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IMPACT OF TAX POLICIES ON THE COMMERCIAL APPLICATION OF RENEWABLE ENERGY TECHNOLOGY

HEARING

BEFORE THE

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT
JOINT WITH THE
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

ONE HUNDRED TWELFTH CONGRESS

SECOND SESSION

THURSDAY, APRIL 19, 2012

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IMPACT OF TAX POLICIES ON THE COMMERCIAL APPLICATION OF RENEWABLE ENERGY TECHNOLOGY

THURSDAY, APRIL 19, 2012

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT,
JOINT WITH THE
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, DC.

The Subcommittees met, pursuant to call, at 9:42 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Paul Broun [Chairman of the Subcommittee on Investigations and Oversight] presiding.

RALPH M. HALL, TEXAS
CHAIRMAN

EDDIE BERNICE JOHNSON, TEXAS
RANKING MEMBER

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Subcommittees on Investigations & Oversight and Energy & Environment Hearing

Impact of Tax Policies on the Commercial Application of Renewable Energy Technology

Thursday, April 19, 2012
9:30 a.m. to 11:30 a.m.
2318 Rayburn House Office Building

Witnesses

Panel I
Dr. Molly F. Sherlock, Specialist in Public Finance, Congressional Research Service

Mr. John Parcell, Acting Deputy Tax Legislative Counsel, U.S. Department of the Treasury

Dr. Michael Pacheco, Vice President, Deployment and Market Transformation, National Renewable Energy Laboratory

Panel II
Mr. Rhone Resch, President and CEO, Solar Energy Industries Association

Mr. Terry Royer, CEO, Winergy Drive Systems Corporation

Mr. Steven Erby, Vice President, Monolith Solar Associates, LLC

Dr. Benjamin Zycher, Visiting Scholar, American Enterprise Institute

Dr. Margo Thorning, Senior Vice President and Chief Economist, American Council for Capital Formation

Ms. Lisa Linowes, Executive Director, Industrial Wind Action Group

U.S. House of Representatives
Committee on Science, Space, and Technology
Subcommittee on Investigations and Oversight
and the
Subcommittee on Energy and Environment

HEARING CHARTER

"Impact of Tax Policies on the Commercial Application of Renewable Energy Technology"

Thursday, April 19, 2012
9:30 a.m. – 11:30 a.m.
2318 Rayburn House Office Building

1. Purpose

On Thursday, April 19, 2012, the Committee on Science, Space, and Technology's Subcommittee on Investigations and Oversight and the Subcommittee on Energy and Environment will hold a joint hearing titled, "Impact of Tax Policies on the Commercial Application of Renewable Energy Technology."[1] The purpose of the hearing is to examine recently expired, current, and proposed renewable energy tax preferences, and their impact on the commercial application of renewable energy technologies.

2. Witness List

Panel 1

Dr. Molly F. Sherlock, Specialist in Public Finance, Congressional Research Service
Mr. John Parcell, Acting Deputy Tax Legislative Counsel U.S. Department of the Treasury
Dr. Michael Pacheco, Vice President, Deployment and Industrial Partnerships, National Renewable Energy Laboratory

Panel 2

Mr. Rhone Resch, President and CEO, Solar Energy Industries Association
Mr. Terry Royer, CEO, Winergy Drive Systems Corporation, Elgin, IL
Mr. Steven Erby, Vice President, Monolith Solar Associates, LLC, Rensselaer, NY
Dr. Benjamin Zycher, Visiting Scholar, American Enterprise Institute
Dr. Margo Thorning, Senior Vice President and Chief Economist, American Council for Capital Formation
Ms. Lisa Linowes, Executive Director, Industrial Wind Action Group, Lyman, NH

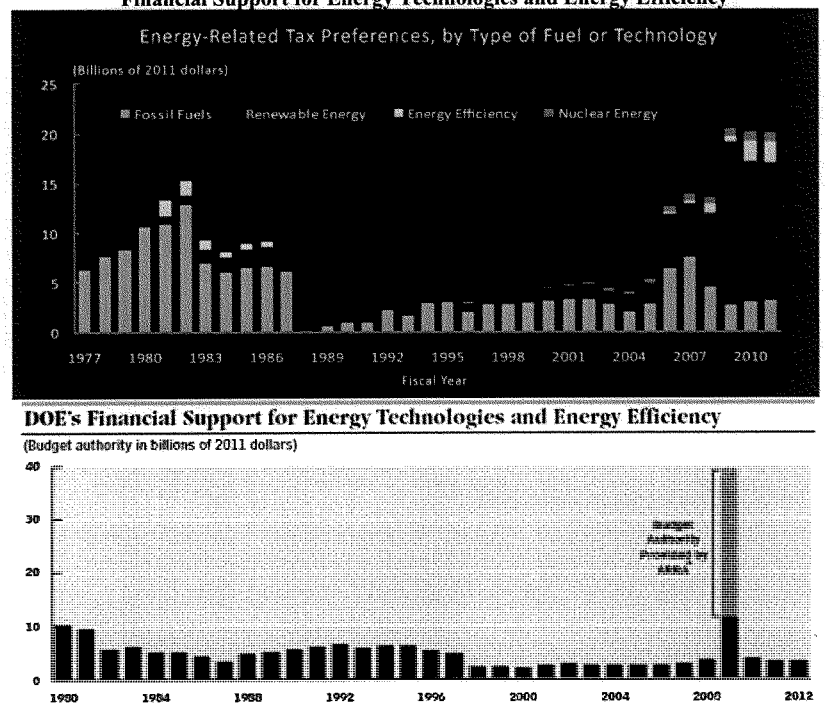
[1] The hearing is being conducted pursuant to clause (1)(p)(6) of House rule X, which assigns the Committee on Science, Space, and Technology jurisdiction over the "commercial application of energy technology," and clause 2(c) of House rule X, which requires "[e]ach standing committee" to "review and study on a continuing basis the impact or probable impact of tax policies affecting subjects within its jurisdiction."

