Revenue Effects of the Tax Provisions Contained in H.R. 5351*. February 27, 2008. [http://www.house.gov/jct/x-20-08.pdf].

[79] Senate Finance Committee, *Clean Energy*, Testimony of Todd Raba of MidAmerican Energy Company, p. 3.

[80] House Committee on Ways and Means. *H.R. 5351 Renewable Energy and Energy Conservation Tax Act of 2008*. February 12, 2008. A summary of the PTC provision is provided on page 1. [http://waysandmeans.house.gov/media/pdf/110/februarybillsummary.pdf]. See Table 4 for a list of resources that are currently eligible for

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that uses marine (ocean thermal, wave, tidal, and current) energy. **Table 2** shows the status of the PTC provision in H.R. 5351, compared with action on other recent proposals to extend the credit in the Economic Stimulus bill (H.R. 5140) and the Energy Independence bill (H.R. 6).[81] The Administration threatened to veto both H.R. 5140 and H.R. 6, if the bills contained the PTC and certain other tax provisions.[82]

Table 2. Production Tax Credit (PTC) Extension Proposals

Bill	House		Senate	
	Extension Period	Final Action	Extension Period	Final Action
H.R. 5351	3 years	—	—	—
H.R. 5140	no provision	—	1 year (S.Amdt. 3983)	cloture motion defeated (58-41)
H.R. 6	4 years (§1501)	adopted (235-181)	2 years (S.Amdt. 3841)	cloture motion defeated (59-40)

Proponents of extending the credit past 2008 argue that the PTC is merited because it corrects a market failure by providing economic value for the environmental benefits of "clean" energy sources that emit less (in many cases, far less) air pollutants and CO_2 than conventional energy equipment. Also, they contend it helps "level the playing field," noting that there is an even longer history of federal subsidies for conventional energy.[83] For example, they point to the permanent depletion allowance for oil and natural gas that has been in place for many decades.[84]

Opponents of extending the production tax credit beyond the end of 2008 argue that generally there are no market failures that warrant special tax subsidies for

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[80] (...continued)
only half-credit.

[81] In Senate floor action on its previous amendment to H.R. 6 in June 2007, S.Amdt. 1704 (§801) would have extended the PTC for five years, but a cloture motion was defeated (57-36). Also, in August 2007, the House approved H.R. 3221 with a four-year PTC extension (§11001).

[82] Executive Office of the President. Office of Management and Budget. *Statement of Administration Policy on H.R. 6*. December 7, 2007. [http://www.whitehouse.gov/omb/legislative/sap/110-1/hr6sap-h_2.pdf].

[83] Federal subsidies for conventional energy resources and technologies and for electric power facilities (including large hydroelectric power plants) have been traced back as far as the 1920s and 1930s. See DOE (Pacific Northwest Laboratory), *An Analysis of Federal Incentives Used to Stimulate Energy Production*, 1980. 300 p.

[84] GAO. *Petroleum and Ethanol Fuels: Tax Incentives and Related GAO Work*. (GAO/RCED-00-301R) September 25, 2000. The report notes that from 1968 through 2000, about $150 billion (constant 2000 dollars) worth of tax incentives were provided to support the oil and natural gas industries.

particular types of renewable energy technologies. They argue further that subsidies generally distort the free market and that renewables should not get special treatment that exempts them from this principle. Also, regarding the concern about the environmental problems of "dirty" conventional energy sources, they contend that the most cost-effective economic policy is to put a tax on the pollution from energy sources and let the free market make the necessary adjustments. Another argument against the PTC is that much renewable energy production, particularly from wind and solar equipment, has a fluctuating nature that makes it less valuable than energy produced by conventional facilities.[85]

At a Senate hearing in February 2007, Energy Secretary Bodman testified that the Administration is unlikely to support a five-year or 10-year PTC extension because it would not be consistent with free markets.[86] Consistent with this stance, the Administration's FY2008 budget request did not include a provision to cover a PTC extension beyond 2008. Similarly, the Administration's FY2009 budget request did not include such a provision. However, Section 304 of the Senate version (S.Con.Res. 70) of the budget resolution would create a deficit-neutral reserve that could be used to support a five-year PTC extension. Further, Section 305 of the House budget resolution (H.Con.Res. 312) would also allow support for renewable energy tax incentives.

Solar Investment Tax Credits

Residential Credit. The Energy Tax Act of 1978 (P.L. 95-618) established a residential energy investment tax credit (ITC) for solar and wind energy equipment.[87] As energy prices declined, Congress allowed the credit to expire at the end of 1985. In 2005, EPACT (P.L. 109-58, §1335) established a 30% residential solar credit with a cap at $2,000, through the end of 2007.[88] The Tax Relief Act of 2006 (P.L. 109-432, §206) extended the credit through the end of 2008.

H.R. 5351 (§106) would extend the residential solar tax credit at the 30% level for six years, through the end of 2014.[89] Further, the annual cap on the credit would

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[85] Some argue further that as the contributions from wind and solar power production rise, their intermittent nature may create grid management problems for electric utilities.

[86] U.S. Congress. Senate. Committee on Energy and Natural Resources. *Proposed Budget for FY 2008 for the Department of Energy.* Hearing held February 7, 2007. [http://energy.senate.gov/public/index.cfm?FuseAction=Hearings.Hearing&Hearing_ID=1601].

[87] The claim against income was set at 30% of the first $2,000 and 20% of the next $8,000. The Crude Oil Windfall Profits Tax Act of 1980 (P.L. 96-223) increased the credit from 30% to 40% of the first $10,000.

[88] Joint Tax Committee, *Description of H.R. 6*, p. 49.

[89] On December 6, 2007, the House approved a nearly identical provision in H.R. 6 (§1504). That provision would not have made ground source heat pumps eligible for the credit. On S.Amdt. 3841 to H.R. 6 (introduced December 12, 2007) included a provision (§1503) that was virtually identical to the House-passed provision. However, the amendment was

(continued...)

be increased from $2,000 to $4,000. Also, residential wind equipment and ground source heat pumps would become eligible for the credit.

Business Credit. The Energy Tax Act also established a 10% business investment tax credit for solar, wind, geothermal, and ocean energy equipment.[90] The Energy Policy Act of 1992 made permanent the 10% business credit for solar and geothermal equipment. In 2005, EPACT (§1337) increased the solar business credit to 30% through the end of 2007.[91] The Tax Relief Act of 2006 extended the 30% rate through the end of 2008. After that, it would drop back to 10%.

