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# CRS Report for Congress

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

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

## 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. Both the House-passed (H.R. 2641) and Senate Appropriations Committee-approved (S. 1751) energy and water development appropriations bills for FY2008 would provide a major increase over the Administration's request for the Department of Energy's renewable energy program. The Administration has indicated that it intends to veto the appropriations bills due to the increases and the lack of funding for the Asia Pacific Partnership.

Tax and regulatory 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 major House-passed energy bill (H.R. 3221) would extend the PTC for four years past its scheduled expiration at the end of 2008, and it would establish a national RPS with a target of 15% by 2020. Further, it would establish $2 billion in a new category of clean renewable energy (tax credit) bonds, extend for eight years the 30% level for the commercial solar tax credit, and remove the dollar cap on the residential solar tax credit. Also, H.R. 3221 would establish $15.3 billion in revenue offsets from oil and natural gas provisions to support tax incentives for renewable energy and energy efficiency. The major Senate-passed energy bill (H.R. 6) has no RPS or tax provisions.

The ethanol fuel issue has intensified. Corn ethanol production is rising rapidly, but appears to be causing food price increases. Concerns about rising food prices and apparent limits to the long-term potential for corn ethanol have brought a focus on cellulosic ethanol. Cellulosic sources avoid the limits on corn and appear to have much lower net $CO_2$ emissions, but they require an extensive and costly conversion process. The Senate-passed version of H.R. 6 would establish a modified renewable fuels standard (RFS) that starts at 8.5 billion gallons in 2008 and rises to 36 billion gallons in 2022. H.R. 3221 has no RFS provision.

Key challenges to the omnibus energy bills remain. First, there are significant differences between H.R. 3221 and H.R. 6. Second, because the House and Senate have passed different measures, further action would be required in at least one chamber before a conference committee could be arranged. Third, concerns about the oil and natural gas revenue offset provisions, and the lack of measures to increase oil and gas production have led the Administration to threaten to veto each bill. (The major provisions of these two bills are compared in CRS Report RL34135.)

## Contents

## List of Tables

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

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

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

## History and Background

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

### Fuels Production

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

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

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

## Electricity Production

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

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

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

[3] This is now the Government Accountability Office.

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

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

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

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

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

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

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

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

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

## Action in the 110th Congress

Economic and environmental concerns — namely energy security, international competitiveness, high energy prices, air pollution, and climate change — are now driving policy proposals to support renewable energy R&D and market deployment. In the 110th Congress, more than 100 bills have been introduced that would support renewable energy.[8] In particular, omnibus energy efficiency and renewable energy legislation (House-passed H.R. 3221 and Senate-passed H.R. 6) and appropriations bills (H.R. 2641, S. 1751) would greatly increase support for renewable energy.[9]

# Budget and Funding Issues

## EPACT Implementation

As part of the strategy to address energy security, climate change, and other national interests, the Energy Policy Act of 2005 (EPACT, P.L. 109-58) contains several provisions that authorized new programs and spending for renewable energy. Many of these 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] In August 2006,

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

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

[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 (continued...)

DOE issued guidelines for an initial $2 billion in loan guarantees, which would include biomass, solar, wind, and hydropower projects.[12] The FY2007 continuing appropriations bill (P.L. 110-5, H.J.Res. 20) increased the Loan Guarantee Program authority to $4 billion. It also provided $7 million for program operating costs, and required that DOE prepare a rulemaking to implement the program.[13] DOE's FY2008 budget request seeks $9 billion for program authority and $8.4 million for operating costs.[14] The requested authority includes $4 billion for biofuels projects and $1 billion for renewable energy power production projects.

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. 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. An additional concern was voiced that DOE's request for $9 billion in program authority is too small to achieve the environmental goals of the program.

The House approved $2.4 million for administrative costs of the Loan Guarantee Program in FY2008.[15] Also, it recommended that the 2008 loan authority be limited to $7 billion, including $4 billion for biofuels and other clean transportation fuels and $1 billion for electricity transmission and renewable energy power generation facilities. In contrast, the Senate Appropriations Committee recommended funding the full request for $8.4 million for administrative costs and proposed no limit on the amount of loan guarantees.[16] However, the Committee expressed concern that DOE's draft rulemaking proposes to limit the federal guarantee to 90% of the debt portion. The Committee found that to be inconsistent with EPACT, which it says calls for the federal government to guarantee up to 100% of the debt portion.

**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),

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[11] (...continued)
pollution control equipment.

[12] DOE. *Loan Guarantee Solicitation Announcement.* August 8, 2006. The solicitation included hydrogen, coal, electricity transmission, industrial energy efficiency, and other types of projects. [http://www.lgprogram.energy.gov/Solicitationfinal.pdf]

[13] DOE issued a proposed rule for the Loan Guarantee Program on May 16, 2007. [http://www.lgprogram.energy.gov/NOPR-fr-5-16-07.pdf]

[14] The Loan Guarantee Program funding request appears on pages 702-711 of volume 4 in the *DOE FY2008 Budget Request*. [http://www.mbe.doe.gov/budget/08budget/Content/Volumes/Vol_4_SC_DA.pdf]

[15] The House Appropriations Committee noted in its report (H.Rept. 110-185, p. 89) that P.L. 110-5 (H.J.Res. 20) had provided initial funds for the Loan Guarantee Program in FY2007, after the FY2008 DOE budget request had been submitted. DOE's *FY2007 Operating Plan* allocates $7 million from P.L. 110-5 for the program.

[16] S.Rept. 110-127, p. 148-149.

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.

## FY2008 DOE Budget

**Continuing Resolution for FY2008.** H.J.Res. 32, the continuing resolution for FY2008, was signed into law as P.L. 110-92 on September 29, 2007. It extends appropriations at the FY2007 level through November 16, 2007.

