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

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Renewable Energy: Tax Credit, Budget, and Electricity Restructuring 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 Iraq war of 2003 and the terrorist attack of September 11, 2001 have led to heightened concern about energy security, the vulnerability of energy infrastructure, and the need for alternative fuels. Further, the 2001 electricity shortages in California brought a new emphasis to the role that renewable energy may play in electricity supply.

In the 108th Congress, debate over renewable energy programs is focusing on tax credits, incentives, budget, and provisions of the omnibus energy policy bill, H.R. 6.

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

For DOE's FY2003 Renewable Energy Program, the Bush Administration sought $407.0 million.

The Consolidated Appropriations Resolution (H.J.Res. 2) was signed into law as P.L. 108-7. For DOE's Renewable Energy Program, it appropriates $422.3 million (excluding $10.0 million in prior year balances), which is $39.6 million more than the FY2002 appropriation. The conference report (H.Rept. 108-10) notes that Biomass/Biofuels subprograms have been combined into a single program and the Solar Energy subprograms have been combined into a single program.

The FY2004 budget request for DOE's Renewable Energy Program seeks $444.2 million (excluding a funding for retirements), which is $27.7 million more than the FY2003 appropriation, not including inflation. It includes $49.4 million more for Hydrogen Technology (as part of the President's Hydrogen Fuel Initiative) and $15.0 million more for a National Climate Change Technology Initiative. It would also terminate the Concentrating Solar Power Program and cut Biomass/Biorefinery by $17.0 million. The request presents a new budget structure.

The House-passed omnibus energy bill (H.R. 6) has a renewable energy production tax credit (PTC), renewable energy fuel standard (RFS), and several other renewables provisions. Also, an adopted floor amendment (H.Amdt. 72), authorizes funds for the General Services Administration (GSA) to install solar electric equipment in public buildings. The Senate bill (S. 14) also has a PTC, RFS, and other renewables provisions, but with some differences from the House bill. Further, two floor amendments are expected that would, respectively, add a 10% renewable energy portfolio standard (RPS) and a 20% RPS. The 10% proposal is similar to the one passed by the Senate in the 107th Congress, but it is simpler and less prescriptive. However, it still faces concerns about the eligibility of energy from municipal solid waste and the eligibility conditions for municipal power agencies and rural electric cooperatives.

MOST RECENT DEVELOPMENTS

Senate floor action on the omnibus energy bill (S. 14) is expected to resume in mid-July. Debate is expected to focus on floor amendments that would add a renewable energy portfolio standard (RPS) and a renewable fuel standard (RFS). Also, the energy tax bill, S. 1149, is expected to come up as a floor amendment. It expands the renewable energy production tax credit, creates incentives for alternative fuels, and creates a residential tax credit for solar and geothermal equipment. Action was suspended on June 12, 2003, after about 350 amendments were proposed, including 40 on renewable energy. (For a comparison of the House and Senate provisions, see "Renewables in Omnibus Energy Bills, 108th Congress," hereafter.)

In late April 2003, the House Appropriations Committee issued updated appropriation figures for FY2003. On February 3, 2003, the Bush Administration issued its FY2004 budget request. For the Renewable Energy Program under DOE's Office of Energy Efficiency and Renewable Energy (EERE), it seeks $444.2 million (excluding funding for retirements), which is $27.7 million more than the FY2003 appropriation, not including inflation. It includes $49.4 million more for Hydrogen Technology (as part of the President's Hydrogen Fuel Initiative) and $15.0 million more for a National Climate Change Technology Initiative. It would also would terminate the Concentrating Solar Power Program and cut Biomass/Biorefinery Programs by $17.0 million. The request presents a new budget structure that follows from a major reorganization of the EERE Office.

(The DOE FY2004 Budget Request is on the DOE web site at [http://www.mbe.doe.gov/budget/04budget/content/es/solar.pdf].)

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 web site 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 2003,* renewable energy resources (excluding wood use for home heating) supplied about 5.3 Q (quadrillion Btu's or quads) of the 97.3 Q the nation used in 2001, or about 5.4% 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 recent 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 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 2003* projects that current policies would yield a 2.1% average annual increase in renewable energy production to 8.8 Q through 2025, resulting in a 65% total increase. This would amount to about 6.3% of the projected 139 Q total demand in 2025. (Detailed breakdowns of renewable energy use appear in EIA's *Renewable Energy Annual 2001* and *Renewable Energy 2000: Issues and Trends*.)