The solar industry has testified that the business ITC is the most important tax incentive for solar equipment. It believes that a longer-term extension of the ITC would help the industry achieve economies of scale and broaden the use of this equipment.

H.R. 5351 (§103) would extend the business solar tax credit at the 30% level for eight years, through the end of 2016.[92] Further, the credit would be allowed to offset the alternative minimum tax. Also, public utilities would become eligible for the credit.

The debate over extending these credits is similar to that for the PTC. Opponents argue that subsidies distort the operation of the free market. They also contend that the most effective policy is to impose a tax on energy equipment that causes pollution. Proponents counter-argue that the credits correct a market failure and help establish equality with subsidies that exist for conventional energy equipment. They also assert that the subsidy-induced increase in demand helps manufacturers establish economies of scale that will make solar equipment more competitive in the long term.

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[89] (...continued)
defeated on a cloture vote and it was not further considered. The Solar Energy Industry Association had endorsed H.R. 550/S. 590, which would have extended the residential credit at the 30% level for eight years.

[90] The Windfall Profits Act increased the credit to 15% and extended it through the end of 1985. The Tax Reform Act of 1986 (P.L. 99-514) extended the credit through 1988.

[91] Joint Tax Committee, *Description of H.R. 6*, p. 52-53.

[92] This is the same provision that the House approved in H.R. 6 (§1503) on December 6, 2007. S.Amdt. 3841 included the same provision in section 1502, except that it would have also made certain combined heat and power equipment eligible for the credit. However, the amendment was defeated on a cloture vote and it was not further considered. The Solar Energy Industry Association had endorsed H.R. 550/S. 590, which would have expanded the business credit to include certain solar storage and lighting equipment, and it would have extended the credit at the 30% level for eight years.

Clean Renewable Energy (Tax Credit) Bonds

Non-profit electric utilities provide about 25% of the nation's electricity.[93] Due to their tax-exempt status, they are not eligible for the PTC. To address the cost and risk barriers for developing renewable energy facilities, these organizations have sought incentives comparable to the PTC. Using a design that parallels the PTC, the Energy Policy Act of 1992 (EPACT92) established a renewable energy production incentive (REPI) that provided 1.5 cents/kwh, adjusted for inflation.[94] REPI typically receives about $5 million per year, through DOE appropriations. This limited funding and annual uncertainty may have severely limited REPI's potential. DOE data for 2004 shows, for example, that funding covered only about 10% of requests for REPI payments.[95]

In 2005 testimony, the American Public Power Association (APPA) stated that REPI was "woefully underfunded," and the National Rural Electric Cooperative Association (NRECA) proposed that a "clean energy bond" be created to establish an incentive for non-profit electric utilities that would be more comparable in scope to the PTC.[96] Subsequently, EPACT (§1303) established clean renewable energy bonds (CREBs), a tax credit bond that allowed the bond holder to receive a federal tax credit in lieu of interest paid by the issuer.[97] EPACT authorized $800 million in CREBs for 2006 and 2007.[98] In late 2006, the Internal Revenue Service (IRS) reported requests totaling $2.6 billion in bond authority. The Tax Relief Act of 2006 (§202) extended the CREBs through the end of 2008, adding $400 million more in total bond authority.

H.R. 5351 (§104) would establish a new category of CREBs (New CREBs) for public power providers (utilities) and cooperative electric companies.[99] The "New

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[93] These non-profit organizations include public power utilities, cooperative electric utilities, and federally owned power utilities.

[94] For background on REPI, see the Database of State Incentives for Renewable Energy. [http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=US33F&State=federal&currentpageid=1&ee=0&re=1].

[95] For historical details of REPI's use, see the table entitled "REPI Appropriation Summary," on DOE's website at [http://www.eere.energy.gov/wip/repi.cfm].

[96] U.S. Congress. House. Committee on Ways and Means. *Tax Credits for Electricity Production from Renewable Sources.* Hearing held May 24, 2005. Testimony of APPA (p. 61-63) and NRECA (p. 67-69).

[97] Thus, CREBs allow a bond issuer to borrow at a zero percent interest rate. Eligible bond issuers include state and local governments, cooperative electric companies, and certain other non-profit organizations. For the bondholder, the tax credit is also treated as taxable interest. For example, a bondholder in a 30% tax bracket who receives a $100 tax credit from the bond purchase would also have $30 treated as taxable interest income, leaving a net tax credit of 70%. See [https://www.appanet.org/files/PDFs/CREB.pdf].

[98] This included $500 million for governmental borrowers.

[99] This provision is identical to section 1506 of H.R. 6 passed by the House on December 6, 2007. S.Amdt. 3841 included an identical provision (§1505). However, the amendment

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CREBs" differ from the previously issued CREBs in four aspects. First, issuers of New CREBs would be subjected to a shorter three-year period for use of the bond proceeds, two years less than the previous five-year period for CREBs. Second, the tax credit rate would be lower, set at 70% of the previous rate for CREBs.[100] Third, taxpayers could carry forward unused credits into future years. Fourth, the tax credit benefits could be separated from bond ownership.[101]

A national limit of $2 billion would be set for New CREBs, of which 60% would be available for public power providers and 40% would be available for cooperative electric companies. The revenue drain on the U.S. Treasury is estimated at a total of $640 million over the period from 2008 through 2018.[102] The Administration has stated its opposition to the New CREBs that the House approved last year in H.R. 3221 and its version of H.R. 6. Specifically, it contended that the CREBs are "expensive and highly inefficient," and that New CREBs would be "inconsistent with the Federal Credit Reform Act of 1990 and/or unduly constrain the Administration's ability to effectively manage Federal credit programs.[103] The Administration has asserted its opposition to the CREBs proposed in H.R. 5351.[104] Proponents of the New CREBs counter-argue that the New CREBs would "help limit the environmental consequences of continued reliance on power generated using fossil fuels." The tax-credit bonds, they argue, can attract investment from taxpayers that are unable to benefit from tax credits.[105]

Revenue Offsets Debate

Title III of the Renewable Energy and Energy Conservation Tax Act of 2008 (H.R. 5351) proposes $17.7 billion in oil and natural gas revenue offsets, and $400 million from closing the "Hummer" tax credit loophole, to support $16.7 billion in new incentives for renewables (Title I) and efficiency (Title II).[106] These new

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[99] (...continued)
was defeated on a cloture vote and it was not further considered.

[100] The previous tax credit rate for CREBs was set as the rate that would permit issuance of CREBs without discount and interest cost to the issuer.