**Administration's Request.** In his 2006 State of the Union address, President Bush announced the launch of the American Competitiveness Initiative (ACI) to stimulate long-term economic growth. This would be achieved mainly by increased promotion of R&D and technological innovation. A key component of the ACI is the Advanced Energy Initiative (AEI), which DOE says "aims to reduce America's dependence on imported energy sources." AEI's Biofuels and Solar America initiatives are funded under renewable energy programs in DOE's Office of Energy Efficiency and Renewable Energy (EERE). The goals of the Solar America Initiative are to reduce the cost of photovoltaics (PV) technology, increase its deployment, and help reduce natural gas demand for electric power generation. The goal of the Biofuels Initiative is to develop transportation fuels, such as cellulosic ethanol, from agricultural waste products and energy crops such as wood chips, switchgrass, and plant stalks.

In the 2007 State of the Union address, the President reasserted the importance of "investing in new methods of producing ethanol" and set forth a goal to "reduce gasoline usage in the United States by 20% in the next ten years."[17] To reach this goal he called for an alternative fuels production target of 35 billion gallons by 2017. This target, he noted, is nearly five times the 7.5 billion gallon target in the Renewable Fuels Standard (RFS) set by EPACT.[18] In support of the 35 billion gallon goal, the FY2008 DOE budget request for renewable energy programs proposes funding for the Biofuels Initiative under the Biomass/Biorefineries Program.[19] The goal is to "help make cellulosic ethanol cost competitive by 2012 using a wide array

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[17] The White House. *State of the Union 2007*. p. 3. [http://www.whitehouse.gov/news/releases/2007/01/20070123-2.html]

[18] Because the President's statement specified "alternative fuels," not "renewable fuels," there is some speculation that the intent may be that the 35 billion gallon target would be met, in part, with non-renewable fuels.

[19] Relative to uncompleted action in the 109th Congress on FY2007 appropriations for EERE programs, the FY2008 DOE budget request sought significant increases for the Biofuels Initiative and other AEI initiatives. However, the final FY2007 EERE appropriations set by the 110th Congress in P.L. 110-5 were much higher than those proposed by the 109th Congress. The appropriations were also higher than the levels recommended by the FY2008 DOE budget request; and the request was released two weeks before the final EERE appropriations were set by P.L. 110-5.

of regionally available biomass resources." Also, the request seeks funding for the Solar America Initiative under the Solar Energy Program. This funding would "help accelerate the market competitiveness of solar electricity." It also aims to "lower the cost of energy from photovoltaic systems through manufacturing and efficiency improvements."[20]

As **Table 1** shows, the FY2008 DOE request includes $378.0 million for renewable energy programs,[21] which is $53.8 million, or 12%, less than the FY2007 appropriation (excluding inflation).[22] Except for the Asia-Pacific Partnership, the request proposes no increases relative to the FY2007 appropriation. Key technology program decreases include Biomass (-$20.4 million), Solar Energy (-$11.1 million), and Wind Energy (-$9.3 million).[23] Also, the request would terminate International Renewables (-$9.5 million), and Geothermal Technology (-$5.0 million).

**Congressional Hearings.** At House and Senate hearings on the FY2008 DOE budget request, Energy Secretary Bodman testified that the funding request for AEI will continue to "support clean energy technology breakthroughs that will help improve our energy security through diversification and could help to reduce our dependence on foreign oil."[24] In support of the requested increase for the Biofuels Initiative, the Secretary said that biomass is "a promising renewable option for producing liquid transportation fuels in the near term." Also, he stated that the proposed increase for the Solar America Initiative is focused on the goal of "achieving cost competitiveness for photovoltaic (PV) solar electricity by 2015," through an emphasis on "public-private partnerships with industry, universities, national laboratories, states, and/or other government entities." At the hearings, concerns were raised about DOE's proposed elimination of funding for the Geothermal and Small Hydropower programs.

**House Action (H.R. 2641).** The House recommended a much higher funding level for the DOE Renewable Energy Program than the Administration's request. In the Energy and Water Development Appropriations Bill for FY2008 (H.R. 2641),[25]

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[20] The White House. Office of Management and Budget. *Budget of the United States Government, Fiscal Year 2008 — Appendix*. (Department of Energy) p. 362. [http://www.whitehouse.gov/omb/budget/fy2008/pdf/appendix/doe.pdf]

[21] Note that the FY2007 appropriation includes a major one-time outlay for facilities construction and expansion at the National Renewable Energy Laboratory (NREL). This expense is not an annual one.

[22] The DOE FY2008 budget document is online at [http://www.mbe.doe.gov/budget/08budget/Content/Volumes/Vol_3_ES_New.pdf].

[23] The request also shows a decrease of $100 million for construction of facilities at the National Renewable Energy Laboratory. Because this funding line does not support work on a specific technology program, it was not included in the total funding for technology programs.

[24] His Senate testimony is at [http://energy.senate.gov/public/_files/BodmanTestimony.pdf].

[25] For more details on this bill see CRS Report RL34009, *Energy and Water Development: FY2008 Appropriations.*

the House approved $593.7 million for DOE's Renewable Energy Program.[26] This would be $215.7 million, or 57%, more than the request. Compared with the request, key increases for renewable energy R&D include Biomass/Biofuels ($70.7 million), Solar Energy ($51.7 million), Geothermal Energy ($44.3 million), and Hydro/Marine Energy ($22.0 million).[27] Using an authorization from EPACT (§931[a][2][e]), the House approved $6 million under the Hydropower account to create a new R&D focus on hardware for ocean, tidal, and in-stream-based electricity generation. This equipment is sometimes referred to collectively as "hydrokinetic" or "marine" energy technologies.