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* ([http://www.johannesburgsummit.org/]), which includes "Clean Energy" as one of five key policy actions. The U.S. Department of State plans to implement a $43 million Clean Energy Initiative in 2003 ([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 joint 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 *FY2003 Congressional Budget Request*, DOE/ME-0003, v. 3, February 2002.)

From FY1973 through FY2002, the federal government spent about $14.2 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 FY2002, it reached $403 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 FY2002, the federal government spent $49.1 billion for nuclear (fission and fusion), $24.8 billion for fossil, $14.2 billion for renewables, and $11.1 billion for energy efficiency. Total energy R&D spending from FY1948-FY2002, in 2003 constant dollars, reached $128.9 billion, including $73.4 billion, or 57%, for nuclear, $30.2 billion, or 23%, for fossil, $14.2 billion, or 11%, for renewables, and $11.1 billion, or 9%, for energy efficiency.

Tax Credits. The Energy Tax Act of 1978 (P.L. 95-618) created residential solar credits and the 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) systems. P.L. 106-170 expanded this credit to include poultry waste. On March 9, 2002, the Job Creation and Worker Assistance Act of 2002 (P.L. 107-147, H.R.

3090) was signed into law. Section 603 extends the production tax credit for wind, closed-loop biomass, and poultry waste, retrospectively, from December 31, 2001 to December 31, 2003.

Public Utility Regulatory Policies Act. The Public Utilities Regulatory Policies Act (PURPA, P.L. 96-917) 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, to receive avoided cost payments, each renewables facility must file for, and obtain, qualifying facility (QF) status from FERC. EIA's *Renewable Energy 2000: Issues* reports that, in 1998, QF renewable power capacity reached 12,700 megawatts (MW) and generation reached 64 billion kilowatt-hours (kwh). Thus, QFs provided about 1.6% of national electric capacity and about 1.7% of national electricity generation. In comparison, the capacity of all renewables reached 94,800 MW, or about 12% of national capacity; and generation for all renewables stood at 418,000, which is about 11.5% of national generation.

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.

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

DOE's Office of Energy Efficiency and Renewable Energy (EERE). This office is led by the Assistant Secretary for Energy Efficiency and Renewable Energy. In 2002, Assistant Secretary David Garman completed a major reorganization of EERE. The new management strategy is described in *Focused on Results: A New Government Business Model*, available at [http://www.eere.energy.gov/office_eere/pdfs/eere_reorg.pdf]. More information about EERE is available on the DOE web site [http://www.eere.energy.gov/office_eere/organization.html].

Renewables in Omnibus Energy Bills, 108th Congress

In the 108th Congress, most legislative action on renewables has focused on the omnibus energy policy bills, H.R. 6 and S. 14, the renewable fuel standard bills (S. 385 and S. 791) and the Senate energy tax bill, S. 1149 (replaces S. 597), which is expected to be added to S. 14 in floor action. On April 10, 2003, the House passed the omnibus energy bill (H.R. 6). It has a renewable energy production tax credit (PTC), renewable energy production incentive (REPI), renewable fuel standard (RFS), the residential solar and geothermal tax credit, and certain alternative fuels incentives. The Senate bill (S. 14 and S. 1149) has

similar provisions, but with some differences. Also, one renewable energy floor amendment (H.Amdt. 72) was adopted, which would authorize funds for the General Services Administration (GSA) to install solar electric equipment in public buildings. Other renewables provisions cover hydroelectric relicensing, geothermal leasing, biomass grants, and authorizations for renewable energy R&D programs. (For information on H.R. 4, the omnibus energy bill in the 107th Congress, see CRS Report RL31427.)

