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Report RL34162

*Renewable Energy: Background and Issues for the 110th
Congress*

Fred Sissine, Specialist in Energy Policy

December 10, 2008

Abstract. 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.

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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%). The Continuing Appropriations Resolution for FY2009 (P.L. 110-329, H.R. 2638) continues DOE funding at the FY2008 level through March 6, 2009.

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. The Emergency Economic Stabilization Act of 2008 (P.L. 110-343 [Division B], H.R. 1424) extends the PTC for wind farms for one year (three years for most other renewables) through the end of 2009, provides \$800 million for a new category of clean renewable energy (tax credit) bonds, and extends for eight years the 30% level for the business solar tax credit and the 30% residential solar tax credit. Further, the law repeals nearly \$17.7 billion in tax subsidies for oil and natural gas and reduces certain other financial incentives that will be used to offset the cost of the tax incentives for renewable energy (\$9.1 billion) and energy efficiency (\$3.6 billion).

The ethanol fuel issue intensified for much of the 110th Congress. Corn ethanol production climbed rapidly, but appeared 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 CO₂ 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. P.L. 110-343 (H.R. 1424) and the farm bill (P.L. 110-246, H.R. 6124) contain several tax incentives and other provisions for biofuels.

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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 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

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/>.

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>.

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 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

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 D. Yacobucci.

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

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 (CO₂) 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 CO₂ 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

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 200 bills were 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 In the second session, the Emergency Economic

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_energy/policy/notices/2007-05-21_committee_workshop.html.

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, Lynn J. Cunningham, and Mark Gurevitz.

⁹ For a side-by-side comparison of the omnibus bills, see CRS Report RL34135, *Omnibus Energy Efficiency and Renewable Energy Legislation: A Side-by-Side Comparison of Major Provisions in House-Passed H.R. 3221 with Senate-Passed H.R. 6*, coordinated by Fred Sissine.

Stabilization Act (P.L. 110-343, Division B) provided several billion in tax incentives for renewables.

(For more details on the Energy Independence Act, see CRS Report RL34294, *Energy Independence and Security Act of 2007: A Summary of Major Provisions*, by Fred Sissine; for more details on FY2008 appropriations for DOE's renewable energy programs, see CRS Report RL34009, *Energy and Water Development: FY2008 Appropriations*, by Carl E. Behrens et al. and CRS Report RL34417, *Energy and Water Development: FY2009 Appropriations*, by Carl E. Behrens et al.; for more information about renewable energy laws and bills, see CRS Report RL33831, *Energy Efficiency and Renewable Energy Legislation in the 110th Congress*, by Fred Sissine, Lynn J. Cunningham, and Mark Gurevitz.)

Budget and Funding Issues and Action

EPACT Implementation (P.L. 109-58)

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 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”

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).

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 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.

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 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.

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.

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

The FY2008 Consolidated Appropriations Act (P.L. 110-161) directed DOE to issue \$38.5 billion in new loan guarantee authority through the end of FY2009.²² The law calls for \$10.0 billion of the \$38.5 billion to be designated to support renewables, energy efficiency, distributed energy, and transmission and distribution projects.

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]).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

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>.

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

²² 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.

²³ 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."

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.

The Continuing Appropriations Resolution for FY2009 (P.L. 110-329, H.R. 2638) provides for continued funding at the FY2008 level through March 6, 2009.

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.

Second Round of Project Solicitations

On June 30, 2008, DOE announced three solicitations for the 2nd round of solicitations. A total of up to \$30.5 billion of loan guarantee authority was established for “advanced energy technologies” that would reduce air pollutants or greenhouse gases. One of the three solicitations was for “renewable energy and advanced transmission and distribution technologies.”²⁸ On October 29, 2008, DOE announced that it was extending the “Renewables Solicitation” application due dates for stand-alone and manufacturing projects and for Part I large-scale integration projects, from December 31, 2008, to February 26, 2009. The deadline for Part II applications for large-scale integration projects will remain set at April 30, 2009.²⁹

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.

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>.

²⁸ The other solicitations were for energy efficiency and nuclear power facilities. See DOE loan guarantee program chronology at <http://www.lgprogram.energy.gov/>.

²⁹ DOE. *DOE Extends Application Deadline for Renewable Energy Loan Guarantee Solicitation*. (press release) <http://www.lgprogram.energy.gov/press/102908.pdf>.

Energy Independence Act Implementation (P.L. 110-140)

As part of the strategy to address energy security, climate change, and other national interests, the Energy Independence and Security Act of 2008 (EISA, P.L. 110-140) contained several provisions that authorized new programs and spending for renewable energy. Some of those provisions have either gone unfunded or have been funded below the authorized level.

Accelerated Research and Development

Title VI directs DOE to conduct several new programs to accelerate the development of renewable energy and hydrogen technologies. For example, \$90 million was authorized for new geothermal programs, but the FY2009 continuing appropriations bill (P.L. 110-329) does not include new funding to cover the cost of the programs. Also, \$1 billion was authorized over a 10-year period to support the establishment of a hydrogen prize (H-prize) to accelerate technology development. DOE has issued a solicitation for an organizational host, pending congressional appropriations.³⁰ P.L. 110-329 does not provide new funding for this program.

International Energy Programs

Title IX, Subtitle A, calls for a new program of “Assistance to Promote Clean and Efficient Energy Technologies in Foreign Countries.” The U.S. Agency for International Development (USAID) is directed to report to Congress on efforts to support policies for clean and efficient energy technologies. The Department of Commerce is directed to increase efforts to export such technologies and report to Congress on the results. Other U.S. agencies with export promotion responsibilities are required to increase efforts to support these technologies. Also, a multi-agency Task Force on International Cooperation for Clean and Efficient Energy Technologies is created to support the implementation of clean energy markets in key developing countries. The Senate Appropriations Committee recommended \$100 million for FY2009 USAID programs that “directly support zero-carbon” efficiency and renewables programs.³¹ However, P.L. 110-329 does not provide appropriations at that level, and it does not call for the new program developments set out in the Energy Independence Act.

Subtitle B directs that an “International Clean Energy Foundation” be established, with the long-term goal of reducing greenhouse emissions. Authorized funds would be used to make grants to promote projects outside the United States that serve as models of how to reduce emissions. The Senate Appropriations Committee recommended \$200 million for a U.S. contribution to establish an “International Clean Energy Fund” at the World Bank or other entity, and requires that the contribution “be matched by other sources.”³² However, P.L. 110-329 does not provide appropriations for such a fund.

³⁰ See http://www.hydrogen.energy.gov/news_h-prize_administrator.html.

³¹ S.Rept. 110-425, p. 43.

³² S.Rept. 110-425, p. 67.

Green Jobs

Title X authorizes up to \$125 million in funding to establish national and state job training programs, administered by the Department of Labor, to help address job shortages that impair growth in green industries, such as energy efficient buildings and construction, renewable electric power, energy efficient vehicles, and biofuels development. No funding was proposed for such programs in FY2009 budget requests nor in congressional committee appropriations recommendations.