**Senate Action (S. 1751).** The Senate Appropriations Committee also recommended a much higher funding level than the Administration's request. In its version of the Energy and Water Development Appropriations Bill for FY2008 (S. 1751), the Committee approved $528.5 million for DOE's Renewable Energy Program — $150.5 million, or 40%, more than the request.[28] Compared with the request, key increases for R&D programs include Biomass/Biofuels ($70.7 million), Solar Energy ($51.7 million), Geothermal Energy ($44.3 million), and Hydro/Marine Energy ($22.0 million).[29] Under Hydropower, the Committee recommended $8 million for a new program focused on marine energy technologies. The Committee's report (S.Rept. 110-127) directs DOE to study and report on increasing ethanol blends to 25%, the National Biofuels Action Plan, reverse auction for cellulosic biofuels grants, and improving vehicles to use E-85 (85% ethanol) fuel.

# Tax Credit Issues

## Renewable Energy Electricity Production Tax Credit (PTC)

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

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[26] For details of the House recommendation, see H.Rept. 110-185, p. 59-65.

[27] The National Renewable Energy Laboratory (NREL) is the premier national lab for solar energy R&D and has major programs in hydrogen, biomass/biofuels, wind energy, and vehicles. The large increase recommended for the Facilities Construction program includes $8 million for solar R&D equipment, $13 million for infrastructure to test plug-in hybrid vehicles, $77 million for NREL's distributed energy systems integration facility, and $91 million to design and build a facility for biological and chemical research.

[28] For details about the Senate recommendation, see S.Rept. 110-127, p. 125-134.

[29] Compared with the House levels, the Committee recommends somewhat lower amounts for some R&D programs, including Solar Energy (-$20.0 million), Geothermal Energy (-$19.3 million), and Hydro/Ocean Energy (-$12.0 million). Also, International Renewables would be terminated (-$10.0 million).

is qualified, a taxpayer may claim the credit annually over a 10-year period that commences on the facility's placed-in-service date.[30]

**Background and History.** The PTC was established by federal law (P.L. 102-486) in 1992.[31] The credit was originally set at 1.5 cents/kwh and is adjusted annually for the previous year's inflation rate.[32] Since 1992, it has expired and been reinstated three times, and it has been extended two other times.[33] In August 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.[34] Also, the credit was expanded to include incremental hydropower and to increase the credit duration to 10 years for open-loop biomass, geothermal, solar, small irrigation power, and municipal solid waste. The Tax Relief Act of 2006 (P.L. 109-432, §201) extended the PTC for one additional year, through the end of 2008.

**Current Status.** In 2007, the credit stood at 2.0 cents/kwh for claims against 2006 taxes. To illustrate the credit's significance, this 2.0 cents/kwh represented about one-third of wind production costs in 2006. As **Table 2** 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.[35]

**Revenue Effects.** Claims for the PTC were less than $1 million in 1993 and 1994. **Table 3** shows that credit claims started growing more rapidly in 1995 and increased sharply, though erratically, from 1999 through 2004. Wind farm developments accounted for more than 90% of the dollar value of PTC claims through 2004.[36] Assuming the credit's availability for new projects ends as scheduled in 2008, the table shows that the claims for 2005 through 2010 are estimated to increase substantially (in current year dollars) relative to past levels.

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[30] 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]

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

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

[33] The most recent expiration occurred during 2004.

[34] 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].

[35] 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]

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

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

***Impact of Boom-Bust Cycle on Wind Energy Industry.*** Coupled with rising energy costs, R&D advances, and a variety of state policies, the PTC has stimulated significant growth in wind capacity over the past 10 years.[37] 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.[38] 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.[39]

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.[40]

The American Wind Energy Association has recently noted that the cycle of decline in wind industry activity actually starts about 8 months before a PTC expiration date.[41] Representatives of the wind industry have testified that the cycle of peak manufacturing production demands followed by cutbacks "would be

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[37] 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]

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

[39] 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]

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

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

eliminated if a long-term PTC extension was in effect."[42] 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.[43] However, industry testimony suggests that identifying a 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.[44]

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."[45] The geothermal industry says a PTC extension of 10 years or more could be sufficient to stimulate a higher level of sustained industry growth.[46]

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

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

[43] 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.

[44] 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]

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

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

development periods, even if the credit were large enough to make them economical.[47]

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.[48] These aspects make the PTC less valuable for solar than the business and residential investment tax credits (ITC).[49] 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.[50] 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.[51] State RPS action began in the mid-1990s.[52] Since then, an increasing number of states have implemented an RPS. **Table 3** 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.[53]

**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.[54] 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 5 years or more.

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

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

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

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

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

[52] 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.

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

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

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

***Extend the Credit to Achieve a 5-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.[55] 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.[56]

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 1-year to 2-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%.[57] The Joint Committee on Taxation has estimated that a four-year extension of the credit's placed-in-service deadline would reduce tax revenue to the U.S. Treasury by about $6.6 billion over the nine-year duration of credit claims.[58]

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 5 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

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[55] 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.

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

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

[58] Joint Committee on Taxation. *Estimated Revenue Effects of the Tax Provisions Contained in H.R. 2776.* June 19, 2007. [http://www.house.gov/jct/x-36-07.pdf]

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.[59]

**Credit Extension Debate.** The PTC is set to expire at the end of 2008. In the 110th Congress, the House-passed version of H.R. 3221 (§11002) would extend the credit for four years, to the end of 2012.[60] It would also expand the credit to include equipment that uses marine (ocean thermal, wave, tidal, and current) energy. The Senate-passed version of H.R. 6 did not include any tax provisions. In Senate floor action on H.R. 6, S.Amdt. 1704 included a provision (§801) that would have extended the PTC for five years, and expanded it to include marine energy. A failed attempt at cloture (57-36) on the amendment kept it from being added to the bill. Subsequently, a successful cloture vote on the bill caused the amendment to become non-germane.