Renewable Portfolio Standard (RPS). In the 107th Congress, a 10% RPS provision was adopted (58-42) into the Senate version of H.R. 4, the omnibus energy bill. In the 108th Congress, an attempt was made in the House Committee on Energy and Commerce to amend H.R. 6 with an RPS provision, but it was rejected. In the Senate Committee on Energy and Natural Resources, an amendment to add a 10% RPS was defeated (11-12). Thus, as reported by Committee, the Senate omnibus energy bill does not include an RPS provision. However, one floor amendment is expected that would add a 20% RPS, similar to the one proposed in S. 944 (Section 3). Another draft floor amendment would add a 10% RPS, similar to the provision proposed in Committee. This draft amendment draws from the provision that was adopted in the Senate version of H.R. 4 in the 107th Congress. However, the new provision is different. It is much simpler and less prescriptive, leaving key decisions about its structure and leaves determination of its relationship to state measures up to the discretion of the DOE Secretary. Aside from the choice of the percentage target, the anticipated RPS amendment must address concerns about the eligibility of municipal solid waste energy resources and the conditions under which municipal power agencies and rural electric cooperatives may be qualified for tradeable credits. A CRS memorandum on RPS is available at [http://www.congress.gov/brbk/pdf/ebele27.pdf].

Production Tax Credit (PTC) and Production Incentive. The existing renewable energy production tax credit provides a 1.8 cents/kwh credit for businesses that generate power from wind, closed-loop biomass (energy crops), and poultry waste for sale to the grid. P.L. 107-147 extended this credit through Dec. 31, 2003. Both H.R. 6 (Section 41002) and S. 1149 would extend the credit for three years, through Dec. 31, 2006. They would also expand the eligible sources to include open-loop biomass (forest, agricultural, and construction wastes). H.R. 6 would further extend the credit to landfill gas and trash combustion facilities. S. 1149 does not include landfill gas and trash facilities, but would expand credit eligibility to swine and bovine waste, geothermal energy, solar energy, small irrigation power facilities, municipal biosolids, and recycled sludge. Further, S. 1149 (Section 104) sets conditions under which the credit could be transferable.

Parallel to the PTC, there is a renewable energy production "incentive" (REPI) for state and local governments. This 1.5 cent/kwh incentive was created by EPACT Section 1212 and it is funded through appropriations to DOE. H.R. 6 (Section 16072) and S. 14 (Section 502) have identical provisions that would extend this incentive through 2023 and add landfill gas to the list of eligible resources.

Renewable Energy Fuel Standard (RFS). According to the Renewable Fuels Association, the ethanol industry produced 2.2 billion gallons in 2002. H.R. 6 (Section 17101) sets a target for blending gasoline with renewable fuels, including ethanol and biodiesel. The RFS would start in 2005 at 2.7 billion gallons per year and grow to 5.0 billion gallons per year in 2015. Also, it extends exemption from product liability claims (safe harbor) to methyl tertiary-butyl ether (MTBE) producers. In Senate floor action on June 5,

2003, the approval (67-29) of S.Amdt 850 to S. 14 added an RFS provision that sets a 5.0 billion gallon target for 2012. Further, it bans use of MTBE. Also, S.Amdt. 854 was approved (voice vote) as a second-degree amendment to S.Amdt. 850. It encourages the use of cellulosic ethanol to attain the target by raising the value of 1.0 gallon of cellulosic ethanol from a previous level of 1.5 gallons of renewable fuel to 2.5 gallons. Several amendments (nos. 843, 844, 851, 853) to allow waivers or exemptions from the RFS were defeated.

Renewable Hydrogen. H.R. 6 (Section 60003) 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. Some hydrogen provisions of S. 14 (Sections 801-825) include references (e.g. Section 802) to renewables.

Residential Tax Credit. H.R. 6 (Section 41001) and S. 1149 (Section 303) would create a 15% residential tax credit worth up to $2,000 for homeowners who purchase photovoltaics and solar water heating equipment. The Solar Energy Industry Association says the credit would be more effective with a $4,000 cap and shorter eligibility period. The Senate version also provides a 30% credit worth up to $1,000 for wind energy equipment.

Alternative Fuels Incentives. In H.R. 6, Sections 15011-15024, 15046, 17102-17108, and 21703 have measures related to alternative fuels and vehicles. In S. 1149, Sections 201-209 contain incentives for ethanol, biodiesel, and other alternative fuels.

Other renewable energy provisions are identified in **Table 1**, below.