[101] H.Rept. 110-214. *Renewable Energy and Energy Conservation Tax Act of 2007.* June 27, 2007. p. 40.

[102] Joint Committee on Taxation. *Estimated Revenue Effects of the Tax Provisions Contained in H.R. 5351.* February 27, 2008. [http://www.house.gov/jct/x-20-08.pdf].

[103] Executive Office of the President. Office of Management and Budget. Statement of Administration Policy on H.R. 2776 and H.R. 3221. August 3, 2007. p. 2. [http://www.energy.gov/media/SAP_on_HR2776_and_HR3221.pdf]

[104] Executive Office of the President. Office of Management and Budget. Statement of Administration Policy on H.R. 5351. February 26, 2008. p. 2. [http://www.whitehouse.gov/omb/legislative/sap/110-2/saphr5351-r.pdf]

[105] U.S. Congress. House. Committee on Ways and Means. *Renewable Energy and Energy Conservation Tax Act of 2007.* (H.Rept. 110-214) p. 39.

[106] H.R. 5351 also includes $1.83 billion for "New York Liberty Zone" tax credits for (continued...)

incentives would include $8.9 billion in renewable energy production (electricity and fuels) tax incentives and $7.8 billion in energy efficiency (transportation and buildings/equipment) tax incentives. The renewable energy incentives would include $6.6 billion for the renewable energy electricity production tax credit (PTC), $634 million for residential solar tax credits, $621 million for business solar (and fuel cell) credits, and $640 million for clean renewable energy (tax credit) bonds.[107]

Debate over the revenue offset provisions in H.R. 5351 directly parallels the House and Senate floor debates over similar proposals for H.R. 6 during the first session. In those debates, opponents argued that the reduction in oil and natural gas incentives would dampen production, cause job losses, and lead to higher prices for gasoline and other fuels. Proponents counter-argued that record profits show that the oil and natural gas incentives were not needed and that the new incentives would help spur the development of "green" jobs.

Regulatory Issues

Renewable Portfolio Standard (RPS)

Under a renewable energy portfolio standard (RPS), retail electricity suppliers (electric utilities) must provide a minimum amount of electricity from renewable energy resources or purchase tradable credits that represent an equivalent amount of renewable energy production. The minimum requirement is often set as a percentage of retail electricity sales. More than 20 states have established an RPS, with most targets ranging from 10% to 20% and most target deadlines ranging from 2010 to 2025. Most states have established tradable credits as a way to lower costs and facilitate compliance. State RPS action has provided an experience base for the design of a possible national requirement.

State RPS Debate. Opponents often contend that state RPS policies are not worth implementing because the incremental costs of renewable energy may lead to substantial increases in electricity prices. RPS proponents often counter by presenting evidence that renewable energy costs would be modest and arguing that RPS creates employment, reduces natural gas prices, and produces environmental benefits.[108]

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[106] (...continued)
transportation infrastructure projects proposed in the Administration's FY2009 budget. For more discussion of the revenue offset provisions, see CRS Report RL33578, *Energy Tax Policy: History and Current Issues*, by Salvatore Lazzari.

[107] Committee on Ways and Means. *H.R. 5351 Renewable Energy and Energy Conservation Tax Act of 2008.* February 12, 2008. [http://waysandmeans.house.gov/media/pdf/110/februarybillsummary.pdf].

[108] DOE. Lawrence Berkeley National Laboratory. *Weighing the Costs and Benefits of State Renewables Portfolio Standards: A Comparative Analysis of State-Level Policy Impact Projections.* March 2007. p. 58. [http://eetd.lbl.gov/ea/ems/reports/61580.pdf]. This survey (continued...)

Federal Tax Credit (PTC) Supports State RPS Policies. The renewable energy electricity production tax credit (PTC) is the single most important form of federal support for state RPS policies. The PTC can "buy-down" the cost of renewable energy by about $20/mwh on a long-term levelized cost basis. Thus, assumptions about the future availability and level of the PTC can have a major impact on planning for state RPS policies.[109] Otherwise, federal agency involvement with state RPS programs has primarily involved support for planning and analysis.[110]

Federal RPS Debate. RPS proponents contend that a national system of tradable credits would enable retail suppliers in states with fewer resources to comply at the least cost by purchasing credits from organizations in states with a surplus of low-cost production. Opponents counter that regional differences in availability, amount, and types of renewable energy resources would make a federal RPS unfair and costly.

During the first session of the 110th Congress, RPS action began with Senate floor consideration of S.Amdt. 1537 to H.R. 6. The amendment proposed a 15% RPS target. The proposal triggered a lively debate, but was ultimately ruled non-germane. In that debate, opponents argued that a national RPS would disadvantage certain regions of the country, particularly the Southeastern states. They contended that the South lacks a sufficient amount of renewable energy resources to meet a 15% renewables requirement. They further concluded that an RPS would cause retail electricity prices to rise for many consumers.

RPS proponents countered by citing an EIA study that examined the potential impacts of the 15% RPS proposed in S.Amdt. 1537. It indicated that the South has sufficient biomass generation, both from dedicated biomass plants and existing coal plants co-firing with biomass fuel, to meet a 15% RPS. EIA noted further that the estimated net RPS requirement for the South would not make it "unusually dependent" on other regions and was in fact "below the national average requirement...." Regarding electricity prices, EIA estimated that the 15% RPS would likely raise retail prices by slightly less than 1% over the 2005 to 2030 period.

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[108] (...continued)
of 28 state RPS cost projection studies found two that estimated rate increases greater than 5% and 19 that estimated rate increases less than 1%. Of the latter 19 studies, six estimated rate decreases. The study concludes that "when combined with possible natural gas price reductions and corresponding gas bill savings, the overall cost impacts are even more modest."

[109] DOE. Lawrence Berkeley National Laboratory. *Weighing the Costs and Benefits of State Renewables Portfolio Standards: A Comparative Analysis of State-Level Policy Impact Projections.* March 2007. p. 50. [http://eetd.lbl.gov/ea/ems/reports/61580.pdf].

[110] Under its State and Local Program, the Environmental Protection Agency (EPA) has provided online workshops (conference calls) that have promoted collaboration between various states with an RPS in place. FERC has prepared studies and rulemakings related to transmission, grid interconnection, and other RPS-related policies. NREL has prepared various studies of state RPS programs and activities. EIA has prepared studies projecting impacts of RPS proposals on electricity and natural gas prices. Some of these EIA studies are cited under the below section on Federal RPS Debate.

Further, the RPS would likely cause retail natural gas prices to fall slightly over that period.

