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Renewable Energy: Tax Credit, Budget, and Electricity Production Issues

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Renewable Energy: Tax Credit, Budget, and Electricity Production Issues

SUMMARY

Energy security, a major driver of federal renewable energy programs in the past, came back into play as oil and gas prices rose late in the year 2000. The terrorist attack in 2001 and the Iraq war have led to heightened concern about energy security, energy infrastructure vulnerability, and the need for alternative fuels. Further, the 2001 electricity shortages in California, the northeast-midwest blackout of 2003, and continuing high natural gas prices have brought a new emphasis to the role that renewable energy may play in producing electricity, displacing fossil fuel use, and curbing demand for power transmission equipment.

Also, worldwide emphasis on environmental problems of air and water pollution and global climate change, the related development of clean energy technologies in western Europe and Japan, and technology competitiveness may remain important influences on renewable energy policymaking.

The Bush Administration's FY2007 budget request for the Department of Energy's (DOE's) Renewable Energy Program seeks \$359.2 million for renewables, which is \$84.0 million, or 30.5%, more than the FY2006 appropriation. In support of the President's proposal for an Advanced Energy Initiative, the request includes major funding increases for solar energy (to support the Solar America Initiative) and biomass (to support the Biorefinery Initiative). The main increases are for Solar Photovoltaics (\$79.5 million) and Biomass (\$59.0 million). The main cuts are for Geothermal (-\$23.1 million), Solar Heat & Light (\$1.5 million), International Renewables (-\$1.4 million), and Small Hydro (-\$0.5 million). Further, the request would eliminate all

congressional earmarks under the DOE Renewable Energy Program, which amount to \$80.0 million for FY2006.

P.L. 109-102 (H.R. 3057) provides \$100 million for clean (renewable) energy and energy efficiency programs in developing countries. P.L. 109-97 (H.R. 2744) provides \$23 million for farm-based renewable energy grants and loans. H.R. 2863 (in conference) would authorize \$5 million for a wind energy project on an Air Force base.

P.L. 109-58 (H.R. 6) authorizes or reauthorizes several renewable energy programs, sets new goals for renewable energy use in federal facilities and fleets, expands programs for hydrogen fuel cell buses, and sets (§1501) a renewable fuels standard of 7.5 billion gallons per year by 2012 to increase use of ethanol and biodiesel. Among the tax measures, §1301 extends the renewable energy production tax credit for two years, §1303 provides \$800 million in renewable energy bonds, §1335 establishes a residential solar (heat and electricity) tax credit, and §1337 increases a business solar tax credit. However, the enacted law does not include a Senate-proposed provision to set a 10% renewable portfolio standard.

P.L. 109-59 (H.R. 3) contains several provisions for "alterative" and "clean" fuels, including sections 1113, 1121, 3010, 3044, and 6015.

P.L. 109-171 (S. 1932, Section 1301) limits funding for one renewable energy program at USDA, and Section 1402 terminates funding for another one.

MOST RECENT DEVELOPMENTS

On March 9, 2006, the House Committee on Science held a hearing focused on a National Academy of Sciences proposal that Congress consider establishing an Advanced Research Projects Agency for Energy (ARPA-E) at the U.S. Department of Energy (DOE). Some bills (H.R. 4435, H.R. 4906, S. 2196, S. 2197, S. 2398) propose creating such an agency in various forms. However, the Administration has already requested FY2007 funding for an Advanced Energy Initiative (AEI) as part of its American Competitiveness Initiative (ACI), which includes accelerated funding for the “Solar America” and “Biorefinery” initiatives under DOE’s Renewable Energy Program.

On February 6, 2006, President Bush issued the Administration’s budget request for FY2007. The Department of Energy (DOE) request seeks \$359.2 million for renewables, which is \$84.0 million, or 30.5%, more than the FY2006 appropriation (excluding inflation). The main increases are for Solar Photovoltaics (\$79.5 million) and Biomass (\$59.0 million). The main cuts are for Geothermal (-\$23.1 million), Solar Heat & Light (\$1.5 million), International Renewables (-\$1.4 million), and Small Hydro (-\$0.5 million). Further, the request calls for the elimination (or reprogramming) of all congressional earmarks, which amount to \$80.0 million for FY2006, including Biomass (\$48.8 million) and Solar Energy (\$14.4 million). (For more budget details, see “FY2006 DOE Budget” and **Table 2**. CRS Report RL33294, *DOE Budget Earmarks: A Selective Look at Energy Efficiency and Renewable Energy R&D Programs*, by Fred Sissine, provides more details about earmarks for DOE’s renewable energy programs. Also, the DOE budget document is online at [<http://www.cfo.doe.gov/budget/index.htm>].)