Table 1: Omnibus Energy Bills: Other Provisions

Provision	**H.R. 6**	**S. 14**
Hydropower	13001-13204	511
Cogen. / Small Power	16062	1145
Net Metering	16071	1141
Federal Lands	16073, 30501-30503	121-126
Resource Assessment	16074	501
Funding Authorization	21301-21322	931-935
Biomass / Biopower	21706, 30301	531-534
Indian Energy	30301	303
Geothermal Energy	30601-30614	521-526
Insular Areas	30801	505
Federal Purchases	H. Amdt. 72	504

Renewables Tax Revenue Effect. **Table 2** compares the estimated 10-year revenue effect of renewable energy and alternative fuel tax provisions in H.R. 6 (H.R. 1531) and S. 14 (S. 1149). It also shows percentage share of renewables relative to the total in each bill.

Table 2: Omnibus Energy Bills, Tax Revenue Effect
($ billions)

	H.R. 6 (H.R. 1531)	S. 14 (S. 1149)
Renewable Production Tax Credit	$ 3.19	$ 2.95
Residential Solar Tax Credit	$ 0.11	$ 0.11
Alternative Fuels and Vehicles	$ 0.31	$ 2.32
Total, Renewables & Alternative Fuels	$ 3.61	$ 5.38
Total, All Tax Provisions	$18.67	$15.25
Renewables Share of Total	19.3%	35.3%

Source: Joint Tax Committee. Estimated Revenue Effects of H.R. 1531, April 3, 2003, and Estimated Revenue Effects of S. 1149, May 30, 2003.

FY2004 DOE Budget

The FY2004 request for DOE finds that hydrogen energy is the "most promising long-term revolution in energy use that can help the nation "liberate itself from dependence on imported oil," according to the Budget of the U.S. Government FY2004 (p 105). The FY2004 request for DOE's Renewable Energy Program elaborates that its aim is to "accelerate progress" and make hydrogen technologies "cleaner, safer, and lower in cost." Further, it stresses that the new National Climate Change Technology Initiative will create "competitive solicitations" in applied research that aims to reduce greenhouse gas emission and will "complement" existing R&D programs.

FY2003 USDA Budget

In the 108th Congress, debate has surfaced over appropriations for executing the mandatory spending requirements for renewable energy and energy efficiency programs, set by Title IX (Section 9006) of the Farm Security and Rural Investment Act of 2002.

The Department of Agriculture's (USDA) renewable energy programs have recently grown, spurred by federal bioenergy initiatives (P.L. 106-224, Executive Order 13134), the President's National Energy Policy, and the Farm Security Act (P.L. 107-171). According to USDA, renewable energy program funding reached $247.6 million in FY2002. Table 3 shows some funding details. Also, for FY2003, Section 6013 of the Farm Security Act of 2002 provides loan guarantees for renewable energy equipment and broadens the range of

Table 3. USDA Funding for Renewable Energy Programs
($ millions)

	FY2001	FY2002	FY2003*
Biobased Products and Bioenergy Programs			
Agricultural Research Service	48.9	64.2	67.4
Commodity Credit Corporation (CCC)*	40.7	150	-----
Cooperative State Research, Education, Extension	23	12.3	14.2
Forest Service	12.5	12.5	17.5
Other	8	8.2	3.4
Subtotal, Biobased Products and Bioenergy Programs*	133	247.2	102.5
Substitution: Solar and Wind Energy Programs	0.4	0.4	0.4
Farm Security Act, Title IX (mandatory appropriations)	-----	-----	39
Total*	133.4	247.6	141.9
*The appropriations for the FY2003 CCC Bioenergy Incentives Program have not yet been set. The Senate has recommended $50 million and the House has recommended $150 million.			

Source: USDA. Office of Energy Policy and New Uses. Selected tables from Roger Conway, October 29, 2002.

renewable energy equipment available for loans. Sections 2101 and 6401 of the Act provide other programs and incentives for renewable energy (For more information about USDA Bioenergy Programs, go to the website at [http://www.ars.usda.gov/bbcc/index.htm]).

Electricity from Renewable Energy

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. H.R. 6 (Section 16062) and S. 14 (Section 1145) include a conditional repeal of the mandatory renewables purchase requirement in Section 210 of PURPA. (For a discussion of broader electricity restructuring issues, see the CRS Electronic Briefing Book on *Electricity Restructuring* at [http://www.congress.gov/brbk/html/ebele1.shtml].)

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 107th Congress, the Senate version of H.R. 4 had an RPS (see above under "Renewable Energy Portfolio Standard").

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 the web site [http://www.eren.doe.gov/greenpower/home.shtml].)