In House floor action on H.R. 3221, an RPS amendment (H.Amdt. 748) was added by a vote of 220 to 190. The bill subsequently passed the House by a vote of 241 to 172. The RPS amendment would set a 15% target for 2020, of which up to four percentage points of the requirement could be met with energy efficiency measures. Key points and counterpoints of the Senate debate were repeated. On the House floor, RPS opponents also contended that biomass power technologies were not yet ready for commercial use and that certain usable forms of biomass were excluded. Proponents acknowledged that there is a need to expand the definition of biomass resources, and offered to do so in conference committee.

On December 6, 2007, the House approved the same RPS provision as section 1401 of the omnibus energy bill, H.R. 6. However, the Senate passed H.R. 6 without an RPS provision. Thus, the Energy Independence Act (P.L. 110-140) does not contain an RPS. (For more details see CRS Report RL34116, *Renewable Energy Portfolio Standard (RPS): Background and Debate Over a National Requirement.*)

Other Regulatory Issues

Wind Energy. Major wind developments in Europe have expanded from land-based operations to include some offshore coastal areas. Proposals to develop offshore wind have emerged in the United States as well. During the 109th Congress, a major debate erupted over safety, economic, and environmental aspects of a proposal by Cape Wind Associates to develop a 420-megawatt offshore wind farm in Nantucket Sound, south of Cape Cod, Massachusetts. Cape Wind and other proponents say the project is a safe, clean way to develop renewable energy and create jobs. Opponents of the project have collaborated to create the Alliance to Protect Nantucket Sound. The Alliance says that the project poses threats to the area's ecosystem, maritime navigation, and the Cape Cod tourism-based economy.

EPACT (§388) placed regulatory responsibility for offshore wind developments with the Minerals Management Service (MMS) of the Department of the Interior. In 2006, MMS announced that an environmental impact statement (EIS) would be prepared for the project. In February 2007, Cape Wind submitted its draft EIS to MMS.[111] MMS released its Draft Environmental Impact Statement in January 2008.[112] The study found that environmental, fishery, and marine transportation impacts would range from negligible to minor. On-shore visual impacts would be moderate. After the report was released, MMS began a two-month review and comment period. Also, the Coast Guard Act of 2006 (P.L. 109-241, §414) directs the Coast Guard to determine the status of navigational safety aspects for the Cape Wind Project. The parties to the debate are waiting for the final results of the EIS and Coast Guard study.

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[111] Cape Wind has posted its draft EIS at [http://www.capewind.org/article137.htm].

[112] MMS. *Draft Environmental Impact Statement* Available on the MMS website at [http://www.mms.gov/offshore/RenewableEnergy/DEIS/Volume%20I%20-%20Cape%20Wind%20DEIS/Cape%20Wind%20DEIS.pdf].

There is also a concern that tall wind turbines create false radar signals that may disrupt civilian and military radar equipment.[113] This led to federal actions to temporarily halt several wind farm developments. The Defense Authorization Act for FY2006 directed the Department of Defense (DOD) to study the issue and report to Congress. In 2006, the Sierra Club filed suit to compel DOD to complete the radar study. DOD released the report in late 2006,[114] and allowed most of the delayed projects to resume action. However, the report concluded that some mitigation strategies would have to be conducted on a case-by-case basis and that the development of additional mitigation measures would require further research and validation.

The impact of wind turbines on wildlife has also become a focus of concern. H.R. 3221 (§7231-7234) would have required the Department of the Interior to form a committee to recommend guidance to minimize and assess impacts of land-based wind turbines on wildlife and wildlife habitats. State and federal laws (and regulations) would not be preempted. However, this provision was not included in the final version of H.R. 6 that was enacted as the Energy Independence Act (P.L. 110-140).

Marine (River, Tidal, Wave, and Ocean) Energy. Technology that generates electricity from marine sources — including ocean waves, tides, and river currents — has reached the pre-commercial stage. Tax incentives and other programs have been established in Florida, Maine, and New Jersey to encourage commercial development. MMS has authority under EPACT (§388) to regulate development of ocean energy resources on the outer continental shelf (OCS). The Federal Energy Regulatory Commission (FERC) has asserted its authority to regulate these technologies, which it considers to be forms of hydropower. As these technologies develop to commercial scale, environmental issues are likely to arise, over which several other agencies appear to have regulatory jurisdiction. As technologies advance and new incentives become available, the regulatory struggle between MMS and FERC, and the potential regulatory roles of other agencies, may grow in importance.[115]

In the 110th Congress,[116] the Energy Independence Act (P.L. 110-140) directs DOE to create an R&D program focused on technology that produces electricity from waves, tides, currents, and ocean thermal differences (§633). A report to Congress

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[113] More information on this issue is available on DOE's website at [http://www.eere.energy.gov/windandhydro/windpoweringamerica/ne_issues_interference.asp].

[114] The report is available at [http://www.defenselink.mil/pubs/pdfs/WindFarmReport.pdf].

[115] For more information, see CRS Report RL33883, *Issues Affecting Tidal, Wave, and In-Stream Generation Projects*, by Nic Lane.

[116] The 109th Congress considered, but did not enact, legislation for these technologies that would have authorized guaranteed loans and direct revenues from Outer Continental Shelf (OCS) leases to fund ocean energy development. Also, a proposal to expand the renewable energy production tax credit (PTC) to include these technologies was approved by the Senate, but it was dropped in conference committee.

is required. Further, DOE is instructed to award grants to institutions of higher education (or consortia thereof) to establish National Marine Renewable Energy Research, Development, and Demonstration Centers (§634). The FY2008 Consolidated Appropriations Act (P.L. 110-161) provided $9.9 million for DOE's Water/Marine Energy Technology Program. The FY2009 DOE budget request seeks $3.0 million for that program, primarily for resource assessment studies.

Renewable Fuels and Energy Security

Types of Renewable "Biofuels"

Renewable fuel is defined to include ethanol, biodiesel, and certain other sources. Ethanol is the only one produced in large quantity.

Corn Ethanol. In the United States, ethanol is produced mainly from corn grown on farms.[117] It is most often used as a 10% blend with gasoline. Ethanol's high cost has been a key barrier to increased commercial use. This barrier has been addressed mainly by a 51-cent per gallon tax credit for fuel use. Also, there has been a debate over the net energy benefit of using corn ethanol.[118] National ethanol production was estimated at 4.85 billion gallons in 2006.[119] However, due to ethanol's lower heat content,[120] this is equivalent to about 3.2 billion gallons of gasoline, or about 210,000 barrels of oil per day (b/d).