(The renewable energy provisions in the Energy Policy Act of 2005 [P.L. 109-58, H.R. 6] and other bills of the 109th Congress are discussed in the “Renewables in the 109th Congress” and “Legislation” sections below. A list of all renewable energy bills introduced in the 109th Congress is provided in CRS Report RL32860, *Energy Efficiency and Renewable Energy Legislation in the 109th Congress*, by Fred Sissine).

BACKGROUND AND ANALYSIS

Renewable Energy Concept

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 have not achieved the technological efficiency and market penetration which 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 this brief treats it as one. Commercial nuclear power is not generally considered

to be a renewable energy resource. (For further definitions of renewable energy, see the National Renewable Energy Laboratory's website information on "Clean Energy 101" at [http://www.nrel.gov/clean_energy/].)

Contribution to National Energy Supply

According to the Energy Information Administration's (EIA's) *Annual Energy Outlook 2006*, renewable energy resources (excluding wood used for home heating) supplied about 5.7 Q (quadrillion Btu's or quads) of the 99.7 Q the nation used in 2004, or about 6.0% of national energy demand. More than half of renewable energy production takes the form of electricity supply. Of this, most is provided by large hydropower. However, from 1998 through 2001, a drought-driven decline in hydroelectric availability led to a major drop in national renewable energy use. Industrial use of renewables, supplied primarily by biofuels, accounts for most of the remaining contribution.

After more than 25 years of federal support, some note that renewable energy has achieved neither a high level of market penetration nor a growing market share among other energy sources. A review of renewable energy studies by Resources for the Future, *Renewable Energy: Winner, Loser, or Innocent Victim?*, concludes that the lower-than-projected market penetration and flat market share are due primarily to declining fossil fuel and electricity prices during most of this period. In contrast, however, it notes that the costs for renewable energy technologies have declined by amounts equal to or exceeding those of earlier projections.

EIA's *Annual Energy Outlook 2006* projects that current policies would yield a 1.8% average annual increase in renewable energy production to 9.0 Q through 2030, resulting in a 57% total increase. This would amount to about 6.7% of the projected 134 Q total demand in 2030. (Detailed breakdowns of renewable energy use appear in EIA's *Renewable Energy Trends 2004*.)

Role in Long-Term Energy Supply

Our Common Future, the 1987 report of the United Nations World Commission on Environment and Development, found that "energy efficiency can only buy time for the world to develop 'low-energy paths' based on renewable sources." Though many renewable energy systems are in a relatively early stage of development, they offer "a potentially huge primary energy source, sustainable in perpetuity and available in various forms to every nation on Earth." The report suggested that a research, development, and demonstration (RD&D) program of renewable energy projects is required to attain the level of primary energy now obtained from a mix of fossil, nuclear, and renewable energy resources.

The *Agenda 21* adopted at the 1992 United Nations Conference on Environment and Development (UNCED) concluded that mitigating urban air pollution and the adverse impact of energy use on the atmosphere — such as acid rain and climate change — requires an emphasis on "clean and renewable energy sources." The U.N. Commission on Sustainable Development oversees implementation of *Agenda 21*. The 2002 U.N. World Summit on

Sustainable Development (Johannesburg Summit) adopted a *Political Declaration* and a *Plan of Implementation* (see [<http://www.johannesburgsummit.org/>]), which includes “Clean Energy” as one of five key policy actions. The U.S. Department of State implemented a \$42 million Clean Energy Initiative in 2003 (see [<http://www.state.gov/g/oes/sus/wssd/>]), and the European Union committed to a \$700 million energy partnership.

History

The oil embargo of 1973 sparked a quadrupling of energy prices, major economic shock, and the establishment of a comprehensive federal energy program to help with the nation’s immediate and long-term energy needs. During the 1970s, the federal renewable energy program grew rapidly to include basic and applied R&D, and federal participation with the private sector in demonstration projects, commercialization, and information dissemination. In addition, the federal government instituted market incentives, such as business and residential tax credits, and created a utility market for non-utility produced electric power through the Public Utility Regulatory Policies Act (P.L. 95-617).