Distributed Generation. Distributed generation 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. (More information about DOE's Distributed Power Program is available at [http://www.eren.doe.gov/distributedpower/]).

Net Metering. Net metering allows customers with generating facilities to "turn their electric meters backwards" when they are feeding power into the grid, so that they receive retail prices for the excess electricity they generate. This encourages customer investment in distributed generation, which includes renewable energy equipment. In 2002, California enacted laws (AB58, Chapter 836; AB2228, Chapter 845) that encourage net metering, including a provision that permanently raises the size limit from 10 kw to 1 Mw. Also, H.R. 6 (Section 16071) and S. 14 (Section 1141) provide nearly identical language for net metering.

Natural Gas and Renewables

Biomass-Generated Synthetic Natural Gas. The natural gas price spike in spring 2003 has created interest in using renewables to dampen natural gas demand. EIA data presented at a June 10 hearing of the House Energy and Commerce Committee show not only that natural gas is used for heating, but that a growing share is used for electric power generation. Renewable energy (mainly biomass) can be used to produce methane (the main component of natural gas) to substitute for natural gas directly. Also, a variety of renewables can generate electricity that indirectly displaces natural gas use for power generation. In 2002, the nation used about 20 trillion cubic feet (Tcf) of natural gas. DOE says biomass currently produces about 110 billion cubic feet of methane, mostly in the form of biogas (LFG, 55% methane) from landfills. More than half is used for direct heat and the remainder for power that is sold to the grid. There are 1,100 MW of LFG power facilities in place. For its methane outreach programs, EPA reports about 400 MW of proposed projects that could be accelerated in the short term. Further, DOE projects that over a five-year period biomass resources (mainly urban residues and mill residues) could produce over 1 tcf per year of synthetic natural gas. Incorporating energy crops could allow the annual production to reach 3 to 5 Tcf by 2020.

Substituting Electricity from Renewables for Gas-Fired Generation. The American Wind Energy Association (AWEA) says that the installed base of wind farms,

including those that will be installed by the end of 2003, will produce enough electric power to save 0.18 trillion cubic feet (Tcf) of natural gas that would otherwise be used for power generation in 2004. Assuming the current gas shortfall is about 1.5 Tcf, AWEA concludes that wind power lessens the shortfall by 10% to 15%. To help with an ongoing natural gas problem, AWEA further projects that over the next four years accelerated wind power production could reach the equivalent of 1.1 Tcf per year. That rapid increase assumes significant enhancements of power transmission capacity in the Midwest and West. Similarly DOE's report *Scenarios for a Clean Energy Future* (Table 7.11) projects that biomass-based power production could be greatly accelerated through 2010. This acceleration assumes the PTC is extended, R&D spending is enhanced, national RPS is enacted, and other policy changes.

Climate Change and Renewables

Because most forms of renewable energy generate no carbon dioxide (CO_2), renewables are seen as a key long-term resource that can 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 2000 report, *Scenarios for a Clean Energy Future*, estimates that new policies could triple non-hydro renewables electricity production in 2010 from a projected business-as-usual 86 billion kilowatt-hours (Bkwh) to 265 Bkwh. 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 can play in curbing global CO_2 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 (CO_2) and other human-generated emissions.

The federal government funds programs for renewable energy as a mitigation measure at DOE, the Department of Agriculture (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 CO_2 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 (CO_2) 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 CO_2 at an intensity that may rival or exceed that for natural gas. However, the growth of biomass material, which absorbs CO_2, 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 CO_2 emissions.

LEGISLATION

P.L. 108-7, Division D (H.J.Res. 2)

Consolidated Appropriations Resolution for FY2003. The Energy and Water Appropriations Bill appears as Division D of the Resolution and it appropriates $422.3 million (excluding $10.0 million in prior year balances) for DOE's Renewable Energy program, which is $39.6 million more than the FY2002 appropriation. The conference report (H.Rept. 108-10) notes that the Biomass/Biofuels subprograms are combined into a single program and the Solar Energy subprograms are combined into a single program. House passed as a continuing resolution, January 8, 2003. Senate inserted its amendment (S.Amdt 1) and issued an unnumbered committee print (*Congressional Record*, p. S492) January 15, 2003. Passed Senate, amended, January 23, 2003. Conference reported (H.Rept. 108-10) February 13. Passed House and Senate February 13. Signed into law February 20.