Corn Ethanol Impacts and Debate. The U.S. Department of Agriculture (USDA) estimates that 20% of the 2006 corn crop was used to produce ethanol. The rapid growth in agriculture-based biofuel production generated a sharp upturn in corn, grain, and oilseed prices in late 2006. At the end of 2006, corn ethanol plant capacity expansion was on record pace. The rapid growth in production and plant capacity has raised concerns that further acceleration of ethanol production may pose

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[117] Ethanol is the major farm-based renewable fuel. Corn provides 98% of ethanol production. Biodiesel is another important farm-based fuel, produced mainly from soybean oil. However, annual production is nearly 99% less than that for corn ethanol. For more information on farm-based renewable fuels, see CRS Report RL32712, *Agriculture-Based Renewable Energy Production*, by Randy Schnepf.

[118] For more information about ethanol developments and issues, see CRS Report RL33564, *Alternative Fuels and Advanced Technology Vehicles: Issues in Congress*, and CRS Report RL33290, *Fuel Ethanol: Background and Public Policy Issues*, both by Brent Yacobucci.

[119] Renewable Fuels Association, *Industry Statistics: Historic U.S. Ethanol Fuel Production*, September 4, 2007, at [http://www.ethanolrfa.org/industry/statistics/].

[120] DOE, EIA, *Ethanol*. EIA reports that the heat content of ethanol is about 3.5 million Btu per barrel (42 gallons); see [http://www.eia.doe.gov/oiaf/ethanol3.html]. Also, EIA's *Monthly Energy Review*, at [http://www.eia.doe.gov/emeu/mer/append_a.html], reports that the heat content of motor gasoline is 5.25 million Btu per barrel. Thus, on a per volume basis, ethanol has about 67% of the heat content of gasoline.

more challenges, including the development of pipeline capacity and the potential for more food price increases.[121]

Supporters argue that ethanol displaces petroleum imports, thus improving energy security. They further contend that its use can lead to lower emissions of air pollutants and greenhouse gases, especially if higher-percentage blends are used. Opponents argue that various federal and state incentives for ethanol distort the market and provide "corporate welfare" for corn growers and ethanol producers. Further, they assert that the energy and chemical inputs that fertilize corn and convert it into ethanol actually increase energy use and emissions. However, proponents counter-argue that ethanol provides modest energy and emissions benefits relative to gasoline.

Cellulosic Ethanol. Cellulosic ethanol can be produced from dedicated fuel crops, such as fast-growing trees and switchgrass. Switchgrass grows well on marginal lands, needing little water and no fertilizer. This allows its growing area to be much larger than that for corn.[122] Cellulosic feedstocks may be cheaper and more plentiful than corn, but they require more extensive and costly conversion to ethanol. Both DOE and USDA are conducting research to improve technology and reduce costs. The United States and Canada have pilot production facilities. Canada has one commercial-scale plant in operation, and the first U.S. commercial plants are expected to start operating in 2009.

Renewable Fuel Standard (RFS)

New Goals Set By the Energy Independence Act. Section 202 of the Energy Independence and Security Act of 2007 (P.L. 110-140) extends and increases the RFS. The standard requires minimum annual levels of renewable fuel in U.S. transportation fuel. The previous standard was 5.4 billion gallons for 2008, rising to 7.5 billion by 2012.[123] The new standard starts at 9.0 billion gallons in 2008 and rises to 36 billion gallons in 2022. Starting in 2016, all of the increase in the RFS target must be met with advanced biofuels, defined as cellulosic ethanol and other biofuels derived from feedstock other than corn starch — with explicit carve-outs for cellulosic biofuels and biomass-based diesel.[124]

The law gives the EPA Administrator authority to temporarily waive part of the biofuels mandate, if it were determined that a significant renewable feedstock

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[121] For more information on renewable energy initiatives in the 2007 farm bill proposals, see CRS Report RL34130, *Renewable Energy Policy in the 2007 Farm Bill*, by Randy Schnepf.

[122] For more information about using cellulosic biomass for ethanol production, see CRS Report RL32712, *Agriculture-Based Renewable Energy Production*, by Randy Schnepf.

[123] The previous standard was set by section 1501 of the Energy Policy Act of 2005 (EPACT, P.L. 109-58). Actual production had been exceeding EPACT targets.

[124] The RFS includes an "advanced biofuels mandate," which begins with 600 million gallons in 2009 and rises to 21 billion gallons in 2022. The cellulosic ethanol portion of the advanced biofuels mandate starts with 100 million gallons in 2010 and rises to 16 billion gallons in 2022.

disruption or other market circumstance might occur. Renewable fuels produced from new biorefineries will be required to reduce by at least 20% the life cycle greenhouse gas (GHG) emissions relative to life cycle emissions from gasoline and diesel. Fuels produced from biorefineries that displace more than 80% of the fossil-derived processing fuels used to operate a biofuel production facility will qualify for cash awards. Several studies are required on the potential impacts of the RFS expansion on various sectors of the economy.

Implementation Concerns. In February 2008, the Senate Committee on Energy and Natural Resources held an oversight hearing on the new RFS.[125] Both leaders of the Committee, the Chairman[126] and the Ranking Member,[127] expressed concern that the RFS set by the Energy Independence Act may need changes in order to be implemented effectively. One major focus of concern is that the law may unintentionally preclude new technologies and feedstock sources, such as woody biomass from federal lands, urban and commercial waste, and biocrude from algae. (For more details on issues related to the RFS, see CRS Report RL34265, *Selected Issues Related to an Expansion of the Renewable Fuel Standard (RFS)*, by Brent D. Yacobucci and Randy Schnepf.)

Potential to Reduce Oil Imports. **Table 6** shows baseline EIA data for U.S. oil use and Persian Gulf Imports in 2005 and EIA projections for selected future years through 2030.[128] The table also shows ethanol production estimates for the current RFS of 36 billion gallons by 2022.[129] At its peak in 2022, the current RFS would displace an estimated 1.57 million barrels per day (mbd), or about 49% of projected Persian Gulf imports for that year.

Biofuels Funding and Tax Issues

Biofuels Technology Funding Initiative. The Administration's Biofuels Initiative, part of the AEI, was designed to increase funding for cellulosic ethanol

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[125] U.S. Senate. Committee on Energy and Natural Resources. *The Energy Market Effects of the Recently-Passed Renewable Fuel Standard.* Hearing held February 7, 2008. [http://energy.senate.gov/public/index.cfm?FuseAction=Hearings.Hearing&Hearing_ID=1676].