Proponents of extending the credit past 2008 argue that the PTC is merited because it corrects a market failure by providing economic value for the environmental benefits of "clean" energy sources that emit less (in many cases, far less) air pollutants and $CO_2$ than conventional energy equipment. Also, they contend it helps "level the playing field," noting that there is an even longer history of federal subsidies for conventional energy.[61] For example, they point to the permanent depletion allowance for oil and natural gas that has been in place for many decades.[62]

Opponents of extending the production tax credit beyond the end of 2008 argue that generally there are no market failures that warrant special tax subsidies for particular types of renewable energy technologies. They argue further that subsidies generally distort the free market and that renewables should not get special treatment that exempts them from this principle. Also, regarding the concern about the environmental problems of "dirty" conventional energy sources, they contend that the most cost-effective economic policy is to put a tax on the pollution from energy sources and let the free market make the necessary adjustments. Another argument against the PTC is that much renewable energy production, particularly from wind

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

[60] Another bill (S. 411) would make the full credit available for all resources. See Table 2 for a list of resources that are currently eligible for only half-credit.

[61] 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.

[62] 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.

and solar equipment, has a fluctuating nature that makes it less valuable than energy produced by conventional facilities.[63]

At a Senate hearing in February 2007, Energy Secretary Bodman testified that the Administration is unlikely to support a 5-year or 10-year PTC extension because it would not be consistent with free markets.[64] Consistent with this stance, the Administration's FY2008 budget request does not include a provision to cover a PTC extension beyond 2008. However, Section 332 of the Senate version (S.Con.Res. 21) of the budget resolution would create a deficit-neutral reserve that could be used to support the PTC and other tax incentives. The Administration has not singled out opposition to the proposed extension of the PTC in H.R. 3221. However, for other reasons, it has threatened to veto both the House-passed version of H.R. 3221 and the Senate-passed version of H.R. 6.

## Solar Investment Tax Credits

The Energy Tax Act of 1978 (P.L. 95-618) established a residential energy tax credit for solar and wind energy equipment.[65] 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.[66] The Tax Relief Act of 2006 (P.L. 109-432, §206) extended the credit through the end of 2008.

The Energy Tax Act also established a 10% business tax credit for solar, wind, geothermal, and ocean energy equipment.[67] 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.[68] The Tax Relief Act of 2006 extended the 30% rate through the end of 2008. After that, it would drop back to 10%.

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

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[63] 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.

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

[65] 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.

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

[67] 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.

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

H.R. 3221 (§11003) would extend the commercial solar tax credit at the 30% level for eight years. Also, it would make the credit allowable against the alternative minimum tax.[69] Section 11006 would eliminate the cap on the residential solar tax credit and allow the credit to offset alternative minimum tax liability.[70]

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

## Clean Renewable Energy (Tax Credit) Bonds

Non-profit electric utilities provide about 25% of the nation's electricity.[71] 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.[72] 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.[73]

In 2005 testimony, the American Public Power Association (APPA) stated that REPI was "woefully underfunded," and the National Rural Electric Cooperative

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[69] In Senate floor action on H.R. 6, S.Amdt. 1704 included a provision (§804) that would have extended the commercial solar credit at the 30% level for 8 years, and it would have allowed the credit to be used by public utilities. The amendment lost a cloture vote (57-36) and was not further considered. The Solar Energy Industry Association had endorsed H.R. 550/S. 590, which would have expanded the commercial credit to include certain solar storage and lighting equipment, and it would have extended the credit at the 30% level for 8 years.

[70] S.Amdt. 1704 to H.R. 6 included a provision (§808) that would have extended the residential solar credit at the 30% level for 6 years and doubled the credit cap to $4,000. The amendment lost a cloture vote and was not further considered. The Solar Energy Industry Association had endorsed H.R. 550/S. 590, which would have extended the residential credit at the 30% level for 8 years.

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

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

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

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.[74] 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.[75] EPACT authorized $800 million in CREBs for 2006 and 2007.[76] In late 2006, the Internal Revenue Service (IRS) reported requests totaling $2.6 billion in bond authority. The Tax Relief Act of 2006 (§202) extended the CREBs through the end of 2008, adding $400 million more in total bond authority.

H.R. 3221 (§11004) would establish a new category of CREBs (New CREBs) for public power providers (utilities) and cooperative electric companies.[77] The "New CREBs" differ from the previously issued CREBs in four aspects. First, issuers of New CREBs would be subjected to a shorter 3-year period for use of the bond proceeds, two years less than the previous 5-year period for CREBs. Second, the tax credit rate would be lower, set at 70% of the previous rate for CREBs.[78] Third, taxpayers could carry forward unused credits into future years. Fourth, the tax credit benefits could be separated from bond ownership.[79]

A national limit of $2 billion would be set for New CREBs, of which 60% would be available for public power providers and 40% would be available for cooperative electric companies. The revenue drain on the U.S. Treasury is estimated at a total of $550 million over the period from 2007 through 2017.[80] The Administration has stated its opposition to the New CREBs proposed in H.R. 3221. Specifically, it contends 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

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[74] 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).

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

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

[77] In Senate floor action on its substitute amendment (S.Amdt. 1502) to H.R. 6, S.Amdt. 1704 (§802) proposed to extend the CREBs for 4 years with an annual bond authority limit of $900 million (including $563 million for governments) for 2008, 2009, 2010, and 2011. Unused bond authority in any year would have been allowed to carryover to the next year.

[78] 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.