P.L. 108-7, Division E (H.J.Res. 2)

Consolidated Appropriations Resolution for FY2003. The Foreign Operations, Export Financing, and Related Programs Appropriations Bill appears as Division E of the Resolution. Appropriates funding for renewable energy and energy efficiency under programs of the Global Environment Facility (GEF), U.S. Agency for International Development (AID), Overseas Private Investment Corporation (OPIC), and other bilateral and multilateral programs. Under Development Assistance, Section 555 appropriates $175 million in a new account to create a fund for "energy conservation, energy efficiency, and clean energy" in developing countries. As noted above, signed into law February 20.

H.R. 6 (Tauzin)

Omnibus Energy Bill. Includes provisions for renewable energy production tax credit (PTC), renewable energy production incentive (REPI), renewable energy fuel standard (RFS), renewable hydrogen, residential solar tax credit, alternative fuels, and others. Incorporates renewable energy provisions of H.R. 39, H.R. 238, and H.R. 1531. Introduced April 7, 2003; referred to Committee on Energy and Commerce and several other committees. Passed House, amended, April 10.

S. 14 (Domenici)

Omnibus Energy Bill. Renewable energy appears as Titles V. Also, Title VII A covers alternative fuels, Title VIII covers hydrogen, Title IX covers R&D authorizations, and Title XI on Electricity includes provisions on PURPA and net metering. S. 1149 (energy tax bill) and S. 385 and S. 791 (renewable fuels mandate) are expected to be incorporated into S. 14. Introduced April 30, 2003. Floor action began May 6.

S. 597 (Grassley)

Energy Tax Incentives Act of 2003. Contains provisions for renewable energy production tax credit, alternative fuels incentives, and residential solar energy property. Introduced March 11, 2003; referred to Committee on Finance. Superseded by S. 1149.

S. 944 (Jeffords)

Renewable Energy Investment Act. Would establish a renewable portfolio standard (RPS) that reaches 20% by the year 2020. Introduced April 9, 2003; referred to Committee

on Energy and Natural Resources. Expected to be offered as floor amendment to omnibus Senate energy bill.

S. 1149 (Grassley)

Energy Tax Incentives Act of 2003. Contains provisions for renewable energy production tax credit (Title I, Section 101), alternative fuels incentives (Title II), and residential solar energy property (Title III, Section 301). Committee on Finance reported (S.Rept. 108-54) May 23, 2003. Expected to be incorporated into S. 14 as a floor amendment.

CONGRESSIONAL HEARINGS, REPORTS, AND DOCUMENTS

U.S. Congress. House. Committee on Energy and Commerce. Subcommittee on Energy and Air Quality. The Hydrogen Energy Economy. Hearing held May 20, 2003.

U.S. Congress. Joint Committee on Taxation. Description of Revenue Provisions Contained in the President's Fiscal Year 2004 Budget Proposal. (Energy Provisions) [http://www.house.gov/jct/s-7-03.pdf]. March 2003. p. 122-145.

U.S. Congress. House. Committee on Appropriations. Subcommittee on Energy and Water. FY2004 Renewable Energy Budget Request. Hearing held March 13, 2003.

U.S. Congress. Senate. Committee on Appropriations. Subcommittee on Energy and Water. DOE FY2004 Budget Request for Energy Efficiency and Renewable Energy. Hearing held March 12, 2003.

CRS Reports

CRS Issue Brief IB10116. *Energy Policy: The Continuing Debate*, by Rob Bamberger.

CRS Memorandum. *Renewable Energy Portfolio Standard (RPS)*, by Fred Sissine.

CRS Report RL31033. *Energy efficiency and renewable energy fuel equivalents to potential oil production from the Arctic National Wildlife Refuge (ANWR)*, by Fred Sissine.

CRS Report RS20270. *Renewable energy and electricity restructuring*, by Fred Sissine.

CRS Electronic Briefing Book. *Electric utility restructuring and reliability*, by Amy Abel. [http://www.congress.gov/brbk/html/ebele1.shtml]

CRS Report RS21442. *Hydrogen and fuel cell vehicle R&D: freedomCAR and the President's hydrogen fuel initiative*, by Brent Yacobucci.