[126] The Chairman's statement is available on the Committee's website, at [http://energy.senate.gov/public/index.cfm?FuseAction=PressReleases.Detail&PressRelease_id=235445&Month=2&Year=2008&Party=0].

[127] The Ranking Member's statement is available on the Committee's website, at [http://energy.senate.gov/public/index.cfm?FuseAction=PressReleases.Detail&PressRelease_id=235447&Month=2&Year=2008].

[128] To facilitate comparison, all figures in the table are shown in terms of millions of barrels per day, mbd.

[129] The RFS scenario is identified by its ultimate target, expressed in billions of gallons per year of ethanol production in a certain future year. The ethanol figures in Table 6 were converted from billions of gallons per year to millions of barrels per day. They assume 100% corn ethanol, with 67% of the heat content of gasoline by volume.

development with the goal of accelerating its commercial use.[130] In 2006, DOE formed a joint research effort between its Office of Energy Efficiency and Renewable Energy (EERE) and the Office of Science to develop cellulosic biotechnology that would enable the production of 60 billion gallons per year.[131] The research plan aims for biotechnology breakthroughs to increase the quantity of biomass (e.g., switchgrass) per acre and to breed the plants to have more cellulose. The plan would cut costs through biorefinery breakthroughs that reduce the number of conversion steps and shift the process from chemical steps to biological steps.[132]

As **Table 3** shows, DOE's FY2009 budget request would provide $225.0 million for DOE's Biomass Program that supports the Biofuels Initiative and the RFS goals. This would be a $26.8 million increase from the $198.2 million appropriated for FY2008.

Tax Incentives Proposed in H.R. 5351.[133] The bill has four tax incentive provisions for biofuels. Section 213 would create a new production tax credit of 50 cents per gallon for cellulosic fuel ethanol. This credit would be available in addition to the existing 51 cents per gallon ethanol credit and the 10 cents per gallon small producer credit. Section 211 would extend for two years (end of 2010) the $1.00 per gallon production credit for biodiesel and the 50 cents per gallon credit for small biodiesel producers. Also, it would extend the $1.00 per gallon production credit for biomass-derived diesel fuel. Section 202 would extend the alternative refueling stations credit for two years, through the end of 2010. Also, it would increase the credit value from 30% (capped at $30,000) to 50% (capped at $50,000). Section 212 would clarify that the production incentives in sections 213, 211, and 202 would be available only for fuels produced in the United States.

Farm Bill (H.R. 2419) Provisions. The House passed its version of the 2007 farm bill (H.R. 2419; "Farm, Nutrition, and Bioenergy Act of 2007") on July 27, 2007. The Senate approved its version of the farm bill (Senate substitute amendment to H.R. 2419; "Farm Security Act of 2007"), on December 14, 2007. Both bills contain provisions that extend and/or expand upon renewable energy (and energy efficiency) provisions of the Farm Security Act of 2002 (P.L. 107-171).

Common/Similar Provisions in House and Senate Versions. Both versions would provide grants and loan guarantees for biofuels research,

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[130] The White House, *Fact Sheet: President Bush's Four-Part Plan to Confront High Gasoline Prices*, April 26, 2005, at [http://www.whitehouse.gov/news/releases/2006/04/20060425-2.html].

[131] DOE, *Factsheet on a Scientific Roadmap for Cellulosic Ethanol*, p. 1. Assuming that the 60 billion gallons per year is provided by ethanol, that would be equal to 3.9 million barrels per day of ethanol. Using the fact that ethanol has about 67% of the heat content of gasoline by volume yields an estimate of 2.6 million barrels of oil equivalent per day. See [http://www.er.doe.gov/News_Information/News_Room/2006/Biofuels/factsheet.htm].

[132] DOE, *Factsheet on a Scientific Roadmap for Cellulosic Ethanol*, p. 2.

[133] A description of the provisions is available at [http://waysandmeans.house.gov/media/pdf/110/februarybillsummary.pdf].

development, deployment, and production. Further, both bills would reauthorize biofuels R&D at the Department of Agriculture. Also, both versions would establish a new program — the Bioenergy Reserve Program in the House version and the Biomass Crop Transition Assistance Program in the Senate version — with mandatory funding to promote the production, harvest, storage, and processing of cellulosic biomass feedstock. In addition, both versions include several new studies, research and demonstration projects, and pilot programs on renewable energy — all of which would be subject to the availability of funding from the annual appropriations process. (For more details, see CRS Report RL34239, *Biofuels in the 2007 Energy and Farm Bills: A Side-by-Side Comparison*; and see CRS Report RL34130, *Renewable Energy Policy in the 2007 Farm Bill*.)

Tax Provisions in the Senate Version (H.R. 2419/S. 2302). Title XII of the Senate-passed farm bill contains tax provisions for renewable energy.[134] There are several provisions for the production, blending, and use of biofuels (ethanol, biodiesel, renewable diesel). Also, there are investment incentives for infrastructure (fueling stations) and for the development of production facilities. (For more details on the tax provisions, see CRS Report RL33578, *Energy Tax Policy: History and Current Issues*, by Salvatore Lazzari. For more background on all energy provisions of the farm bill, see CRS Report RL34130, *Renewable Energy Policy in the 2007 Farm Bill*, by Randy Schnepf.)

Climate Change

This section discusses the potential for renewable energy to reduce carbon dioxide (CO_2) emissions by displacing fossil fuel use.

CO_2 Emissions Reduction Estimates

In most cases renewable energy appears to release less carbon dioxide (CO_2) than fossil fuels.[135] Thus, renewables are seen as a key long-term resource that could substitute for significant amounts of fossil energy that would otherwise be used to produce vehicle fuels and electricity. The potential percentage of renewable energy substitution can depend on many factors, including energy prices, energy demand growth,[136] technology cost, and market penetration. As renewable energy production

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[134] The Joint Committee on Taxation has published a description of the tax provisions at [http://www.house.gov/jct/x-15-08.pdf].

[135] Because renewable energy is often developed for energy security, air pollution reduction, or other purposes, it is an example of a "no-regrets" strategy for CO_2 emission reductions. Wind and solar energy have zero CO_2 emissions in operation but may need an energy storage back-up system (such as batteries or fuel cells) that do require fossil fuel use. When biomass is developed as an energy crop, the CO_2 emissions are near zero because each new crop absorbs the same amount of emissions as are released by combusting the previous crop — unless fertilizer is used.