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

[80] Joint Committee on Taxation. *Estimated Revenue Effects of the Tax Provisions Contained in H.R. 2776.* June 19, 2007. [http://www.house.gov/jct/x-36-07.pdf]

credit programs.[81] 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.[82]

## Debate Over Revenue Offsets in Omnibus Energy Bill (H.R. 3221)

The tax provisions in House-passed H.R. 3221 propose $15.3 billion in oil and natural gas revenue offsets to support $15.3 billion in new incentives.[83] These new incentives would include $7.8 billion in renewable energy production tax incentives and $7.5 billion in energy efficiency tax incentives. The renewable energy incentives would include $6.6 billion for the renewable energy production tax credit (PTC), $550 million for clean renewable energy (tax credit) bonds, and a portion of another $650 million for commercial and residential solar tax credits.[84]

Concerns about the use of oil and natural gas revenue offsets to support renewable energy and energy efficiency initiatives first emerged when the House passed its version of H.R. 6 in January 2007. That bill's revenue offset provisions, which are nearly identical to those of H.R. 3221, were designed to fund an "Energy Efficiency and Renewables Reserve."[85] Specific uses of the reserve were left to be determined by ensuing legislation. Subsequently, section 308 of the conference report on the concurrent resolution on the budget for FY2008 established a deficit-neutral reserve fund for energy legislation.[86]

Debate over the revenue offset provisions in H.R. 3221 directly parallels the House floor debate over the proposed language in the House version of H.R. 6. In that debate, opponents argued that the reduction in oil and natural gas incentives

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[81] 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]

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

[83] In Senate floor action on H.R. 6, S.Amdt. 1704 included provisions in Part VII, Subtitle B, that would have established about $24 billion in oil and gas offsets to support renewable energy and energy efficiency measures. The amendment failed on a cloture vote (57-36). For more discussion of those provisions, see CRS Report RL33578, *Energy Tax Policy: History and Current Issues*, by Salvatore Lazzari.

[84] Joint Committee on Taxation. *Estimated Revenue Effects of the Tax Provisions Contained in H.R. 2776.* June 19, 2007. [http://www.house.gov/jct/x-36-07.pdf]

[85] For more details about the reserve, see CRS Report RS22571, *The Strategic Energy Efficiency and Renewables Reserve in the CLEAN Energy Act of 2007 (H.R. 6).* 3 p.

[86] H.Rept. 110-153. *Concurrent Resolution on the Budget for Fiscal Year 2008*. The allowed uses of the energy reserve fund differ somewhat for the House and Senate. However, the resolution allows each chamber to use the fund to support renewable energy legislation, including tax legislation. [http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_reports&docid=f:hr153.110.pdf]

would dampen production, cause job losses, and lead to higher prices for gasoline and other fuels. Opponents also contended that the proposal for the reserve does not identify specific policies and programs that would receive funding. Proponents of the bill counter-argued that record profits show that the oil and natural gas incentives were not needed. They also argued that the Reserve could be used to support a variety of R&D, deployment, and tax incentives for renewable fuels. Further, they said that the specifics would evolve as legislative proposals come forth for using resources from the reserve.[87]

# Regulatory Issues

## Renewable Portfolio Standard (RPS)

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

**State RPS Debate.** Opponents often contend that state RPS policies are not worth implementing because the incremental costs of renewable energy may lead to substantial increases in electricity prices. RPS proponents often counter by presenting evidence that renewable energy costs would be modest and arguing that RPS creates employment, reduces natural gas prices, and produces environmental benefits.[88]

**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

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[87] *Congressional Record*. January 18, 2007. p. H688 through H729.

[88] 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."

impact on planning for state RPS policies.[89] Otherwise, federal agency involvement with state RPS programs has primarily involved support for planning and analysis.[90]

**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.

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

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

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[89] 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]

[90] 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.

see CRS Report RL34116, *Renewable Energy Portfolio Standard (RPS): Background and Debate Over a National Requirement.*)

## Other Regulatory Issues

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

EPACT (§388) placed regulatory responsibility for offshore wind developments with the Minerals Management Service (MMS) of the Department of the Interior. In 2006, MMS announced that an environmental impact statement (EIS) would be prepared for the project. In February 2007, Cape Wind submitted its draft EIS to MMS.[91] 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 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. 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,[92] and allowed most of the delayed projects to resume action. However, the report concluded that a more detailed study is needed to understand and mitigate impacts on radar systems.[93]

The impact of wind turbines on wildlife has also become a focus of concern. H.R. 3221 (§7231-7234) would require 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.

**Marine (River, Tidal, Wave, and Ocean) Energy.** Technology that generates electricity from marine sources — including ocean waves, tides, and river currents — has reached the pre-commercial stage. Tax incentives and other

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

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

[93] Alliance to Protect Nantucket Sound, *Pentagon Continues to Study Potential Cape Wind Interference of Military Radar,* February 13, 2007. [http://www.saveoursound.org/node/537]

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.

In the 110th Congress,[94] the House-passed H.R. 3221 contains several provisions on these technologies. These include a funding authorization for a DOE R&D program (§4101-4107), state grants for resource assessments (§7301), ocean thermal energy licensing regulation (§7305), renewable energy portfolio standard (ocean and tidal, §9611), and PTC (§11002).[95]

# Renewable Fuels and Energy Security

## Corn Ethanol

**Farm-Based Corn Ethanol Production.** In the United States, ethanol is produced mainly from corn grown on farms.[96] 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.[97] National ethanol production was estimated at 4.85 billion gallons in 2006.[98]

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[94] 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.

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

[96] 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.

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

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

However, due to ethanol's lower heat content,[99] this is equivalent to about 3.2 billion gallons of gasoline, or about 210,000 barrels of oil per day (b/d).

**Corn Ethanol Impacts and Debate.** The U.S. Department of Agriculture (USDA) estimates that 20% of the 2006 corn crop was used to produce ethanol. The rapid growth in agriculture-based biofuel production generated a sharp upturn in corn, grain, and oilseed prices in late 2006. At the end of 2006, corn ethanol plant capacity expansion was on record pace. The rapid growth in production and plant capacity has raised concerns that further acceleration of ethanol production may pose more challenges, including the development of pipeline capacity and the potential for more food price increases.[100]

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.[101] 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.

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[99] 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.

[100] For more information on renewable energy initiatives in the 2007 farm bill proposals, see CRS Report RL34130, *Renewable Energy Policy in the 2007 Farm Bill*, by Randy Schnepf. Also see CRS Report RL33037, *Previewing a 2007 Farm Bill*, coordinated by Jasper Womach. (Chapter on Energy)

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

## Renewable Fuel Standard (RFS)

EPACT (§1501) defines "renewable fuel" to include ethanol, biodiesel, and certain other sources. Ethanol is the only one produced in large quantity. The law set a national standard that required the use of 4.0 billion gallons in 2006 and rises to 7.5 billion gallons by 2012. An incentive in the law encourages the use of cellulosic and waste-derived ethanol to help achieve the RFS target. The incentive is a multiplier that values each gallon of these two fuels at 2.5 gallons of renewable fuel.