The subsequent failure of the oil cartel and the return of low oil and gas prices in the early 1980s slowed the federal program. Despite Congress’s consistent support for a broader, more aggressive renewable energy program than any Administration, federal spending for these programs fell steadily through 1990. Until 1994, Congress led policy development and funding through legislative initiatives and close reviews of annual budget submissions. FY1995 marked a noteworthy shift, with the 103rd Congress for the first time approving less funding than the Administration had requested. The 104th Congress approved 23% less than the Clinton Administration request for FY1996 and 8% less for FY1997. However, funding turned upward again during the 105th Congress and in the 106th Congress. (A detailed description of DOE programs appears in DOE’s *FY2006 Congressional Budget Request*, DOE/ME-0053, v. 3, February 2005.)

From FY1973 through FY2003, the federal government spent about \$14.6 billion (in 2003 constant dollars) for renewable energy R&D. Renewable energy R&D funding grew from less than \$1 million per year in the early 1970s to over \$1.4 billion in FY1979 and FY1980, then declined steadily to \$148 million in FY1990. By FY2003, it reached \$411 million in 2003 constant dollars.

This spending history can be viewed within the context of DOE spending for the three major energy supply R&D programs: nuclear, fossil, and energy efficiency R&D. From FY1948 through FY1972, in 2003 constant dollars, the federal government spent about \$24.3 billion for nuclear (fission and fusion) energy R&D and about \$5.5 billion for fossil energy R&D. From FY1973 through FY2003, the federal government spent \$49.7 billion for nuclear (fission and fusion), \$25.4 billion for fossil, \$14.6 billion for renewables, and \$11.7 billion for energy efficiency. Total energy R&D spending from FY1948 to FY2003, in 2003 constant dollars, reached \$131.2 billion, including \$74.0 billion, or 56%, for nuclear; \$30.9 billion, or 24%, for fossil; \$14.6 billion, or 11%, for renewables; and \$11.7 billion, or 9%, for energy efficiency.

DOE’s FY2004 renewable energy R&D funding totaled \$439.4 million, or about 19% of DOE’s energy R&D appropriation. Energy conservation received \$559.7 million (24%),

fossil energy received \$672.8 million (29%), and fission and fusion were appropriated \$667.4 million (29%).

Tax Credits. The Energy Tax Act of 1978 (P.L. 95-618) created residential solar credits and residential and business credits for wind energy installations; it expired on December 31, 1985. However, business investment credits were extended repeatedly through the 1980s. Section 1916 of the Energy Policy Act of 1992 (EPACT, P.L. 102-486) extended the 10% business tax credits for solar and geothermal equipment indefinitely. Also, EPACT Section 1914 created an income tax “production” credit of 1.5 cents/kwh for electricity produced by wind and closed-loop biomass (energy crops or trees grown only for use as a fuel). P.L. 106-170 expanded this credit to include poultry waste. Section 603 of the Job Creation and Worker Assistance Act (P.L. 107-147) extended the production tax credit to December 31, 2003. The JOBS Act (P.L. 108-357) expanded the PTC (adding solar, geothermal, and open-loop biomass, landfill gas, trash combustion, and certain small hydro) and extended it through the end of 2005. Additionally, P.L. 96-223 created an income tax credit for alcohol fuels; section 9003(a)(3) of P.L. 105-178 extended the 40- to 60-cent/gallon credit through December 31, 2007. Further, the Energy Tax Act created a 5.2 cents/gallon federal excise tax exemption for gasohol (gasoline blended with alcohol), which now stands at 5.3 cents/gallon.

Public Utility Regulatory Policies Act. The Public Utilities Regulatory Policies Act (PURPA, P.L. 95-617) required electric utilities to purchase power produced by qualified renewable power facilities. Under PURPA, the Federal Energy Regulatory Commission (FERC) established rules requiring that electric utilities purchase power from windfarms and other small power producers at an “avoided cost” price based on energy and capacity costs that the utility would otherwise incur by generating the power itself or purchasing it elsewhere. However, Section 1253 of P.L. 109-58 terminated the mandatory purchase and sale requirements for a new renewable power facility, provided that FERC finds that the new facility has access to wholesale power markets and transmission services.

State and Local Government Roles. State and local governments have played a key role in renewable energy development. For example, in the early 1980s, a generous state investment tax for wind energy in California combined with PURPA and the federal tax credit to stimulate industry development of the first windfarms. California and New York have invested some state funds in renewable energy R&D. Recently, Texas and several other states have used a regulatory tool, the renewable energy portfolio standard (RPS), to encourage renewable energy. Also, in 2001, the city of San Francisco enacted a \$100 million revenue bond (Proposition B, “Vote Solar”) to support solar and wind energy implementation. In 2004, the city of Honolulu approved a \$7.85 million solar and energy efficiency bond.