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."³³ 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.³⁴

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."³⁵ 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."³⁶ Further, the *Budget* states that there is a goal to make solar power "cost-competitive with conventional electricity by 2015."³⁷

As **Table 4** shows, DOE's FY2009 request seeks \$1,255.4 million for the EERE programs. Compared to the FY2008 appropriation, the FY2009 request would reduce EERE funding by \$467.0 million, or 27.1%. The request would eliminate \$186.7 million in Congressionally-Directed Assistance and it would reduce Facilities construction spending by \$57.3 million.³⁸ For renewable energy technologies, **Table 4** 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

³³ The White House. State of the Union 2008. <http://www.whitehouse.gov/news/releases/2008/01/print/20080128-13.html>.

³⁴ 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.

³⁵ U.S. Executive Office of the President, *Budget of the United States Government, Fiscal Year 2009*, Appendix, p. 393.

³⁶ U.S. Executive Office of the President, *Budget of the United States Government, Fiscal Year 2009*, Appendix, p. 393.

³⁷ *U.S. Budget*, p. 59.

³⁸ 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.

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).³⁹ Also, the request would terminate the Renewable Energy Production Incentive (-\$5.0 million).⁴⁰

In contrast to the Administration's request, the House Appropriations Committee recommended \$2,531.1 million for DOE's EERE programs in FY2009.⁴¹ This would be a \$808.7 million (47%) increase over the FY2008 appropriation and a \$1,275.7 million (102%) increase over the DOE request. Compared with the request, the Committee recommendation would embrace a \$381.5 million increase for R&D programs. Further, the Committee-approved bill would provide \$259.2 million more for energy assistance programs, of which \$250.0 million would go to the Weatherization Program—in sharp contrast to DOE's proposal to eliminate it. Also, the Committee recommended \$500.0 million for new assistance programs authorized by the Energy Independence and Security Act (EISA, P.L. 110-140).

As a major initiative, the Committee recommended \$500.0 million as “initial program investment” for several new programs authorized by EISA. The Renewable Fuel Infrastructure Program (EISA §244) would get \$25.0 million to begin grant-giving operations. Aside from the \$500.0 million initiative, some additional EISA-related funding would be provided under the technology programs. The most notable examples are \$25 million for the production of advanced biofuels (EISA §207) under the Biomass and Biorefinery Program and \$33 million for zero net energy commercial buildings (EISA §422) under the Buildings Program.

The committee recommended \$134.7 million for Congressionally-Directed Assistance.

In addition to funding recommendations, the House Appropriations Committee report includes three policy directives for DOE. First, DOE would be required to report annually on the return on investment for each of the major EERE program funding accounts. Second, DOE would be directed to make up to \$20 million of EERE funds available for “projects at the local level capable of reducing electricity demand.” Each project would involve multiple technologies and public-private partnerships. Priority would go to projects that have a substantial local cost-share, help reduce water use, or curb greenhouse gas emissions. Third, DOE would be required to implement “an aggressive program” of minority outreach at Historically Black Colleges and Universities and at Hispanic Serving Institutions to deepen the recruiting pool of scientific and technical persons available to support the growing renewable energy marketplace.

The Senate Appropriations Committee recommended (S. 3258) \$1,928.3 million for EERE,⁴² which is \$205.9 million (12.0%) more than the FY2008 appropriation and \$672.9 million (53.6%) more than the request.

³⁹ *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.

⁴⁰ For a brief discussion of the Renewable Energy Production Incentive, see the section on “Clean Renewable Energy (Tax Credit) Bonds”, below.

⁴¹ See the House report on H.R. 7324.

⁴² The Senate Appropriations Committee report directs that \$59.5 million of a proposed \$72.9 million increase for the Solar Energy Program, will be provided by a transfer from the Basic Energy Sciences Program under the Office of Science.

Compared with the House Appropriations Committee report, the Senate Appropriations Committee recommended \$602.8 million, or 23.8%, less for EERE programs. The main difference (\$450.0 million) is that the House Appropriations Committee proposes an increase of \$500.0 million for a new EISA Federal Assistance Program, while the Senate Appropriations Committee proposes an increase of \$50.0 million for a new Local Government/Tribal Technology Demonstration Program. Further, the Senate report recommended less funding than the House report for several technology programs. Relative to the House Committee report figures, the Senate Committee report's proposed decreases for renewable energy R&D include Geothermal (-\$20.0 million), Bioenergy (-\$15.0 million), and Water Energy (-\$10.0 million). The major decreases for energy efficiency include Weatherization (-\$48.8 million), Industrial Technologies (-\$34.9) million, and Vehicle Technologies (-\$24.5 million).

The Senate Appropriations Committee recommended \$124.2 million for Congressionally-Directed Projects.

In general, both committee reports recommended higher funding levels than the request. In particular, each included more than \$200 million for the Weatherization Program. Both committees disagreed with the DOE request to fund the Asia Pacific Partnership,⁴³ and neither committee recommended funding it. Both committees called for the Biomass program to emphasize the use of non-food sources for the development of biofuels. The Senate Committee report further stressed R&D efforts to focus on algae as a biofuels source.

Electricity Delivery and Energy Reliability

The FY2009 request includes \$134.0 million for the Office of Electricity Delivery and Energy Reliability (OE). The House Appropriations Committee recommended \$149.3 million, which is \$15.3 million more than the request. The Senate Appropriations Committee recommended \$166.9 million, which is \$17.7 million more than the House Appropriations Committee recommended. For OE congressionally directed projects, the House Committee report called for \$5.3 million, while the Senate Committee report sought \$12.9 million.

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."⁴⁴ 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

⁴³ *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. During debate over the FY2008 request for EERE, the Administration threatened to veto the appropriations bill, in part, due to the lack of funding for APP.

⁴⁴ *FY2009 Budget of the U.S. Government*. Appendix. p. 120.

development grants.⁴⁵ (For more details, see CRS Report RL34130, *Renewable Energy Policy in the 2008 Farm Bill*, by Tom Capehart.)

Congressional Action on FY2009 Appropriations (P.L. 110-329)

House Passes H.R. 2638, Continuing Appropriations Resolution

On September 24, 2008, the House substitute to the Senate substitute to the proposed Department of Homeland Security Appropriations Act, 2008 (H.R. 2638) was brought to the House floor. The substitute was adopted by vote of 370 to 58. Division A—the Continuing Appropriations Resolution, 2009—would continue federal funding at FY2008 levels through March 6, 2009. Two provisions of the resolution would provide additional funding for energy efficiency. Section 129 would provide \$7.51 billion for a DOE Advanced Technology Vehicles Manufacturing Loan Program authorized by the Energy Independence Act (P.L. 110-140, §136[d]). The Program would support \$25 billion in loans to domestic automobile manufacturers and automobile part manufacturers to cover up to 30% of the costs of re-equipping, expanding, or establishing a manufacturing facility in the United States to produce advanced technology vehicles or components (automobiles and parts that exceed fuel-efficiency standards). Recipients would be required to pay employees and contractors prevailing wage rates, and the program would be scheduled to expire in 2017. Section 130 would provide an additional \$250 million for the DOE Weatherization Assistance Program in FY2009. Those additional funds would remain available until expended.