CRS Issue Brief IB10054. *Energy tax policy*, by Salvatore Lazzari and Mark Holt.

CRS Report RL30369. *Fuel ethanol: background and public policy issues*, by Brent Yacobucci.

FOR ADDITIONAL READING

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

American Solar Energy Society. *Renewable hydrogen forum*. April 10-11, 2003. 50 p.

Barry, Courtney. *Winds of change in Texas*. Public Utilities Fortnightly, v. 141, no. 7, April 1, 2003. p. 27-31.

Blankinship, Steve. *A sunny outlook for grid-connected PV*. Power Engineering, v. 107, no. 1, May 2003. p. 32-40.

Cato Institute. Policy Analysis. *Evaluating the case for renewable energy: is government support warranted?* January 10, 2002. 16 p.

Edison Electric Institute. [http://www.eei.org/]

Electric Power Research Institute (EPRI) and EPRI Journal Online. [http://www.epri.com/]

—— *Renewable power industry status overview*. EPRI December 1998. 1 vol. (EPRI TR-111893).

Energy Future Coalition. Challenge and opportunity: charting a new energy future, report of the bioenergy and agriculture working group. [http://www.energyfuturecoalition.com/]. 2003. 13 p.

International Energy Agency. *Renewables information 2002*. December 2002. 170 p. [http://www.iea.org/stats/files/Ren2002.pdf]

Loiter, Jeffrey M. and Norberg-Bohm, Vicki. *Technology policy and renewable energy*. Energy Policy, v. 27, 1999. p. 85-97.

Polachek, Jay S.. *Cape Cod: twisting in the wind?* Public Utilities Fortnightly, May 15, 2002. p. 28-37.

Sklar, Scott and Sheinkopf, Kenneth. *Consumer guide to solar energy: new ways to lower utility costs, cut taxes, and take control of your energy needs.* 2002. 195 p.

U.S. Department of Interior. Bureau of Land Management. *Assessing the potential for renewable energy on federal lands*. May 2002. 89 p. [http://www.nrel.gov/docs/gen/fy02/32077Draft.pdf]

U.S. Department of Energy. Interlaboratory Working Group. *Scenarios for a Clean Energy Future*. (ORNL/CON-476) November 2000. 350 p. [http://www.ornl.gov/ORNL/Energy_Eff/CEF.htm]

—— Energy Information Administration. *Federal financial interventions and subsidies in energy markets 1999: primary energy.* (SR/OIAF/99-03). 1999.

—— Lawrence Berkeley Laboratory. *Case Studies of State Support for Renewable Energy.* September 2002.

—— Lawrence Berkeley Laboratory and National Renewable Energy Laboratory. *Forecasting the growth of green power markets in the United States.* 2001.

—— National Renewable Energy Laboratory. Domestic energy scenarios. 2003. 25 p. [http://www.nrel.gov/docs/fy03osti/32742.pdf]

—— *Enhancing homeland security through renewable energy – Richard Truly's remarks to the National Press Club*. March 14, 2002. 7 p. [http://www.nrel.gov/news/news.html]

—— *The Clean Air Act and renewable energy: opportunities, barriers, and options.* (NREL/CP-620-29654). 2001.

U.S. Environmental Protection Agency. *Climate action report: The United States of America's third national communication under the United Nations Framework Convention on Climate Change.* June 2002. 260 p. [http://yosemite.epa.gov/oar/globalwarming.nsf/content/ResourceCenterPublicationsUSClimateActionReport.html]

U.S. Executive Office of the President. *Powerful partnerships: the federal role in international cooperation on energy innovation*. June 1999. 260 p.

U.S. Executive Office of the President. *National Energy Policy Report.* May 2001. 170 p. [http://www.whitehouse.gov/energy/National-Energy-Policy.pdf]

U.S. General Accounting Office. *Renewable energy: DOE's funding and markets for wind energy and solar cell technologies.* (GAO/RCED-99-130) May 1999. 38 p.

Wiser, Ryan et al. *Renewable energy policy and electricity restructuring: a California case study*. Energy Policy, v. 26, 1998. p. 465-475.

Web Sites

American Council for Renewable Energy. [http://www.americanrenewables.org/]

American Solar Energy Society. [http://www.ases.org/]

American Wind Energy Association (AWEA). [http://www.awea.org/]

California Energy Commission. [http://www.energy.ca.gov/renewables/index.html]

Database of State Incentives for Renewable Energy (IREC). [http://www.dsireusa.org/]

Databook of Renewable Energy Power Technologies.