**President's "20-in-10" Alternative Fuels Goal.** In his State of the Union 2007 message, President Bush said, "... We need to ... expand the use of clean diesel vehicles and biodiesel fuel. We must continue investing in new methods of producing ethanol, using everything from wood chips to grasses, to agricultural wastes."[102] In particular, the President set out a "20-in-10" goal, to reduce gasoline use 20% over the next 10 years (by 2017). As a strategy to promote increased energy independence, the President said, "When we do that we will have cut our total imports by the equivalent of three-quarters of all the oil we now import from the Middle East."[103] In addition to a call for increased fuel economy to reach this goal, the President said "we must increase the supply of alternative fuels, by setting a mandatory fuels standard to require 35 billion gallons of renewable and alternative fuels in 2017 — and that is nearly five times the current target."[104]

**Senate-Passed H.R. 6 Proposal to Increase RFS.** In parallel with the President's fuel production target for 2017, the Senate-passed version of H.R. 6 (§111) would increase the RFS annually, starting at 8.5 billion gallons in 2008 and rising to 36 billion gallons in 2022. The House-passed version of H.R. 3221 did not include an RFS. In a Statement of Administration Policy on H.R. 6, the Administration indicated its support for the Senate's RFS proposal.[105]

## Biofuels and Oil Imports

**Administration's Biofuels Initiative.** The Administration's Biofuels Initiative, part of the AEI, was designed to increase funding for cellulosic ethanol development with the goal of accelerating its commercial use.[106] In 2006, DOE formed a joint research effort between its Office of Energy Efficiency and Renewable

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[102] The White House. State of the Union 2007. [http://www.whitehouse.gov/news/releases/2007/01/20070123-2.html]

[103] Ibid.

[104] Ibid. The use of the phrase "renewable and alternative fuels" in the President's address has led many to speculate that the goal would allow for the use of non-renewable fuels, such as coal-based or other fossil-fuel-based sources of liquid fuels.

[105] Executive Office of the President. Office of Management and Budget. *Statement of Administration Policy on H.R. 6.* June 12, 2007. p. 2.

[106] 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].

Energy (EERE) and the Office of Science to develop cellulosic biotechnology that would enable the production of 60 billion gallons per year.[107] The research plan aims for biotechnology breakthroughs to increase the quantity of biomass (e.g., switchgrass) per acre and to breed the plants to have more cellulose. The plan would cut costs through biorefinery breakthroughs that reduce the number of conversion steps and shift the process from chemical steps to biological steps.[108]

As **Table 1** shows, DOE's FY2008 budget request would provide about $179 million for DOE's Biomass Program that supports the Biofuels Initiative and the 20-in-10 fuels goal. This would be a $20 million reduction from the $197 million appropriated for FY2007. In contrast, the House (H.R. 2641) has recommended an increase to $250 million for FY2008, and the Senate Appropriations Committee (S. 1751) has recommended an increase to $244 million.

**Farm-Related Biofuels Proposals.** Omnibus energy legislation would provide loan guarantees for biorefineries and biofuels production facilities. The agriculture title of House-passed H.R. 3221 (§5003 ) would cap the guarantee at 90% of the debt, covering up to $600 million for loans with a principal under $100 million and up to $1 billion for loan principals ranging from $100 million to $250 million. Additional funding from the Commodity Credit Corporation (CCC) would be authorized, starting at $50 million in 2008 and rising to $250 million in 2012.[109] The Senate-passed version of H.R. 6 would allow guarantees for 100% of the debt, covering loans with a principal up to $250 million. Also, the Senate bill would require a validation of the project design in a pilot plant that had produced at least 50,000 gallons per year.

The energy title of the House-passed Farm Bill and the agriculture title of the House-passed H.R. 3221 have parallel, but significantly different, provisions that support the goals for an accelerated RFS and the Biofuels Initiative. The major distinction between the agriculture energy titles of H.R. 3221 and H.R. 2419 is that Title IX of H.R. 2419 has higher funding levels and more provisions than in Title V of H.R. 3221. In particular, H.R. 2419 proposes a total of $3.2 billion in new funding for Title IX energy provisions over 5 years compared with $2.2 billion under Title V of H.R. 3221. The most notable energy provision of H.R. 2419 omitted from H.R. 3221 is a Biomass Energy Reserve (BER) program to provide financial and technical assistance (including five year contracts) to landowners and operators to grow dedicated energy crops as feedstock for cellulosic ethanol and other energy production. (For more background, see CRS Report RL34130, *Renewable Energy Policy in the 2007 Farm Bill*, by Randy Schnepf.)

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

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

[109] The energy title of the House-passed Farm Bill for 2007 (H.R. 2419, Title IX) would cover up to $1 billion for all loans with a principal up to $250 million. Additional CCC funding would start at $75 million in 2008 and rise to $300 million in 2012.

**Potential Oil Import Reductions.** **Table 5** shows baseline EIA data for U.S. oil use and Persian Gulf Imports in 2005 and EIA projections for selected future years through 2030.[110] The Table also shows ethanol production estimates for the current RFS (7.5 billion gallons by 2012, and selected generic scenarios that would increase the RFS to 35-in-2017 or to 36-in-2022.[111] The Table shows that, at its peak in 2012, the current RFS would displace an estimated 0.33 million barrels per day (mbd), or about 11% of Persian Gulf Imports. Similar estimates of Persian Gulf oil displacement are shown for the two scenarios. At the respective peak years, the "35-in-2017" scenario could displace an estimated 1.52 mbd (51%) and the "36-in-2022" scenario could displace an estimated 1.57 mbd (49%).