House Passes H.R. 7110, Supplemental Appropriations

On September 26, 2008, the House passed the Supplemental Appropriations Bill for Fiscal Year 2009 (H.R. 7110) by a vote of 264 to 158. The bill would fund a green schools initiative at the Department of Education (DOED) and provide additional funding, above that in the Continuing Resolution (H.R. 2638), for efficiency and renewables programs at DOE.

Chapter 6 (Energy Development) would provide an additional \$500 million in FY2009 appropriations for DOE's Office of Energy Efficiency and Renewable Energy (EERE). The purpose of the additional funding is to accelerate the development of technologies that would "diversify the nation's energy portfolio and contribute to a reliable, domestic energy supply." An additional \$100 million would be provided to DOE's Office of Electricity Delivery and Energy Reliability (OE) to "modernize the electric grid, enhance security and reliability of the energy infrastructure, and facilitate recovery from disruptions to the energy supply." For the cost of loans authorized by the Energy Independence Act (P.L. 110-140, §135) the bill would provide \$1 billion to remain available until expended. Of that amount, \$5 million could be used only for administrative expenses to conduct the loan program. The leveraged loan guarantee commitments would be capped at a total of \$3.3 billion in loan principal.

⁴⁵ USDA. FY2009 Budget Summary and Annual Performance Plan. February 2008. p. 44.
<http://www.obpa.usda.gov/budsum/fy09budsum.pdf>.

Senate Adopts H.R. 2638

On September 27, 2008, the Senate adopted the House-passed version of H.R. 2638 by vote of 78 to 12. The Senate did not act on the supplement bill, H.R. 7110.

Tax Credit Issues and Action (P.L. 110-343)

On October 3, 2008, the proposed Emergency Economic Stabilization Act of 2008 (H.R. 1424) was signed into law as P.L. 110-343. Division B contains the Energy Improvement and Extension Act (EIEA), which extends and establishes several tax incentives for renewable energy.⁴⁶

P.L. 110-343 extends or re-establishes several tax incentives that support renewable electricity production, biofuels production, transportation efficiency and conservation, buildings efficiency, and equipment efficiency. The law has four incentives for electricity production: the production tax credit, two solar investment tax credits, and new clean energy (tax credit) bonds. Also, the law has several incentives for biofuels. P.L. 110-343 includes \$9.1 billion in renewable energy production (electricity and fuels) tax incentives and \$3.6 billion in energy efficiency (transportation and buildings/equipment) tax incentives.⁴⁷ The renewable energy incentives include \$5.8 billion for the renewable energy electricity production tax credit (PTC), \$1.9 billion for business solar (and fuel cell) credits, \$1.3 billion for residential solar tax credits, and \$267 million for clean renewable energy (tax credit) bonds.⁴⁸ (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*, by Fred Sissine, Lynn J. Cunningham, and Mark Gurevitz.)

EIEA offsets the cost of the incentives by reducing several existing subsidies, with the effect of generating nearly \$17 billion in revenue over 10 years. The largest offset, \$6.67 billion, is provided by a modification of the requirements imposed on brokers for the reporting of their customers' basis in securities transactions. A freeze on a deduction for certain types of oil and natural gas production will provide \$4.91 billion. Additional revenue will be derived from changes in foreign income taxes under Foreign Oil and Gas Extraction Income (FOGEL) and Foreign Oil Related Income (FORI) rules for the production and sale of oil and gas products (\$2.23 billion), a modification of the excise tax for the Oil Spill Liability Trust Fund (\$1.72 billion), and an extension of the Federal Unemployment Tax Act (FUTA) surtax (\$1.47 billion).⁴⁹

⁴⁶ EIEA was first introduced in the text of the Senate-adopted substitute to H.R. 6049. A brief legislative history of action on the tax incentives in the first session of the 110th Congress is provided in CRS Report RL34294, *Energy Independence and Security Act of 2007: A Summary of Major Provisions*, by Fred Sissine. Coverage of the more intense action in the second session is provided in CRS Report RL33831, *Energy Efficiency and Renewable Energy Legislation in the 110th Congress*, by Fred Sissine, Lynn J. Cunningham, and Mark Gurevitz.

⁴⁷ The law also provides \$4.1 billion for carbon mitigation and coal provisions.

⁴⁸ The Joint Committee on Taxation scores the estimated costs of the tax provisions at <http://www.house.gov/jct/x-78-08.pdf>. The Congressional Budget Office provides a brief summary of the scored costs at <http://www.cbo.gov/ftpdocs/98xx/doc9852/hr1424Dodd.pdf>.

⁴⁹ For additional discussion of the offset provisions, see CRS Report RL33578, *Energy Tax Policy: History and Current Issues*, by Salvatore Lazzari.

Debate over Proposed Incentives

Aside from several differences over the amount and duration of some incentives, the primary issue was focused on House proposals to fully offset the estimated cost of the incentives by reducing other tax subsidies. For example, during the House floor debate over H.R. 5351,⁵⁰ opponents 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 severely impair the ability of the credit to stimulate the development of new wind farms.⁵¹

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.⁵² (For more details about the proposed revenue offsets, see CRS Report RL33578, *Energy Tax Policy: History and Current Issues*, by Salvatore Lazzari.)

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.⁵³

Background and History

The PTC was established by federal law (P.L. 102-486) in 1992.⁵⁴ The credit was originally set at 1.5 cents/kwh and is adjusted annually for the previous year’s inflation rate.⁵⁵ Since 1992, it has expired and been reinstated three times, and it has been extended two other times.⁵⁶ In August

⁵⁰ Congressional Record. February 27, 2008. p. H1091-H1131.

⁵¹ 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>.

⁵² 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>.

⁵³ 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>.

⁵⁴ Section 1914 of the Energy Policy Act of 1992 (EPACT92, P.L. 102-486).

⁵⁵ The adjustment is set retrospectively, after inflation data is available for the previous calendar year.

⁵⁶ The most recent expiration occurred during 2004.

2005, the Energy Policy Act of 2005 (P.L. 109-58, §1301) extended the PTC for two years, through the end of calendar year 2007.⁵⁷ 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. The Emergency Economic Stabilization Act (P.L. 110-343, Division B, §101 and §102) extended the PTC for windfarms for one year, through the end of 2009. The PTC for biomass, geothermal, solar, and some other sources was extended for two years, through the end of 2010. Also, the PTC was expanded to include marine (ocean, tidal, wave) and hydrokinetic (river current) power sources, with eligibility established for three years, through the end of 2011.