[http://www.nrel.gov/analysis/power_databook/chapters.asp]

Earthtrack (Database of Energy Subsidies). [http://www.earthtrack.net/]

National Association of Regulatory Utility Commissioners. [http://www.naruc.org/]

Eighth Session of the Conference of Parties to the United Nations Framework Convention on Climate Change (New Delhi, COP-8). October 23 - November 1, 2002. [http://unfccc.int/cop8/index.html]

Renewable Energy Policy Project. [http://solstice.crest.org/]

Renewable Energy Web Site. International Energy Agency (IEA). [http://library.iea.org/renewables/index.asp]

Solar Electric Power Association (SEPA). [http://www.solarelectricpower.org/]

Solar Energy Industries Association (SEIA). [http://www.seia.org/]

U.S. Department of Energy. Energy Efficiency and Renewable Energy Network. [http://www.eren.doe.gov/]

U.S. Department of Energy. Green Power Network Clearinghouse. [http://www.eren.doe.gov/greenpower/home.shtml]

U.S. Department of Energy. National Renewable Energy Laboratory (NREL). [http://www.nrel.gov/]

U.S. Department of Energy. Alternative Fuels Data Center. [http://www.afdc.nrel.gov/]

U.S. Environmental Protection Agency. Solar Site. [http://www.epa.gov/solar/]

Vote Solar Initiative. San Francisco's $100 Million Solar Revenue Bond Initiative. [http://www.votesolar.org/sf.html]

Table 4. DOE Renewable Energy Budget for FY2002-FY2004

($ millions)

OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY	FY2002 App.	FY2003 App.	FY2004 Request	FY2004 - FY2003	Percent Diff.
HYDROGEN	28.9	38.5	88.0	49.4	128%
Production & Delivery	11.1	11.3	23.0	11.7	103%
Storage R&D	6.1	10.9	30.0	19.1	175%
Safety, Codes, Standards & Use	4.5	4.6	16.0	11.4	247%
Infrastructure Validation	5.7	9.7	13.2	3.4	35%
SOLAR ENERGY	87.1	83.8	79.7	-4.1	-5%
Concentrating Solar	13.0	5.3	0.0	-5.3	-100%
Photovoltaics	70.9	74.7	76.7	2.0	3%
Solar Building Technology Research	3.2	3.9	3.0	-0.9	-22%
ZERO-ENERGY BUILDINGS	1.4	7.7	4.0	-3.7	-48%
WIND ENERGY	38.2	42.4	41.6	-0.8	-2%
HYDROPOWER	5.0	5.1	7.5	2.4	47%
GEOTHERMAL ENERGY	27.0	28.9	25.5	-3.4	-12%
BIOMASS & BIOREFINERY	86.1	86.7	69.8	-17.0	-20%
Advanced Technology R&D	38.4	37.8	31.0	-6.8	-18%
Systems & Production	47.8	46.0	38.8	-7.3	-16%
INTERGOVERNMENTAL	5.7	14.4	12.5	-1.9	-13%
International Renewables	2.8	3.9	6.5	2.6	69%
Tribal Energy	2.8	5.8	6.0	0.2	4%
NREL Deployment	0.0	3.9	0.0	-3.9	----
High Temp. Superconductivity R&D	32.0	39.5	47.8	8.4	21%
Transmission Reliability R&D	18.3	22.0	10.7	-11.2	-51%
Distribution & Interconnection	10.8	11.3	7.2	-4.0	-36%
Energy Storage	9.1	9.2	5.0	-4.2	-45%
Production Incentive	3.8	4.8	4.0	-0.8	-17%
Facilities & Infrastructure	4.9	5.3	5.0	-0.3	-7%
Program Direction	18.7	15.4	16.6	1.2	8%
Nat. Climate Change Init.	0.0	0.0	15.0	15.0	----
RENEWABLES, Total	382.0	417.2	444.9	27.7	7%

Source: DOE, EERE Pocket Card, Apr. 30, 2003; H.Rept. 108-10; DOE FY2004 Cong. Budget Request, v. 3; Feb. 2003 (p. 244-247).