# Climate Change

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

## $CO_2$ Emissions Reduction Estimates

In most cases renewable energy appears to release less carbon dioxide ($CO_2$) than fossil fuels.[112] Thus, renewables are seen as a key long-term resource that could substitute for significant amounts of fossil energy that would otherwise be used to produce vehicle fuels and electricity. The potential percentage of renewable energy substitution can depend on many factors, including energy prices, energy demand growth,[113] technology cost, and market penetration. As renewable energy production displaces fossil fuel use, it would also reduce $CO_2$ emissions in direct proportion, except perhaps for biofuels and biopower.[114]

In general, the combustion of biomass for fuel and power production releases $CO_2$ at an intensity that may be close to that for natural gas. However, the re-growth

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

[111] Each 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 5 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.

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

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

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

of biomass material, which absorbs $CO_2$, often offsets this release. Hence, net emissions occur only when combustion is based on deforestation. In a "closed loop" system, biomass combustion is based on rotating energy crops, there is no net $CO_2$ release unless fertilizer is used, and any fossil fuel displacement, including decreased natural gas use, would tend to reduce $CO_2$ emissions.

## Support for Renewables to Curb $CO_2$

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

States have undertaken a variety of programs that support renewables to curb $CO_2$. These programs often have reasons other than climate change for supporting renewables. California and New York are notable examples that have sizable programs for R&D and market deployment.[115] These programs are funded in large part by a surcharge on electricity use, often identified as a public goods charge.[116] 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.[117] Many local governments have also undertaken climate programs that include renewables as a component.[118]

# Legislation

## FY2007 Appropriations (P.L. 110-5, H.J.Res. 20)

DOE's request sought $359.2 million for renewable energy R&D, which was $126.0 million, or 54%, more than the FY2006 appropriation. The Energy and Water Appropriations bill for FY2007 (H.R. 5427) contained appropriations for DOE's renewable energy programs. The House passed the bill (H.Rept. 109-474) and the Senate Appropriations Committee reported (S.Rept. 109-274) its version of the bill.

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[115] 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/].

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

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

[118] Information about local government programs is available from the EPA web site 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].

Both reports contained several new policy directives.[119] However, the 109th Congress did not complete action on the bill.

In the 110th Congress, H.J.Res. 20 was introduced to continue FY2007 appropriations through the end of the fiscal year. It was enacted on February 15, 2007 as P.L. 110-5. The law sets funding for DOE's Energy Efficiency and Renewable Energy Programs at about $1.47 billion, an increase of $311.5 million (27%) above the FY2006 appropriation. **Table 1** shows how the DOE FY2007 *Operating Plan* distributed the $311.6 million across major EERE programs. The $107.0 million for Facilities contains an $80.9 million increase. It includes $63 million to build a new facility at the National Renewable Energy Laboratory (NREL), $20 million for NREL's ethanol research biorefinery, and $16 million for advanced photovoltaic manufacturing equipment. Other key increases include Biomass ($109.9 million), Solar Energy ($77.6 million), Hydrogen ($40.1 million), and Building Technologies ($36.1 million). The main cuts are for Weatherization grants (-$38.0 million), Geothermal (-$17.8 million), and Small Hydro termination (-$0.5 million).

P.L. 110-5 sets conditions on the EPACT (Title 17) loan guarantee program, fixing a cap at $4 billion, prohibiting awards until final regulations are issued, and requiring annual program evaluations by an independent auditor. The law provides $7 million in FY2007 to fund operations of DOE's Loan Guarantee Office.

## Omnibus Energy Bills (H.R. 3221 and H.R. 6)

The Senate-passed version of H.R. 6, the proposed *Renewable Fuels, Consumer Protection, and Energy Efficiency Act of 2007*, was composed from several bills. The key provisions of the bill are appliance efficiency standards, an increase of the renewable fuel standard (RFS) to 36 billion gallons by 2022, and an increase of the combined corporate average fuel economy (CAFE) standards to 35 miles per gallon (mpg) by 2020. Tax provisions and a renewable energy portfolio standard (RPS) were not included.

The House-passed version of H.R. 3221 includes two divisions. Division A contains the *New Direction for Energy Independence, National Security, and Consumer Protection Act*, which was composed from several bills. An adopted floor amendment (H.Amdt. 748) added a 15% renewable portfolio standard (RPS). Division B, the *Renewable Energy and Energy Conservation Tax Act of 2007*, contains the House-approved version of H.R. 2776, and adds four titles to H.R. 3221. It includes a four-year extension of the renewable electricity production tax credit and other efficiency and renewables incentives.

Key challenges remain. First, there are significant differences between the two bills. Second, further action would be required in at least one chamber before a conference committee could be arranged. Third, concerns about certain oil and

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[119] The policy directions are described in CRS Report RL33346, *Energy and Water Development: FY2007 Appropriations.* (Section on Energy Efficiency and Renewable Energy)

natural gas provisions have led the Administration to threaten to veto each bill. (For a comparison of major provisions in the two 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*.)

## Other Bills

In the 110th Congress, more than 270 bills with provisions for energy efficiency or renewable energy have been introduced. A general description of the renewable energy provisions in those bills, including those enacted into law, is available in CRS Report RL33831, *Energy Efficiency and Renewable Energy Legislation in the 110th Congress*. The report also groups the bills by policy and issue areas, provides a table that identifies recent action on the bills, and discusses recent action.