[136] The use of energy efficiency measures can have a significant effect on energy prices and (continued...)

displaces fossil fuel use, it would also reduce CO_2 emissions in direct proportion, except perhaps for biofuels and biopower.[137]

In general, the combustion of biomass for fuel and power production releases CO_2 at an intensity that may be close to that for natural gas. However, the re-growth of biomass material, which absorbs CO_2, often offsets this release. Hence, net emissions occur only when combustion is based on deforestation. In a "closed loop" system, biomass combustion is based on rotating energy crops, there is no net CO_2 release unless fertilizer is used, and any fossil fuel displacement, including decreased natural gas use, would tend to reduce CO_2 emissions.

Support for Renewables to Curb CO_2

Since 1988, the federal government has initiated programs to support renewable energy as a CO_2 mitigation measure at DOE, USDA, EPA, the Agency for International Development (AID), and the World Bank. AID and the World Bank have received funding for renewable energy-related climate actions through foreign operations appropriations bills.

States have undertaken a variety of programs that support renewables to curb CO_2. These programs often have reasons other than climate change for supporting renewables. California and New York are notable examples that have sizable programs for R&D and market deployment.[138] These programs are funded in large part by a surcharge on electricity use, often identified as a public goods charge.[139] As noted in a previous section of this report, many states have enacted a renewable portfolio standard. However, a growing number of states have also undertaken climate programs that specifically include renewables as one mitigation measure.[140] Many local governments have also undertaken climate programs that include renewables as a component.[141]

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[136] (...continued)
demand growth.

[137] Non-biomass renewables also tend to reduce emissions of other air-borne pollutants that cause urban smog, acid rain, and water pollution.

[138] California's renewable energy program is at [http://www.energy.ca.gov/renewables/], and its climate program is at [http://www.climatechange.ca.gov/]; for more about New York's renewable energy program go to [http://www.powernaturally.org/].

[139] The Database of State Incentives for Renewable Energy (DSIRE) has information about virtually all state renewable energy programs at [http://www.dsireusa.org/].

[140] For more information see CRS Report RL33812, *Climate Change: Action by States to Address Greenhouse Gas Emissions*, by Jonathan L. Ramseur.

[141] Information about local government programs is available from the EPA website at [http://www.epa.gov/climatechange/wycd/stateandlocalgov/local.html] and from Cities for Climate Protection Campaign of the International Council for Local Environmental Initiatives at [http://www.iclei.org/index.php?id=391].

Legislation

Major Laws Enacted

FY2008 Appropriations (P.L. 110-161). DOE's FY2008 budget request sought $1,236.2 million for DOE's Energy Efficiency and Renewable Energy (EERE) programs. In H.R. 2641, the House approved $1,873.8 million for EERE and the Senate Appropriations Committee recommended $1,715.6 million for EERE. The Consolidated Appropriations Act of 2007 (H.R. 2764) subsumed H.R. 2641, and the enacted law included $1,723.7 million for EERE. (Details of the FY2008 appropriations are available in the "Key Policy Issues — Department of Energy" section of CRS Report RL34009, *Energy and Water Development: FY2008 Appropriations.*)

Energy Independence and Security Act (P.L. 110-140). At the end of its first session, the 110th Congress enacted a major omnibus energy bill focused on improving energy efficiency and increasing the availability of renewable energy. Highlights of the major provisions enacted are:

- *Corporate Average Fuel Economy (CAFE).* Title I sets a target of 35 miles per gallon for the combined fleet of cars and light trucks by model year 2020.
- *Renewable Fuels Standard (RFS).* Title II sets a modified standard that starts at 8.5 billion gallons in 2008 and rises to 36 billion gallons by 2022.
- *Appliance and Lighting Standards.* Title III legislates new standards for broad categories of incandescent lamps (light bulbs), incandescent reflector lamps, and fluorescent lamps. Further, a required target is set for lighting efficiency, and energy efficiency labeling is required for consumer electronic products. Efficiency standards are set by law for external power supplies, residential clothes washers, dishwashers, dehumidifiers, refrigerators, refrigerator freezers, freezers, electric motors, residential boilers, commercial walk-in coolers, and commercial walk-in freezers. Further, DOE is directed to set standards by rulemaking for furnace fans and battery chargers.

(For more details about the provisions in P.L. 110-140, see CRS Report RL34294, *Energy Independence and Security Act of 2007: A Summary of Major Provisions*).

Other Laws and Bills

In the 110th Congress, more than 310 bills with provisions for energy efficiency or renewable energy have been introduced. A general description of the renewable energy provisions in those bills, including those enacted into law, is available in CRS Report RL33831, *Energy Efficiency and Renewable Energy Legislation in the 110th Congress*. The report also groups the bills by policy and issue areas, provides a table that identifies recent action on the bills, and discusses recent action.

Table 3. DOE Renewable Energy Budget for FY2006-FY2009

(selected programs, $ millions)

Program	FY2006	FY2007	FY2008	FY2009 Request	FY2009-FY2008	Percent Diff.
Biomass & Biorefinery Systems	$89.8	$199.7	$198.2	$225.0	$26.8	13.5%
— Cellulosic Ethanol Auction	10.4	0.0	5.0	0.0	-5.0	-100.0%
Solar Energy Technology	81.8	157.0	168.5	156.1	-12.3	-7.3%
— Photovoltaics	58.8	138.4	136.7	137.1	0.4	0.3%
— Concentrating Solar	7.3	15.7	29.7	19.0	-10.7	-36.0%
— Solar Heating & Lighting	1.4	3.0	2.0	0.0	-2.0	-100.0%
Wind Energy Technology	38.3	48.7	49.5	52.5	3.0	6.0%
Geothermal Technology	22.8	5.0	19.8	30.0	10.2	51.4%
Water/Marine Technology	0.5	0.0	9.9	3.0	-6.9	-69.7%
Subtotal, Renew. Technologies	233.2	407.0	445.9	466.6	20.7	4.6%
International Renewables	3.9	9.5	0.0	0.0	0.0	0.0%
Tribal Energy	4.0	4.0	5.9	1.0	-4.9	83.1%
Renewables Prod'n Incentive	5.0	4.9	5.0	0.0	-5.0	-100.0%
Asia Pacific Partner. (Renew.)	0.0	—	0.0	7.5	7.5	100.0%
Subtotal, Renew. Deployment	12.9	18.4	10.9	8.5	-2.4	-22.0%
Subtotal, Renewables	246.1	425.4	456.8	475.1	18.3	4.0%
Hydrogen Technologies	153.5	189.5	211.1	146.2	-64.8	-30.7%
Vehicle Technologies	178.4	183.6	213.0	221.1	8.0	3.8%
Building Technologies	68.2	103.0	109.0	123.8	14.8	13.5%
Industrial Technologies	55.9	55.8	64.4	62.1	-2.3	-3.6%
Federal Energy Management	19.0	19.5	19.8	22.0	2.2	11.0%
Subtotal, Efficiency R&D	475.0	551.4	617.3	575.2	-42.1	-6.8%
Facilities (Nat. Renew. Lab)	26.1	107.0	76.2	14.0	-62.2	-81.6%
Program Management	115.2	110.2	114.9	141.8	27.0	23.5%
— Weatherization/State Grants	278.7	263.5	271.3	50.0	-221.3	-81.6%
— Renewables Deployment	12.9	18.4	10.9	7.5	-2.4	-22.0%
— Cong.-Directed Assistance [b]	—	0.0	186.7	0.0	-186.7	-100.0%
— Prior Year Balances	—	—	-0.7	-0.7	0.0	0.0%
Federal Assistance Subtotal	316.9	281.7	468.1	57.8	-410.4	-87.7%
Total Appropriation, EE & RE	1,166.1	1,457.2	1,722.4	1,255.4	-467.0	-27.1%
Office of Electricity Delivery & Energy Reliability (OE)[a]	158.2	134.4	138.6	134.0	-4.6	-3.3%