Current Status and Past Significance

For claims against 2008 taxes, the credit stands at 2.1 cents/kwh for wind, closed-loop biomass, geothermal, and solar facilities. The credit stands at 1.0 cents/kwh for marine/hydrokinetic, open-loop biomass, small irrigation power, incremental hydropower, and municipal solid waste (including landfill gas and trash combustion facilities).

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 5** 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.⁵⁸

Revenue Effects

Claims for the PTC were less than \$1 million in 1993 and 1994. **Table 6** shows that credit claims started growing more rapidly in 1995 and increased sharply, though erratically, from 1999 through 2005. Wind farm developments accounted for more than 90% of the dollar value of PTC claims through 2005.⁵⁹ Given the credit's availability for new projects through 2008, the table shows that the claims for 2006 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.

⁵⁷ 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>.

⁵⁸ 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>.

⁵⁹ Personal communication with Curtis Carlson, Office of Tax Policy, Department of the Treasury. November 2008.

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.⁶⁰ 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 expiration, the PTC was reinstated for one- to two-year periods.⁶¹ 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.⁶²

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.⁶³

The American Wind Energy Association has noted that the cycle of decline in wind industry activity actually starts about eight months before a PTC expiration date.⁶⁴ 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.”⁶⁵ 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.⁶⁶ However, industry testimony suggests that identifying a

⁶⁰ 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>.

⁶¹ Senate Finance Committee, *Clean Energy*, Testimony of Ryan Wiser p. 5.

⁶² 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>.

⁶³ Senate Finance Committee, *Clean Energy*, Testimony of Ryan Wiser, p. 7.

⁶⁴ American Wind Energy Association (AWEA). *Legislative Priorities: Production Tax Credit Extension*. <http://www.awea.org/legislative/>.

⁶⁵ House Ways and Means Committee, *Tax Credits for Renewables*, Testimony of Dean Gosselin, p. 25.

⁶⁶ 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.

suitable geothermal resource is similar to prospecting for oil or natural 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.⁶⁷

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."⁶⁸ The geothermal industry says a PTC extension of 10 years or more could be sufficient to stimulate a higher level of sustained industry growth.⁶⁹

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.⁷⁰

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.⁷¹ These aspects make the PTC less valuable for solar than the business and residential investment tax credits (ITC).⁷² 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.⁷³ Even with the PTC, solar is too expensive for utility-scale application.

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.⁷⁴ State RPS action began in the mid-1990s.⁷⁵ Since then, an

⁶⁷ 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.

⁶⁸ Senate Energy Committee, *Implementation of EPACT*, Testimony of GEA, p. 92-93.

⁶⁹ Personal communication with Karl Gawell, Geothermal Energy Association, April 6, 2007.

⁷⁰ House Ways and Means Committee, *Tax Credits for Renewables*, Testimony of Dr. Howard Gruenspect for the Energy Information Administration (EIA), p. 10.

⁷¹ Also, solar energy equipment has high capital costs and low capacity factors.

⁷² House Ways and Means Committee, *Tax Credits for Renewables*, EIA Testimony, p. 6-9.

⁷³ House Ways and Means Committee, *Tax Credits for Renewables*, Testimony of Chris O'Brien for the Solar Energy Industries Association (SEIA), p. 47-49.

⁷⁴ EIA, *AEO2005*, p. 58.

⁷⁵ 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.

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.⁷⁶

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.⁷⁷ 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. This credit design issue surfaced in the 110th Congress, as it addressed the question of whether the credit should be expanded to include production from equipment that uses marine energy (tidal, wave, and ocean thermal) resources and hydrokinetic (river current) resources. P.L. 110-343 (Division B, §102) did expand the credit to cover those resources, establishing a 1.0 cent/kwh credit with a three-year eligibility window.

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.⁷⁸ Landfill gas, geothermal, and biomass were also projected to experience some capacity expansion. EIA estimated a 7-fold increase for wind, a 50% increase for biomass, and a 20% increase for geothermal facilities.⁷⁹

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%.⁸⁰ The Joint Committee on Taxation has estimated that the one-

⁷⁶ 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 Tax Credit (PTC) Supports State RPS Policies."

⁷⁷ Senate Finance Committee, *Clean Energy*, Testimony of Ryan Wisser, p. 7-9.

⁷⁸ 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.

⁷⁹ House Ways and Means Committee, *Tax Credits for Renewables*, EIA Testimony, p. 10.

⁸⁰ Senate Finance Committee, *Clean Energy*, Testimony of Ryan Wisser, p. 8-10.

year⁸¹ extension of the wind credit's placed-in-service deadline in P.L. 110-343 would reduce tax revenue to the U.S. Treasury by about \$5.8 billion over the 10-year duration of credit claims.⁸²

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.⁸³

Debate Over PTC Extension

Because the PTC was set to expire at the end of 2008, proposals to extend it began early in the first session of the 110th Congress. **Table 2** shows that several proposals—with different time periods—were considered. Although PTC cost was a concern, growing higher in relation to the time period, the debate focused mainly on House paygo requirements that drew Administration veto threats. The House consistently proposed that the cost of the incentives be fully offset. Proposed offsets stressed reduced tax subsidies for oil and natural gas, which the Administration found unacceptable.⁸⁴ In the first session, H.R. 2776 proposed a four-year extension that was incorporated into H.R. 3221 and, later, into a House-passed version of H.R. 6.⁸⁵ The Senate was unable to pass any tax incentive package in the first session, and the Energy Independence and Security Act of 2007 (P.L. 110-140) was enacted without tax provisions. In the second session, the key bills were H.R. 5351, H.R. 6049, and H.R. 1424.⁸⁶

⁸¹ The law provides a two-year extension for production from most other sources and sets a three-year eligibility window for production from marine and hydrokinetic sources.

⁸² Joint Committee on Taxation. *Estimated Budget Effects of the Tax Provisions Contained in an Amendment in the Nature of a Substitute to H.R. 1424, Scheduled for Consideration on the Senate Floor on October 1, 2008*. October 1, 2008. <http://www.house.gov/jct/x-78-08.pdf>.

⁸³ Senate Finance Committee, *Clean Energy*, Testimony of Todd Raba of MidAmerican Energy Company, p. 3.

⁸⁴ 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.

⁸⁵ In Senate floor action on an 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).

⁸⁶ Action is discussed in CRS Report RL34294, *Energy Independence and Security Act of 2007: A Summary of Major Provisions*, by Fred Sissine (1st session) and in CRS Report RL33831, *Energy Efficiency and Renewable Energy Legislation in the 110th Congress*, by Fred Sissine, Lynn J. Cunningham, and Mark Gurevitz (2nd session).