## Table 1. DOE Renewable Energy Budget for FY2007-FY2008

(selected programs, $ millions)

| Program | FY2006 | FY2007 | FY2008 Request | FY2008 House | FY2008 Senate Appns. Cmte | FY2008 Conf. |
|---|---|---|---|---|---|---|
| Biomass & Biorefinery Systems | $89.8 | $199.7 | $179.3 | $250.0 | $244.0 | |
| — Cellulosic Ethanol Auction | 10.4 | — | 5.0 | — | — | |
| Solar Energy Technology | 81.8 | 159.4 | 148.3 | 200.0 | 180.0 | |
| — Photovoltaics | 58.8 | — | 137.3 | 149.0 | 145.3 | |
| — Concentrating Solar | 7.3 | — | 9.0 | 34.0 | 25.0 | |
| — Solar Heating & Lighting | 1.4 | — | 2.0 | 12.0 | 4.7 | |
| Wind Energy Technology | 38.3 | 49.3 | 40.1 | 57.5 | 57.5 | |
| Geothermal Technology | 22.8 | 5.0 | 0.0 | 44.3 | 25.0 | |
| Hydro & Marine Technology | 0.5 | 0.0 | 0.0 | 22.0 | 10.0 | |
| International Renewables | 3.9 | 9.5 | 0.0 | 10.0 | 0.0 | |
| Tribal Energy | 4.0 | 4.0 | 3.0 | 5.0 | 7.0 | |
| Renewables Prod'n Incentive | 5.0 | 4.9 | 4.9 | 4.9 | 5.0 | |
| Asia Pacific Partner. (Renew.) | 0.0 | — | 2.5 | 0.0 | 0.0 | |
| **Renewables, Subtotals** | 246.1 | 431.8 | 378.0 | 593.7 | 528.5 | |
| — Technologies R&D/Facilities | 233.2 | 413.4 | 367.6 | 573.8 | 516.5 | |
| — Deployment | 12.9 | 18.4 | 10.4 | 19.9 | 12.0 | |
| Facilities (Nat. Renew. Lab) | 26.1 | 107.0 | 7.0 | 195.7 | 7.0 | |
| **Other EERE/Energy Efficiency** | | | | | | |
| Hydrogen Technologies | 153.5 | 193.6 | 213.0 | 194.6 | 228.0 | |
| — Fuel Cell Technologies | 66.6 | — | 92.7 | — | — | |
| Vehicle Technologies | 178.4 | 188.0 | 176.1 | 235.4 | 230.0 | |
| Building Technologies | 68.2 | 104.3 | 86.5 | 146.5 | 137.0 | |
| Industrial Technologies | 52.1 | 56.6 | 46.0 | 57.0 | 57.0 | |
| Federal Energy Management | 19.0 | 19.5 | 16.8 | 27.0 | 23.0 | |
| Weatherization & Intergov. | 316.9 | 281.7 | 204.9 | 314.9 | 307.6 | |
| Program Management | 115.2 | 110.2 | 118.3 | 128.9 | 118.9 | |
| **R&D Subtotal** | 887.9 | 1,220.3 | 1,046.7 | 1,558.9 | 1,316.8 | |
| **Grants Subtotal** | 278.2 | 254.0 | 189.5 | 314.9 | 398.8 | |
| **Use of Prior Year Balances** | — | — | — | — | — | |
| **Total Appropriation, EE & RE** | 1,166.1 | 1,474.3 | 1,236.2 | 1,873.8 | 1,715.6 | |
| Office of Electricity Delivery & Energy Reliability (OE)[a] | 158.2 | 137.0 | 114.9 | 134.2 | 169.4 | |

**Sources:** DOE *FY2008 Congressional Budget Request*, vol. 3, February 2007; *DOE FY2007 Operating Plan*; H.Rept. 110-185; S.Rept. 110-127.

a. The Distributed Energy Program was moved from EERE to OE in FY2006.

## Table 2. Production Tax Credit Value and Duration by Resource

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

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

## Table 3. Production Tax Credit Claims, History and Projections

($ millions)

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

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

## Table 4. Renewable Fuels Compared with Persian Gulf Imports

(millions of barrels per day, mbd)

| Year | Oil Use or Oil Use Equivalent (mbd)* | | | | | As a Percent of Persian Gulf Imports | | |
|---|---|---|---|---|---|---|---|---|
| | Total Oil Use | Persian Gulf Imports | 7.5-in 2012 (RFS) | 35-in-2017 | 36-in-2022 | 7.5-in 2012 (RFS) | 35-in-2017 | 36-in-2022 |
| 2005 Actual | 20.75 | 2.59 | 0.17 | 0.17 | 0.17 | 6.6% | 6.6% | 6.6% |
| | | | | | | | | |
| 2006 | 20.68 | 2.68 | 0.17 | 0.17 | 0.17 | 6.5% | 6.5% | 6.5% |
| 2007 | 20.94 | 2.71 | 0.20 | 0.20 | 0.20 | 7.6% | 7.6% | 7.6% |
| 2008 | 21.15 | 2.67 | 0.24 | 0.34 | 0.37 | 8.8% | 12.6% | 13.9% |
| 2009 | 21.38 | 2.67 | 0.27 | 0.47 | 0.46 | 10.0% | 17.6% | 17.1% |
| 2010 | 21.59 | 2.74 | 0.30 | 0.60 | 0.52 | 10.8% | 21.9% | 19.1% |
| 2011 | 21.89 | 2.79 | 0.32 | 0.73 | 0.55 | 11.6% | 26.3% | 19.7% |
| 2012 | 22.13 | 2.86 | **0.33** | 0.86 | 0.57 | **11.4%** | 30.2% | 20.1% |
| | | | | | | | | |
| 2017 | 23.29 | 2.99 | — | **1.52** | 0.91 | — | **51.0%** | 30.6% |
| | | | | | | | | |
| 2022 | 24.58 | 3.20 | — | — | **1.57** | — | — | **49.0%** |

**Sources:** For Total Oil Use and Persian Gulf Imports, see EIA, Energy Information Administration. *Annual Energy Outlook 2007*, Supplementary Tables 11 and 118. For the current renewable fuel standard (RFS), see P.L. 109-58, §1501. For the "35-in-2017" proposal, see The White House, *State of the Union 2007*. For the "36-in-2022" proposal, see the Senate-passed version of H.R. 6, §111. 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.

* The ethanol figures for RFS, 35-in-2017, and 36-in-2022 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.