Sources: DOE *FY2009 Congressional Budget Request*, vol. 3, February 2008; *DOE FY2007 Operating Plan*; Congressional Record, December 17, 2007 (Book II), H.R. 2764, Division C. For more details, see CRS Report RL34009, *Energy and Water Development: FY2008 Appropriations*.

a. The Distributed Energy Program was moved from EERE to OE in FY2006
b. In FY2006, there was $159.0 million in congressionally-directed funds spread over EERE accounts.

Table 4. Production Tax Credit Value and Duration by Resource

Energy Resource	Credit Amount for 2007 (cents/kwh)	Credit Period for Facilities Placed in Service after August 8, 2005 (years)
Wind	2.0	10
Closed-Loop Biomass	2.0	10
Open-Loop Biomass (includes agricultural livestock waste nutrient facilities)	1.0	10
Geothermal	2.0	10
Solar (pre-2006 facilities only)	2.0	10
Small Irrigation Power	1.0	10
Incremental Hydropower	1.0	10
Municipal Solid Waste (includes landfill gas and trash combustion facilities)	1.0	10

Source: Joint Committee on Taxation. *Description of the Tax Provisions in H.R. 2776, the "Renewable Energy and Energy Conservation Tax Act of 2007."* (JCX-35-07) June 19, 2007. p. 7. [http://www.house.gov/jct/x-35-07.pdf].

Table 5. Production Tax Credit Claims, History and Projections

($ millions)

Year	Public Law	Credit Lapse (months)	PTC Claims ($ current)	Deflator ($ 2005)	PTC Claims ($ 2005)	Number of States with RPS
History						
1995	P.L. 102-486		3.2	0.8193	3.9	2
1996	P.L. 102-486		9.3	0.8350	11.2	3
1997	P.L. 102-486		9.4	0.8496	11.0	6
1998	P.L. 102-486		13.9	0.8559	16.2	9
1999	P.L. 102-486, P.L. 106-170	6 months	28.9	0.8712	33.2	11
2000	P.L. 106-170		50.1	0.8888	56.4	12
2001	P.L. 106-170		70.6	0.9098	77.6	12
2002	P.L. 107-147	2 months	131.6	0.9272	141.9	13
2003	P.L. 107-147		142.8	0.9460	151.0	13
2004	P.L. 108-311	9 months	207.0	0.9704	213.3	18
Total, History			666.9		715.7	
JCT Future Estimates						
2005	P.L. 108-311		300	1.0000	300	21
2006	P.L. 109-58		900	1.0308	873	23
2007	P.L. 109-58		900	1.0570	851	24
2008	P.L. 109-432		1,000	1.0826	924	
2009			1,600	1.1072	1,445	
2010			1,200	1.1311	1,061	
Total, Future Estimates			5,950		5,154	

Source: Historical data on PTC claims for 1995 through 2004 were obtained from Mr. Curtis Carlson, Office of Tax Analysis, Internal Revenue Service. Estimates of PTC claims for 2005 through 2010 were obtained by combining estimates from the Joint Committee on Taxation for the PTC provisions in P.L. 108-311, P.L. 109-58, and P.L. 109-432.

Table 6. Renewable Fuels Compared with Persian Gulf Imports

(millions of barrels per day, mbd)

Year	Oil Use or Oil Use Equivalent (mbd)[a]				As a Percent of Persian Gulf Imports	
	Total Oil Use	Persian Gulf Imports	7.5-in 2012 (EPACT)	36-in-2022 (P.L. 110-140)	7.5-in 2012	36-in-2022
2005 Actual	20.75	2.59	0.17	0.17	6.6%	6.6%
2006	20.68	2.68	0.17	0.17	6.5%	6.5%
2007	20.94	2.71	0.20	0.20	7.6%	7.6%
2008	21.15	2.67	0.24	0.37	8.8%	13.9%
2009	21.38	2.67	0.27	0.46	10.0%	17.1%
2010	21.59	2.74	0.30	0.52	10.8%	19.1%
2011	21.89	2.79	0.32	0.55	11.6%	19.7%
2012	22.13	2.86	**0.33**	0.57	**11.4%**	20.1%
2017	23.29	2.99	—	0.91	—	30.6%
2022	24.58	3.20	—	**1.57**	—	**49.0%**

Sources: For Total Oil Use and Persian Gulf Imports, see EIA, Energy Information Administration. *Annual Energy Outlook 2007*, Supplementary Tables 11 and 118. For the 7.5-in-2012 renewable fuel standard (RFS), see P.L. 109-58 (EPACT), §1501. For new RFS "36-in-2022" standard, see P.L. 110-140 (Energy Independence and Security Act of 2007). Note that all displacements assume 100% ethanol, with 67% of the heat content of gasoline by volume. The ethanol figures also reflect the conversion that 42 gallons equal one barrel.

a. The ethanol figures for 7.5-in-2012 (EPACT), and 36-in-2022 (P.L. 110-140) assume 100% corn ethanol, with 67% of the heat content of gasoline by volume. The ethanol figures also reflect the conversion that 42 gallons equal one barrel.