Table 2. Selected Wind Production Tax Credit (PTC) Extension Proposals

Bill	House		Senate	
	Extension Period	Final Action	Extension Period	Final Action
First Session				
H.R. 6	4 years (§1501)	adopted (235-181)	2 years (S.Amdt. 3841)	cloture motion defeated (59-40)
Second Session				
H.R. 5351	3 years	adopted (236-182)	—	no action
H.R. 6049	1 year	adopted (263-160)	1 year	adopted (93-2)
P.L. 110-343 (H.R. 1424)	1 year	adopted (263-171)	1 year	adopted (74-25)

Proponents of extending the credit past 2008 argued 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 CO₂ than conventional energy equipment. Also, they contended that it helps “level the playing field,” noting that there is an even longer history of federal subsidies for conventional energy.⁸⁷ For example, they point to the permanent depletion allowance for oil and natural gas that has been in place for many decades.⁸⁸

Opponents of extending the PTC beyond the end of 2008 argued that generally there are no market failures that warrant special tax subsidies for particular types of renewable energy technologies. They argued 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 contended 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 was 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.⁸⁹

At a Senate hearing in February 2007, Energy Secretary Bodman testified that the Administration was unlikely to support a five-year or 10-year PTC extension because it would not be consistent with free markets.⁹⁰ Consistent with that stance, the Administration’s FY2008 budget request did

⁸⁷ 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.

⁸⁸ 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.

⁸⁹ 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.

⁹⁰ U.S. Congress. Senate. Committee on Energy and Natural Resources. *Proposed Budget for FY 2008 for the* (continued...)

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 proposed the creation 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) also allowed for support of 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.⁹¹ 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 2007.⁹² The Tax Relief Act of 2006 (P.L. 109-432, §206) extended the credit through the end of 2008.

The Emergency Economic Stabilization Act of 2008 (P.L. 110-343, Div. B, §106) extends the residential solar tax credit at the 30% level for eight years, through the end of 2016. Further, the annual cap on the credit is increased from \$2,000 to \$4,000. Also, residential wind equipment and ground source heat pumps are eligible for a 30% credit.

Business Credit

The Energy Tax Act also established a 10% business investment tax credit for solar, wind, geothermal, and ocean energy equipment.⁹³ 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 2007.⁹⁴ The Tax Relief Act of 2006 extended the 30% rate through the end of 2008. Without an extension, the credit would have dropped back to 10% after 2008.

P.L. 110-343 (Div. B, §103) extends the business solar tax credit at the 30% level for eight years, through the end of 2016.⁹⁵ Further, the credit would be allowed to offset the alternative minimum tax. Also, public utilities would become eligible for the credit.

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Department of Energy. Hearing held February 7, 2007. http://energy.senate.gov/public/index.cfm?FuseAction=Hearings.Hearing&Hearing_ID=1601.

⁹¹ 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.

⁹² Joint Tax Committee, *Description of H.R. 6*, p. 49.

⁹³ 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.

⁹⁴ Joint Tax Committee, *Description of H.R. 6*, p. 52-53.

⁹⁵ 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 (continued...)

The debate over extending these credits was similar to that for the PTC. Opponents argued that subsidies distort the operation of the free market. They also contended that the most effective policy is to impose a tax on energy equipment that causes pollution. The solar industry has testified that the business ITC is the most important tax incentive for solar equipment. Proponents of the credit counter-argued that the credits correct a market failure and help establish equality with subsidies that exist for conventional energy equipment. They also asserted that the subsidy-induced increase in demand helps manufacturers establish economies of scale that will broaden the use of solar equipment and make it more competitive in the long term.

Other Business Tax Credits

P.L. 110-343 established other new business tax incentives. Division B (§104) establishes a 30% credit (capped at \$4,000) over an eight-year period (end of 2016) for wind machines with a capacity of 100 kilowatts or less. Also, the permanent 10% credit is expanded to include geothermal (ground source) heat pumps (§105).⁹⁶

Clean Renewable Energy (Tax Credit) Bonds

Non-profit electric utilities provide about 25% of the nation's electricity.⁹⁷ 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.⁹⁸ 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.⁹⁹

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.¹⁰⁰ 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.¹⁰¹ EPACT authorized

(...continued)

years.

⁹⁶ Additional energy-efficient equipment was made eligible for the 10% credit. For more details, see the online databases at <http://www.energytaxincentives.org/> and at <http://www.dsireusa.org/>.

⁹⁷ These non-profit organizations include public power utilities, cooperative electric utilities, and federally owned power utilities.

⁹⁸ 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¤tpageid=1&ee=0&re=1.

⁹⁹ 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/repicfm>.

¹⁰⁰ 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).

¹⁰¹ 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, (continued...)

\$800 million in CREBs for 2006 and 2007.¹⁰² In late 2006, the Internal Revenue Service (IRS) reported requests totaling \$2.6 billion in bond authority.¹⁰³ The Tax Relief Act of 2006 (§202) authorized a second round of CREBs through the end of 2008, adding \$400 million more in total bond authority.¹⁰⁴

P.L. 110-343 (Div. B, §107) established a new category of CREBs (New CREBs) for state/local/tribal governments, public power providers (utilities), and cooperative electric companies.¹⁰⁵ The “New CREBs” differ from the previously issued CREBs in four aspects. First, issuers of New CREBs will 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 will be lower, set at 70% of the previous rate for CREBs.¹⁰⁶ Third, taxpayers can carry forward unused credits into future years. Fourth, the tax credit benefits can be separated from bond ownership.¹⁰⁷

A national limit of \$800 million was set for New CREBs, of which one-third will be available for state, local and tribal governments; one-third for public power providers; and one-third for cooperative electric companies. The revenue drain on the U.S. Treasury is estimated at a total of \$267 million over the period from 2009 through 2018.¹⁰⁸ The Administration repeatedly stated its opposition to the New CREBs that the House approved in the first session (H.R. 3221 and the House version of H.R. 6) and in the second session (H.R. 5351 and H.R. 6049).¹⁰⁹ For example, 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.”¹¹⁰ 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.¹¹¹

(...continued)

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>.

¹⁰² This included \$500 million for governmental borrowers.

¹⁰³ DOE’s description of the requests and \$800 million IRS allocation is provided at http://apps1.eere.energy.gov/news/news_detail.cfm/news_id=10423.

¹⁰⁴ DOE’s description of the requests and \$400 million IRS allocation is provided at http://apps1.eere.energy.gov/news/news_detail.cfm/news_id=11575.

¹⁰⁵ 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 was defeated on a cloture vote and it was not further considered.

¹⁰⁶ 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.

¹⁰⁷ H.Rept. 110-214. *Renewable Energy and Energy Conservation Tax Act of 2007*. June 27, 2007. p. 40.

¹⁰⁸ 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>.

¹⁰⁹ 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>.

¹¹⁰ 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

¹¹¹ U.S. Congress. House. Committee on Ways and Means. *Renewable Energy and Energy Conservation Tax Act of 2007*. (H.Rept. 110-214) p. 39.