(For more on federal, state, and local policies (incentives, grants, standards) for renewable energy, see Database of Incentives for Renewable Energy at [<http://www.dsireusa.org/>].)

Renewables in the 109th Congress

Renewable Portfolio Standard (RPS). For retail electricity suppliers, an RPS sets a minimum requirement (often a percentage) for electricity production from renewable energy resources or for the purchase of tradable credits that represent an equivalent amount of production. A growing number of states have enacted an RPS, currently including 19 states and the District of Columbia.

The Senate Committee on Energy and Natural Resources held a hearing on RPS on March 8, 2005. Regional differences in the availability of renewable resources, particularly resource availability in the southeastern United States, was a key issue of the discussion. In the April 12 markup of a committee print (to be incorporated into H.R. 6) by the House Committee on Energy and Commerce, an amendment to add an RPS (1% in 2008, increasing by 1% annually through 2027) was rejected (17-30). Proponents noted a growing number of states with an RPS and that EIA reports show an RPS could reduce electricity bills. Opponents raised concerns about the exclusion of existing hydropower facilities and resource limits for the southeastern United States. There was no RPS provision in the House version of H.R. 6. The Senate version had a 10% RPS provision. During the conference, there was an idea put out to compromise by including nuclear and hydropower facilities. Nevertheless, RPS was dropped in conference. (For more background information on RPS, two memoranda are available from the author. For current status of RPS policies in the states, see Database of State Incentives for Renewable Energy at [<http://www.dsireusa.org>].)

Renewable Energy Production Tax Credit (PTC) and Renewable Energy Production Incentive (REPI). The House version of H.R. 6 had no PTC extension, the Senate version had a three-year extension, and the enacted law (§1301) extends the PTC for two years, through the end of calendar year 2007. (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>].)

Parallel to the PTC, there is a renewable energy production “incentive” (REPI) for state and local governments and nonprofit electrical cooperatives. This 1.5 cent/kwh incentive was created by the Energy Policy Act of 1992 (EPACT) §1212 and is funded by appropriations to DOE. Eligible facilities currently include solar, wind, biomass, and geothermal energy except municipal solid waste and certain types of dry steam geothermal energy. The enacted law (§202) expands REPI to include ocean and wave energy and extends the authorization through FY2016.

Renewable Fuel Standard (RFS). P.L. 109-58 (H.R. 6, §1501) defines “renewable fuel” to include ethanol, biodiesel, and natural gas produced from landfills, sewage treatment plants, and certain other sources. Ethanol is the only renewable motor fuel produced in large quantity. In 2004, about 4.0 billion gallons of ethanol were blended with gasoline. Biodiesel is used at a rate of about 50 million gallons per year. In the House version of H.R. 6, the RFS provision called for renewable fuels (primarily ethanol) production to grow to 3.1 billion gallons a year in 2005, and then increase stepwise to 5.0 billion gallons a year by 2012. In the Senate version of H.R. 6, the RFS called for 4.0 billion gallons in 2006, rising to 8.0 billion gallons in 2012. The enacted version (§1501) set a standard starting at 4.0 billion gallons in 2006 and rising to 7.5 billion gallons by 2012. Further, an incentive would encourage the use of cellulosic and waste-derived ethanol to fulfill the RFS target, by raising

the value of 1.0 gallon of cellulosic or waste-derived ethanol from a previous incentive level of 1.5 gallons of renewable fuel to 2.5 gallons of renewable fuel.

An MTBE “safe harbor” from product liability lawsuits, which had been a major issue in previous omnibus energy bills, was dropped in conference. For more information on the bills’ provisions for renewable fuels and MTBE, see CRS Report RL32865, *Renewable Fuels and MTBE: A Comparison of Selected Provisions in H.R. 6*, by Brent D. Yacobbuci, et al.; CRS Report RS21676, *The Safe-Harbor Provision for Methyl Tertiary Butyl Ether (MTBE)*, by Aaron M. Flynn; and CRS Report RL32787, *MTBE in Gasoline: Clean Air and Drinking Water Issues*, by James E. McCarthy and Mary Tiemann.