Table 3. Clean Renewable Energy Bonds History

Public Law	Bond Authorization	Requests for Bond Authority	Allocation Date
P.L. 109-58 (§1303)	\$800 million	\$2.6 billion	Nov. 20, 2006
P.L. 109-432 (§202)	\$400 million	\$898 million	Feb. 8, 2008
P.L. 110-343 (Div. B, §107)	\$800 million	—	—

Revenue Offsets Debate

The Emergency Economic Stabilization Act (P.L. 110-343, Div. B, Title III) requires nearly \$17.0 billion in revenue offsets, primarily to support incentives for renewables (Title I) and efficiency (Title II).¹¹² Debate over the revenue offset provisions in H.R. 1424 directly paralleled the House and Senate floor debates over similar proposals in other key bills during the first session (H.R. 3221 and H.R. 6) and second session (H.R. 5351 and H.R. 6049). 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 and Action

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 28 states have established an RPS, with most targets ranging from 10% to 20% and most target deadlines ranging from 2010 to 2025.¹¹³ 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.

¹¹² H.R. 5351 also includes \$1.83 billion for “New York Liberty Zone” tax credits for 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.

¹¹³ The Federal Energy Regulatory Commission (FERC) posts a tally of state RPS action that is updated regularly. <http://www.ferc.gov/market-oversight/mkt-electric/overview/elec-ovr-rps.pdf>.

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.¹¹⁴

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.¹¹⁵ Otherwise, federal agency involvement with state RPS programs has primarily involved support for planning and analysis.¹¹⁶

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.

¹¹⁴ 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 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.”

¹¹⁵ 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>.

¹¹⁶ 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.”

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. 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 and Security Act (P.L. 110-140) did not contain an RPS. (For more details see CRS Report RL34116, *Renewable Energy Portfolio Standard (RPS): Background and Debate Over a National Requirement*, by Fred Sissine.)

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.¹¹⁷ MMS released its Draft Environmental Impact Statement in January 2008.¹¹⁸ The study found that environmental, fishery, and marine transportation impacts would range from negligible to minor. On-shore visual impacts would be

¹¹⁷ Cape Wind has posted its draft EIS at <http://www.capewind.org/article137.htm>.

¹¹⁸ 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>.

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.

There is also a concern that tall wind turbines create false radar signals that may disrupt civilian and military radar equipment.¹¹⁹ 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 2006,¹²⁰ 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 and Security Act (P.L. 110-140).

Marine (Tidal, Wave, and Ocean) Energy and Hydrokinetic (River Current) 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.¹²¹

The 110th Congress,¹²² took two major actions to promote marine and hydrokinetic power technologies. First, the Energy Independence and Security 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 is required. Further, DOE is

¹¹⁹ More information on this issue is available on DOE's website at http://www.eere.energy.gov/windandhydro/windpoweringamerica/ne_issues_interference.asp.

¹²⁰ The report is available at <http://www.defenselink.mil/pubs/pdfs/WindFarmReport.pdf>.

¹²¹ For more information, see CRS Report RL33883, *Issues Affecting Tidal, Wave, and In-Stream Generation Projects*, by Nic Lane.

¹²² 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.

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 Continuing Appropriations Act (P.L. 110-329) provides funding through March 9, 2009, at the same level as FY2008.

Second, P.L. 110-343 (Div. B, §102) expanded the renewable energy electricity production tax credit to include production from marine and hydrokinetic sources. The credit is set at 1 cent/kwh for the 2008 tax year. The window of eligibility will be open for three years, through the end of 2011.

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.¹²³ 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.¹²⁴ National ethanol production was estimated at 6.48 billion gallons in 2007.¹²⁵ However, due to ethanol's lower heat content,¹²⁶ this is equivalent to about 4.34 billion gallons of gasoline, or about 285,000 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

¹²³ 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.

¹²⁴ For more information about ethanol developments and issues, see CRS Report RL33564, *Alternative Fuels and Advanced Technology Vehicles: Issues in Congress*, by Brent D. Yacobucci, and CRS Report RL33290, *Fuel Ethanol: Background and Public Policy Issues*, by Brent D. Yacobucci.

¹²⁵ DOE. *U.S. Ethanol Production Totaled 6.48 Billion Gallons in 2007*. March 12, 2008. <http://www.ethanolrfa.org/industry/statistics/>, http://apps1.eere.energy.gov/news/news_detail.cfm/news_id=11633.

¹²⁶ 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.

raised concerns that further acceleration of ethanol production may pose more challenges, including the development of pipeline capacity and the potential for more food price increases.¹²⁷

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.¹²⁸ 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 2012.¹²⁹ 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.¹³⁰

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

¹²⁷ For more information on renewable energy initiatives in the 2008 farm bill proposals, see CRS Report RL34130, *Renewable Energy Policy in the 2008 Farm Bill*, by Tom Capehart.

¹²⁸ For more information about using cellulosic biomass for ethanol production, see CRS Report RL32712, *Agriculture-Based Renewable Energy Production*, by Randy Schnepf.

¹²⁹ 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.

¹³⁰ 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.

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.¹³¹ Both leaders of the Committee, the Chairman¹³² and the Ranking Member,¹³³ 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 Tom Capehart.)

Potential to Reduce Oil Imports

Table 7 shows baseline EIA data for U.S. oil use and Persian Gulf Imports in 2006 and EIA projections for selected future years through 2030.¹³⁴ The table also shows ethanol production estimates for the current RFS of 36 billion gallons by 2022.¹³⁵ At its peak in 2022, the current RFS would displace an estimated 1.57 million barrels per day (mbd), or about 59% of projected Persian Gulf imports for that year.

Biofuels Funding and Tax Issues

Biofuels Technology Funding Initiative

The Bush Administration's Biofuels Initiative, part of the Advanced Energy Initiative (AEI), was designed to increase funding for cellulosic ethanol development with the goal of accelerating its commercial use.¹³⁶ 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.¹³⁷ The research

¹³¹ 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.

¹³² 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.

¹³³ 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.

¹³⁴ To facilitate comparison, all figures in the table are shown in terms of millions of barrels per day, mbd.

¹³⁵ 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 7** 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.

¹³⁶ 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>.

¹³⁷ 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 (continued...)

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.¹³⁸

As **Table 4** shows, DOE's FY2009 budget request would have provided \$225.0 million for DOE's Biomass Program that supports the Biofuels Initiative and the RFS goals. This would have been a \$26.8 million increase from the \$198.2 million appropriated for FY2008. However, the Consolidated Security, Disaster Assistance, and Continuing Appropriations Act (P.L. 110-329) continues FY2009 funding at the FY2008 level through March 6, 2009. It does not provide for a funding increase.

Tax Incentives Provided in P.L. 110-343 (Division B)¹³⁹

The law has four key tax incentive provisions for biofuels. Section 201 makes a 50% tax deduction available for the cost of building facilities that produce cellulosic biofuels, with the incentive available for four years (end of 2012). Section 202 extends for one year (end of 2009) the \$1.00 per gallon production credit for biodiesel and the 10 cents per gallon credit for small biodiesel producers. Also, it extends the \$1.00 per gallon production credit for biomass-derived diesel fuel.¹⁴⁰ Section 207 extends the alternative refueling stations credit for one year, through the end of 2009. The credit value is set at 30%, with a cap at \$30,000. Section 203 clarifies that the production incentives in sections 201, 202, and 207 are available only for fuels produced in the United States.

Climate Change

This section discusses the potential for renewable energy to reduce carbon dioxide (CO₂) emissions by displacing fossil fuel use.

CO₂ Emissions Reduction Estimates

In most cases renewable energy appears to release less carbon dioxide (CO₂) than fossil fuels.¹⁴¹ 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.

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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.

¹³⁸ DOE, *Factsheet on a Scientific Roadmap for Cellulosic Ethanol*, p. 2.

¹³⁹ A summary of the provisions is available on the Senate Finance Committee website at <http://finance.senate.gov/sitepages/leg/LEG%202008/100208%20Economic%20Stabilization%20Summary.pdf>.

¹⁴⁰ Section 202 eliminates a previous gap in the credit for biodiesel and agri-biodiesel and it broadens the range of eligible processes that can be used to produce renewable diesel fuel.

¹⁴¹ 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 CO₂ emission reductions. Wind and solar energy have zero CO₂ 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 CO₂ 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.

The potential percentage of renewable energy substitution can depend on many factors, including energy prices, energy demand growth,¹⁴² technology cost, and market penetration. As renewable energy production displaces fossil fuel use, it would also reduce CO₂ emissions in direct proportion, except perhaps for biofuels and biopower.¹⁴³

In general, the combustion of biomass for fuel and power production releases CO₂ at an intensity that may be close to that for natural gas. However, the re-growth of biomass material, which absorbs CO₂, 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 CO₂ release unless fertilizer is used, and any fossil fuel displacement, including decreased natural gas use, would tend to reduce CO₂ emissions.

Support for Renewables to Curb CO₂

Since 1988, the federal government has initiated programs to support renewable energy as a CO₂ 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 CO₂. 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.¹⁴⁴ These programs are funded in large part by a surcharge on electricity use, often identified as a public goods charge.¹⁴⁵ 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.¹⁴⁶ Many local governments have also undertaken climate programs that include renewables as a component.¹⁴⁷

Climate Security Act (S. 3036)

The proposed Lieberman-Warner Climate Security Act (S. 3036) was introduced during the second session.¹⁴⁸ It would have established a cap-and-trade system to reduce greenhouse gas

¹⁴² The use of energy efficiency measures can have a significant effect on energy prices and demand growth.

¹⁴³ Non-biomass renewables also tend to reduce emissions of other air-borne pollutants that cause urban smog, acid rain, and water pollution.

¹⁴⁴ 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/>.

¹⁴⁵ The Database of State Incentives for Renewable Energy (DSIRE) has information about virtually all state renewable energy programs at <http://www.dsireusa.org/>.

¹⁴⁶ For more information see CRS Report RL33812, *Climate Change: Action by States To Address Greenhouse Gas Emissions*, by Jonathan L. Ramseur.

¹⁴⁷ 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>.

¹⁴⁸ S. 3036 was introduced to replace S. 2191. An attempt to take up S. 3036 failed on a cloture vote. Additional description of the renewable energy provisions and the Senate floor process is provided in CRS Report RL33831, *Energy Efficiency and Renewable Energy Legislation in the 110th Congress*, by Fred Sissine, Lynn J. Cunningham, and (continued...)

emissions. The bill contained several provisions for energy efficiency and renewable energy. Revenue from the auctioned allowances could be used for multiple purposes, including accelerated deployment of renewable energy, energy efficiency, and other new energy technologies. Each year, nearly 40% of the revenue from auctions would go to efficiency and renewables. Compared with S. 3036, the proposed Boxer substitute to the bill would have established an even broader array of incentives for the deployment of energy efficiency and renewable energy measures. Eight of the 17 titles in the substitute contained such measures, including grants, worker training, incentives to facility developers, and leverage for private financing to support international partnerships.

Legislation

Major Laws Enacted in the First Session

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*, by Carl E. Behrens et al.)

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

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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*, by Fred Sissine).

Major Laws Enacted in Second Session

Farm Bill (P.L. 110-246) Provisions

The enacted version of the farm bill (H.R. 6124; “Food, Conservation, and Energy Act of 2008”) became law on June 18, 2008.¹⁴⁹ The law contains provisions that extend and/or expand upon renewable energy (and energy efficiency) provisions of the Farm Security Act of 2002 (P.L. 107-171). Several programs for grants, loans, and tax incentives were put in place to support renewable energy (and/or energy efficiency). (For more details, see CRS Report RL34130, *Renewable Energy Policy in the 2008 Farm Bill*, by Tom Capehart.)

FY2009 Appropriations (P.L. 110-329)

As **Table 4** shows, DOE’s FY2009 budget request sought \$1.255 billion for DOE’s Energy Efficiency and Renewable Energy (EERE) programs. P.L. 110-329 (H.R. 2638) provides continuing appropriations through March 6, 2009, at the FY2008 level. The law provides an additional \$250 million to the DOE Weatherization Assistance Program and provides \$7.5 billion for a \$25 billion loan to help U.S. automakers retool facilities to produce advanced technology energy-efficient vehicles. The law covers appropriations through March 6, 2009.

Emergency Economic Stabilization Act (P.L. 110-343)

Division B of the Emergency Economic Stabilization Act (P.L. 110-343) contains the text of the Senate-passed version of H.R. 6049, which provides several tax incentives for efficiency and renewables. The Senate crafted its substitute to H.R. 6049 as a response to the House-passed version of the bill and to Administration-expressed concerns about House provisions for renewable energy bonds and revenue offsets. The highlights of key provisions enacted into law are as follows:

- *Renewable Electricity Production Tax Credit (PTC)*. The credit for wind farms is extended for one year, through the end of 2009. Other equipment are eligible for two years, through 2010. Newly eligible marine technologies are eligible for three years, through 2011.
- *Solar Investment Tax Credits (ITC) for Residential and Commercial Sectors*. The law extends the existing 30% credit for each sector for eight years, through the end of 2016.

¹⁴⁹ The House and Senate overrode an Administration veto to enact the Food, Conservation, and Energy Act of 2008 (P.L. 110-234, H.R. 2419) on May 22, 2008. Due to a technical error that left one title out of the copy vetoed by the President, a second identical bill, H.R. 6124 was passed by both chambers. Upon the President’s veto of H.R. 6124, the House overrode the veto by a vote of 317 to 109 and the Senate overrode the veto by a vote of 80 to 14. H.R. 6124 was enacted as P.L. 110-246.

- *Clean Renewable Energy Bonds (CREBs)*. The law authorizes a new round of state and local bond issuances, with a total national value of \$800 million.
- *Energy Conservation Bonds*. The law authorizes a new state and local program, with a total national value of \$800 million.
- *Revenue Offsets*. The cost of incentives are offset by a freeze in certain oil and natural gas deductions, a reduced foreign tax credit for certain foreign oil and gas income, reduced deductions for certain securities transactions, a change in the Federal Unemployment Tax Act (FUTA) surtax, and an increase of the Oil Spill Liability Trust Fund tax.