Renewable Hydrogen. P.L. 109-58 (H.R. 6, §933) would create a program to produce hydrogen from a variety of sources, including renewable energy and renewable fuels, as part of a broader effort to develop hydrogen fuels, vehicles, and infrastructure. The provision includes a focus on distributed energy that uses renewable sources. Another section (§812) also calls for use of renewable hydrogen as part of a hydrogen fueling and infrastructure demonstration program.

Renewables Tax Revenue Effect. Table 1 shows the estimated 10-year revenue effect of renewable energy tax provisions in the House version of H.R. 6 (H.R. 1541), the Senate version of H.R. 6, and the enacted law.

Table 1. H.R. 6, Tax Revenue Effect
(\$ billions)

	House	Senate	Conference
Renewable Energy Production Tax Credit (PTC)	—	\$4.577	\$2.747
Clean Renewable Energy Bonds	—	\$0.493	\$0.411
Business Investment Tax Credit (Solar & Geo.)	—	\$0.059	\$0.024
Residential Solar Tax Credit (includes fuel cells)	\$0.018	—	\$0.031
Biodiesel Tax Credit	—	\$0.402	\$0.194
Total, Renewables Provisions	\$0.018	\$5.531	\$3.407
Gross Total, All Tax Provisions	\$8.090	\$18,421	\$14.553
Renewables Share of Total	0.2%	30.0%	23.4%

Sources: Joint Committee on Taxation (JCT), *Estimated Budget Effects of the Conference Agreement for Title XIII of H.R. 6, July 27, 2005 (JCX-59-05)*; *Estimated Revenue Effects of the Chairman’s Amendment in the Nature of a Substitute to H.R. 1541, Scheduled for Markup by the Committee on Ways and Means, April 13, 2005 (JCX-17-05)*; *Estimated Revenue Effects of the Chairman’s Amendment in the Nature of a Substitute to the “Energy Policy Tax Incentives Act of 2005,” Scheduled for Markup by the Committee on Finance, June 16, 2005 (JCX-47-05)*.

Other Renewables Provisions. P.L. 109-58 (H.R. 6) covers additional areas of renewable energy policy, resources, and technology including distributed energy, federal purchases, federal lands, Indian energy, net metering, alternative fuels (alcohol, biofuel, biodiesel), biopower/biomass, geothermal, hydropower, solar, and wind. (Additional bills with renewable energy provisions are identified in CRS Report RL32860, *Energy Efficiency and Renewable Energy Legislation in the 109th Congress*, by Fred Sissine.)

FY2006 DOE Budget

In his State of the Union address, President Bush announced the launch of the American Competitiveness Initiative (ACI) to stimulate long-term economic growth, in large part by increased promotion of R&D and technological innovation. A key component of the ACI is the Advanced Energy Initiative, which DOE says “aims to reduce America’s dependence on imported energy sources.” The Solar America Initiative and the Biorefinery Initiative are two themes under the Advanced Energy Initiative that 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 and to increase its deployment so that it can help reduce the demand for natural gas in the electric power sector. The goal of the Biorefinery 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. To support these two initiatives, DOE request for renewable energy programs proposes major funding increases for solar energy and biomass programs.

Using Renewable Energy to Produce Electricity

The Public Utility Regulatory Policies Act (PURPA) has been key to the growth of electric power production from renewable energy facilities. Since 1994, state actions to restructure the electric utility industry have dampened PURPA’s effect. In the 109th Congress, P.L. 109-58 (H.R. 6, §1253) includes a conditional repeal of the mandatory renewables purchase requirement in Section 210 of PURPA. (For a discussion of broader electricity restructuring issues, see CRS Report RL32728, *Electric Utility Regulatory Reform: Issues for the 109th Congress*, by Amy Abel.)

Renewables Under Electric Industry Restructuring. To encourage a continued role for renewable energy under restructuring, some states and utilities have enacted such measures as a renewable energy portfolio standard (RPS), public benefits fund (PBF), and/or “green” pricing and marketing of renewable power. In the 109th Congress, H.R. 983, H.R. 2828, H.R. 4384, and S. 427 have an RPS. The above section on “Renewable Portfolio Standard” summarizes the RPS action in H.R. 6, including a Senate proposal that was rejected in conference committee.

Green Power. The term “green power” generally refers to electricity supplied in whole or in part from renewable energy sources. Green power marketing (retail or wholesale) is underway in California, Illinois, Massachusetts, New Jersey, New York, Pennsylvania, and Texas. Green pricing is an optional utility service that allows electricity customers who are willing to pay a premium for the environmental benefits of renewable energy to purchase green power instead of conventional power. Utility green pricing programs reach more than one-third of the nation’s consumers. (For more on green power, see [<http://www.eere.energy.gov/greenpower/>].)

Distributed Energy. Distributed energy involves the use of small, modular electricity generators sited close to the customer load that can enable utilities to defer or eliminate costly investments in transmission and distribution system upgrades, and provide customers with quality, reliable energy supplies that may have less environmental impact than

traditional fossil fuel generators. Technologies for distributed electricity generation use wind, solar, bioenergy, fuel cells, gas microturbines, hydrogen, combined heat and power, and hybrid power systems. A DOE study, *Structural Vulnerability of the North American Power Grid*, suggests that adding more distributed power generation could help reduce grid vulnerability. Another DOE study, *Homeland Security: Safeguarding America's Future with Energy Efficiency and Renewable Energy Technologies*, provides a broad look at the potential to address vulnerabilities. (More information about DOE's Distributed Energy Program is available at [<http://www.eere.energy.gov/de/>]).

Net Metering. Net metering allows customers with generating facilities to “turn their electric meters backwards” when feeding power into the grid; they receive retail prices for the excess electricity they generate. This encourages customer investment in distributed generation, which includes renewable energy equipment. About 40 states have some form of net metering in place. P.L. 109-58 (H.R. 6, §1251) provides for net metering.

Natural Gas and Renewables

On January 24, 2005, the Senate Energy and Natural Resources Committee held a natural gas conference. Some participants described the potential for renewable energy to augment gas supplies, reduce gas demand, and thereby help reduce natural gas prices; see [<http://energy.senate.gov/conference/conference.cfm>]. Some of these statements referred to a 2005 Department of Energy (DOE) study, *Easing the Natural Gas Crisis: Reducing Natural Gas Prices through Increased Deployment of Renewable Energy and Energy Efficiency*, available at [<http://eetd.lbl.gov/ea/ems/reports/56756.pdf>].

Biomass-Generated Synthetic Natural Gas (Syngas). Continuing high natural gas prices have created interest in using renewables to dampen natural gas demand. Renewable energy (mainly biomass) can be used to produce methane (the main component of natural gas), which could possibly substitute directly for natural gas. DOE projects that, by 2020, biomass and energy crops could produce 15% of natural gas needs. A 2005 Harvard University study, *The National Gasification Strategy*, cites a Princeton University study (*A Cost-Benefit Assessment of Biomass Gasification Power Generation in the Pulp and Paper Industry*) that says that biomass-generated “black liquor” and wood waste could produce enough syngas to support 25 billion watts (gigawatts) of natural gas-fired power plant capacity by 2020.

Substituting Electricity from Renewables for Gas-Fired Generation. Also, a variety of renewables can generate electricity that indirectly displaces natural gas use for power generation. For many utilities the peak demand (often supported with natural gas peak-load plants) occurs during hot summer afternoons. In many regions, solar and wind energy reach high levels during summer peak periods. The American Wind Energy Association (AWEA) says that by the end of 2005, wind farms will be saving more than 0.5 billion cubic feet (Bcf) of natural gas per day. DOE's report *Scenarios for a Clean Energy Future* (Table 7.11) projects that, with some federal policy changes, biomass-based power production could be greatly accelerated through 2010. (Also see the 2005 DOE study noted above, and the American Council for an Energy Efficient Economy's report, *Impacts of Energy Efficiency and Renewable Energy on Natural Gas Markets*.)

Climate Change and Renewables

Because most forms of renewable energy generate no carbon dioxide (CO₂), renewables are seen as a key long-term resource that could substitute for fossil energy sources used to produce vehicle fuels and electricity. The percentage of renewable energy substitution depends on technology cost, market penetration, and the use of energy efficiency measures to control energy prices and demand. DOE's November 2003 report *U.S. Climate Change Technology Program — Technology Options for the Near and Long Term* compiles information from multiple federal agencies on more than 80 technologies. For these end-use and supply technologies, the report describes President Bush's initiatives and R&D goals for advancing technology development, but it does not estimate emissions saving potentials, as some previous DOE reports on the topic had presented.

EPA's *Climate Action Report — 2002* describes federal renewable energy programs aimed at reducing greenhouse gas emissions. In *Climate Change 2001: Mitigation*, the Intergovernmental Panel on Climate Change looks at the role that renewables could play in curbing global CO₂ emissions.