Other Laws and Bills

In the 110th Congress, more than 460 bills with provisions for energy efficiency or renewable energy were 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*, by Fred Sissine, Lynn J. Cunningham, and Mark Gurevitz. 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 4. DOE Renewable Energy Budget for FY2006-FY2009

(selected programs, \$ millions)

Program	FY2006	FY2007	FY2008	FY2009 Request	FY2009 House	FY2009 Senate
Biomass & Biorefinery Systems	\$89.8	\$199.7	\$198.2	\$225.0	\$250.0	\$235.0
—Cellulosic Ethanol Auction	10.4	0.0	5.0	0.0	—	—
Solar Energy Technology	81.8	157.0	168.5	156.1	220.0	229.0
—Photovoltaics	58.8	138.4	136.7	137.1	—	156.8
—Concentrating Solar	7.3	15.7	29.7	19.0	—	50.0
—Solar Heating & Lighting	1.4	3.0	2.0	0.0	—	22.2
Wind Energy Technology	38.3	48.7	49.5	52.5	53.0	62.5
Geothermal Technology	22.8	5.0	19.8	30.0	50.0	30.0
Water/Marine Technology	0.5	0.0	9.9	3.0	40.0	30.0
Subtotal, Renew. Technologies	233.2	407.0	445.9	466.6	613.0	586.5
International Renewables	3.9	9.5	0.0	0.0	7.0	0.0
Tribal Energy	4.0	4.0	5.9	1.0	6.0	6.0
Renewables Prod'n Incentive	5.0	4.9	5.0	0.0	5.0	5.0
Asia Pacific Partner. (Renew.)	0.0	—	0.0	7.5	0.0	0.0
Subtotal, Renew. Deployment	12.9	18.4	10.9	8.5	18.0	11.0
Subtotal, Renewables	246.1	425.4	456.8	475.1	631.0	597.5
Hydrogen Technologies	153.5	189.5	211.1	146.2	170.0	175.0
Vehicle Technologies	178.4	183.6	213.0	221.1	317.5	293.0

Program	FY2006	FY2007	FY2008	FY2009 Request	FY2009 House	FY2009 Senate
Building Technologies	68.2	103.0	109.0	123.8	168.0	176.5
Industrial Technologies	55.9	55.8	64.4	62.1	100.0	65.1
Federal Energy Management	19.0	19.5	19.8	22.0	30.0	22.0
Subtotal, Efficiency R&D	475.0	551.4	617.3	575.2	785.5	731.6
Facilities (Nat. Renew. Lab)	26.1	107.0	76.2	14.0	33.0	37.0
Program Management	115.2	110.2	114.9	141.8	147.6	136.8
—Weatherization/State Grants	278.7	263.5	271.3	50.0	300.0	251.2
—Renewables Deployment	12.9	18.4	10.9	8.5	18.0	11.0
—Cong.-Directed Assistance ^a	—	0.0	186.7	0.0	134.7	124.2
—Prior Year Balances	—	—	-0.7	-0.7	-0.7	0.0
Federal Assistance Subtotal	316.9	281.7	468.1	57.8	452.0	386.4
Total Appropriation, EE & RE	1,166.1	1,457.2	1,722.4	1,255.4	2,531.1	1,928.3
Office of Electricity Delivery & Energy Reliability (OE) ^b	158.2	134.4	138.6	134.0	149.3	166.9

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*, by Carl E. Behrens et al.

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

Table 5. Production Tax Credit Value and Duration by Resource

Energy Resource	Credit Amount for 2008 (cents/kwh)	Credit Period for Facilities Placed in Service after August 8, 2005 (years)
Wind	2.1	10
Closed-Loop Biomass	2.1	10
Open-Loop Biomass (includes agricultural livestock waste nutrient facilities)	1.0	10
Geothermal	2.1	10
Solar (pre-2006 facilities only)	2.1	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. Technical Explanation of H.R. 7060, The "Renewable Energy and Job Creation Tax Act of 2008," a Schedule for Consideration by the House of Representatives on September 25, 2008." (JCX-75-08) September 25, 2008. p. 7. <http://www.house.gov/jct/x-75-08.pdf>.

Table 6. Production Tax Credit Claims, History and Projections

(\$ millions)

Year	Public Law	Credit Lapse (months)	PTC Claims (\$ current)	Deflator (\$ 2007)	PTC Claims (\$ 2007)	Number of States with RPS
History						
1995	P.L. 102-486		3.2	0.7711	4.2	2
1996	P.L. 102-486		9.3	0.7859	11.9	3
1997	P.L. 102-486		9.4	0.7996	11.7	6
1998	P.L. 102-486		13.9	0.8093	17.2	9
1999	P.L. 102-486, P.L. 106-170	6 months	28.9	0.8199	35.3	11
2000	P.L. 106-170		50.1	0.8365	59.9	12
2001	P.L. 106-170		70.6	0.8562	82.5	12
2002	P.L. 107-147	2 months	131.6	0.8726	150.8	13
2003	P.L. 107-147		142.8	0.8903	160.4	13
2004	P.L. 108-311	9 months	207.3	0.9134	227.0	18
2005	P.L. 108-311		333.2	0.9427	353.5	21
Total, History			1,000.40		1,114.3	
JCT Future Estimates						
2006	P.L. 109-58		900	0.9739	924	23
2007	P.L. 109-58		900	1.0000	900	24
2008	P.L. 109-432		1,000	1.0193	981	28
2009			1,600	1.0399	1,539	
2010			1,200	1.0606	1,131	
Total, Future Estimates			5,600		5,475	

Source: Historical data on PTC claims for 1995 through 2005 were obtained from Mr. Curtis Carlson, Office of Tax Analysis, Department of the Treasury. 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. 109-58, P.L. 109-432, and P.L. 110-343.

Table 7. 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	20.66	2.59	0.17	0.17	6.6%	6.6%
2006 Actual	20.45	2.67	0.24	0.24	9.0%	9.0%
2007	20.52	2.72	0.20	0.20	7.4%	7.4%
2008	20.57	2.76	0.24	0.37	8.7%	13.4%
2009	20.40	2.57	0.27	0.46	10.5%	17.9%
2010	20.66	2.63	0.30	0.52	11.4%	19.8%
2011	20.87	2.69	0.32	0.55	11.9%	20.4%
2012	21.04	2.75	0.33	0.57	12.0%	20.7%
2017	21.30	2.70	—	0.91	—	33.7%
2022	20.83	2.65	—	1.57	—	59.2%

Sources: For Total Oil Use and Persian Gulf Imports, see EIA, Energy Information Administration. *Annual Energy Outlook 2008*. Oil use data were obtained from Supplemental Table 10. Those data were converted with the equivalence that one quad per year is approximately equal to 0.5106 million barrels per day, from EIA Monthly Energy Review, December 2006, Table A3: Approximate Heat Content of Petroleum Consumption. Persian Gulf oil import data were obtained from Supplemental Table 117. 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.

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