Since 1988, the federal government has accelerated programs that study the science of global climate change and has initiated programs aimed at mitigating fossil fuel-generated carbon dioxide (CO₂) and other human-generated emissions. The federal government funds programs for renewable energy as a mitigation measure at DOE, USDA, the Environmental Protection Agency (EPA), the Agency for International Development (AID), and the World Bank. The latter two agencies have received funding for renewable energy-related climate actions through Foreign Operations appropriations bills.

Because CO₂ contributes the largest share of greenhouse gas emission impact, it has been the focus of studies of the potential for reducing emissions through renewable energy and other means. Except for biofuels and biopower, wherever renewable energy equipment displaces fossil fuel use, it will also reduce carbon dioxide (CO₂) emissions, as well as pollutants that contribute to water pollution, acid rain, and urban smog. In general, the combustion of biomass for fuel and power production releases CO₂ at an intensity that may rival or exceed that for natural gas. However, the growth of biomass material, which absorbs CO₂, 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 release, and its displacement of any fossil fuel, including natural gas, reduces CO₂ emissions.

LEGISLATION

Public Laws

P.L. 109-58 (H.R. 6)

Energy Policy Act of 2005 (EPACT 2005). For renewables, Title II has several provisions: Section 202 reauthorizes REPI, Title II (Subtitle C) authorizes increased hydropower at existing dams, Section 203 sets a goal for renewables use in federal facilities and fleets, and Section 206 establishes a residential renewable energy rebate program.

Section 812 creates a program for using solar energy to produce hydrogen. Title IX provides funding reauthorizations for renewable energy R&D programs. Section 1253 would, under certain conditions, terminate PURPA cogeneration and small (renewable) power requirements. Title XIII has several tax incentives for renewables: Section 1301 extends the renewable energy production tax credit (PTC) for two years, Section 1303 creates \$800 million in renewable energy bonds, Section 1335 creates a 30% residential solar investment credit for two years, Section 1337 increases the business solar investment credit from 10% to 30% for two years, and Sections 1345, 1346, 1347, and 1348 create or extend credits for ethanol and biodiesel fuels. Title XV (Subtitle A) has several renewable fuels provisions covering ethanol, biofuels, cellulosic biodiesel, and municipal waste. In particular, Section 1501 sets a renewable fuels standard of 7.5 billion gallons per year by 2012 for increased use of ethanol and biodiesel. Section 1826 requires a study of passive solar energy. Conference reported (H.Rept. 109-190) July 27, 2005. Signed into law August 8.

P.L. 109-59 (H.R. 3)

Transportation Equity Act: A Legacy for Users (SAFETEA-LU). Section 1113 has a volumetric excise tax credit for alternative fuels. Section 1121 on High-Occupancy Vehicle (HOV) Lanes includes provisions for alternative-fueled vehicles. Section 1208 on High-Occupancy Vehicle (HOV) Lanes includes provisions for alternative-fueled vehicles and energy-efficient vehicles. Section 3010 on Clean Fuels Formula Grant Program includes provisions for biodiesel, alcohol fuels, and fuel cells. Section 3044 supports clean fuels, and Section 6015 supports clean fuel school buses. Conference reported (H.Rept. 109-203) July 28. Signed into law August 10.

P.L. 109-148 (H.R. 2863)

Department of Defense Appropriations Bill, 2006. Title II, regarding Operation and Maintenance, includes \$4.25 million for a wind power demonstration project on an Air Force base. Conference Committee reported (H.Rept. 109-359, p. 5) December 18, 2005. Signed into law December 30, 2005.

P.L. 109-171 (S. 1932)

Deficit Reduction Act of 2005. Section 1301 amends section 9006(f) of the Farm Security Act of 2002 to set a limit of \$3 million in FY2007 funding for the USDA Commodity Credit Corporation to carry out renewable energy and energy efficiency projects. Section 1402 terminates FY2007 funding authorization for the USDA Value-Added Producer Program (created by section 6401 of the Farm Security Act of 2002) to provide grants to renewable energy and energy efficiency projects. Conference reported (H.Rept. 109-362) December 19, 2005. Signed into law February 8, 2006.

Note: Three other public laws make appropriations for renewable energy programs. P.L. 109-97 (H.R. 2744), the Agriculture Appropriations Bill for FY2006, includes \$23 million for USDA's renewable energy grant and loan program; P.L. 109-102 (H.R. 3057, Section 585[a]), the Department of State's Appropriations Bill for FY2006, provides \$100 million for clean (renewable) energy and energy efficiency programs that seek to reduce greenhouse gas emissions in developing countries; and P.L. 109-103 (H.R. 2419) makes appropriations for the DOE renewable energy programs. These laws and bills are described in CRS Report RL32860, *Energy Efficiency and Renewable Energy Legislation in the 109th Congress*, by Fred Sissine.

Legislation

S. 2197 (Domenici)

Protecting America's Competitive Edge Through Energy Act (PACE-Energy Act) of 2006. Section 4 would create the Advanced Research Projects Authority — Energy (ARPA-E) at DOE. ARPA-E would implement an innovative energy research, technology development, and deployment program. Also, Subsection (c) would create at the Department of Treasury a revolving fund, the Acceleration Fund for Research and Development of Energy Technologies, with funding of \$300 million for FY2007, rising steadily until reaching \$1 billion in FY2011. Introduced January 26, 2006; referred to Committee on Energy and Natural Resources.

(A more extensive list of more than 140 bills appears in CRS Report RL32860, *Energy Efficiency and Renewable Energy Legislation in the 109th Congress*, by Fred Sissine.)

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(A more extensive list appears in CRS Report RL32860, *Energy Efficiency and Renewable Energy Legislation in the 109th Congress*.)

FOR ADDITIONAL READING

Tables showing DOE Renewable Energy R&D Funding trends back to FY1974 (current and constant) are available from the author of this issue brief.

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Table 2. DOE Renewable Energy Budget for FY2005-FY2007
(selected programs, \$ millions)

OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY (EERE)	FY2005 Appn.	FY2006 Appn.	FY2007 Request	FY2007- FY2006	Percent Change
HYDROGEN TECHNOLOGY	166.8	155.6	195.8	40.2	25.8%
Fuel Cell Technology	81.9	67.8	96.6	28.8	42.4%
BIOMASS & BIOREFINERY	87.5	90.7	149.7	59.0	65.0%
Biochemical Platform (Cellulose)	11.1	10.4	32.8	22.4	215.4%
SOLAR ENERGY	84.3	83.1	148.4	65.3	78.5%
Photovoltaics	65.8	60.0	139.5	79.5	132.6%
Concentrating Solar	5.9	7.4	8.9	1.5	19.9%
Solar Heating & Lighting	2.4	1.5	0.0	-1.5	-100.0%
WIND	40.6	38.9	43.8	5.0	12.8%
GEOHERMAL	25.3	23.1	0.0	-23.1	-100.0%
SMALL HYDRO	4.9	0.5	0.0	-0.5	-100.0%
VEHICLE TECHNOLOGIES	161.3	182.1	166.0	-16.1	-8.8%
BUILDING TECHNOLOGIES	65.2	69.3	77.3	8.1	11.6%
INDUSTRIAL TECHNOLOGIES	73.4	56.9	45.6	-11.3	-19.9%
DISTRIBUTED ENERGY*	59.1	0.0	—	—	—
FEDERAL ENERGY MGMT	19.9	19.2	16.9	-2.3	-11.8%
FACILITIES & INFRASTRUC. (National Renewable Energy Lab)	11.4	26.1	5.9	-20.1	-77.2%
WEATHER'N & INTERGOV.	325.5	316.9	225.0	-91.8	-29.0%
International Renewables	6.4	3.9	2.5	-1.4	-36.1%
Tribal Energy	5.5	4.0	4.0	0.0	-0.1%
Renew. Production Incentive	5.0	5.0	4.9	0.0	-0.1%
PROGRAM MANAGEMENT	115.1	111.9	102.0	-9.9	-8.8%
RENEWABLES, SUBTOTAL	270.3	275.2	359.2	84.0	30.5%
Renewables R&D Subtotal	242.5	236.2	341.9	105.6	44.7%
RENEWABLES, EARMARKS	52.0	80.0	0.0	-80.0	-100.0%
Prior Year Balances (EERE)	-5.3	—	—		
EERE, TOTAL	1,234.3	1,173.8	1,176.4	2.6	0.2%
Office of Electricity Delivery & Energy Reliability (OE)*	117.9	161.9	124.9	-36.9	-22.8%

Source: DOE FY2007 Congressional Budget Request, v. 3; Feb. 2006.

*Funding for Distributed Energy was moved to OE.