3. Background

The Federal Government supports the production and use of fossil fuels, nuclear and renewable energy, and increased energy efficiency through direct financial support to energy producers and consumers,[2] and through the use of energy tax preferences that reduce the taxes paid by producers and consumers of energy from these fuels and technologies.

As shown in Figure 1, in many years of the recent decades (with the notable exception of 2009, (which saw the passage of the American Recovery and Reinvestment Act of 2009 (ARRA)), the combined cost of the reduced revenues and increased outlays from these tax preferences have far exceeded the levels of direct financial support by the Department of Energy (DOE).

Figure 1. Energy-Related Tax Preferences, by Type of Fuel or Technology and DOE's Financial Support for Energy Technologies and Energy Efficiency[3]



[a]Reflects transfers and rescissions of budget authority for Section 1705 loan guarantees after ARRA was enacted.

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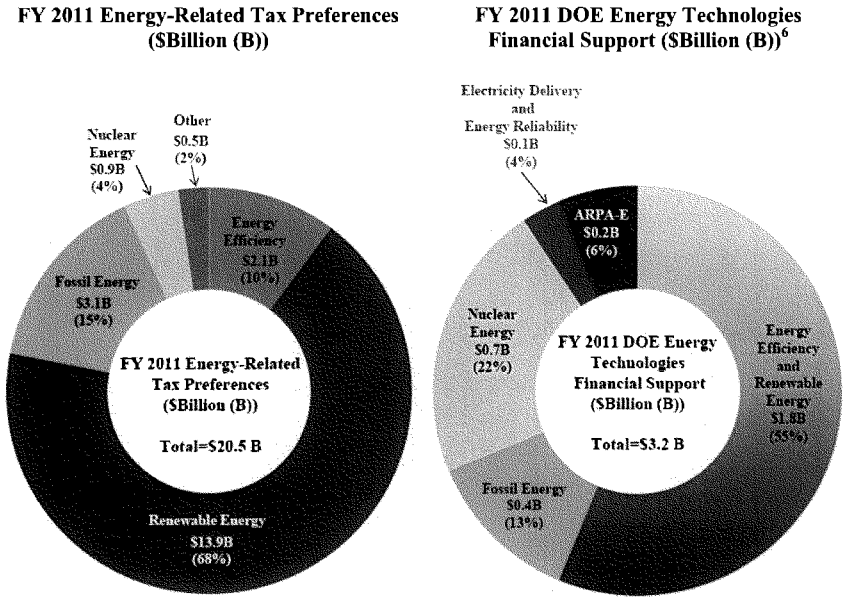
[2]Examples include the Department of Energy's energy research and development (R&D), weatherization and loan guarantee programs.

[3]Terry Dinan and Philip Webre, *Federal Financial Support for the Development and Production of Fuels and Energy Technologies*, Congressional Budget Office, Issue Brief, March 2012, Figure 1, p. 4, and Figure 3, p. 6 (http://www.cbo.gov/sites/default/files/cbofiles/attachments/03-06-FuelsandEnergy_Brief.pdf).

First established in 1916 to stimulate domestic production of oil and natural gas, energy tax preferences were expanded in the 1970's—primarily under the Carter Administration—to include energy efficiency, alternative fuels and renewable energy technologies. These were reduced considerably in the 1980's during the Reagan Administration, and then expanded again during the George H.W. Bush, Clinton, George W. Bush, and Obama Administrations.[4] As shown in Figure 1 above, the cost of these energy tax preferences grew rapidly after 2005—particularly for renewable energy. And, as shown in Figure 2, the Congressional Budget Office (CBO) recently estimated the FY 2011 tax preference costs for all sources of energy at $20.5 billion. Renewable energy tax preferences account for $13.9 billion, or 68%, of this amount, far exceeding DOE's $3.2 billion in direct financial support for overall energy technology development.

Figure 2. FY 2011 Cost of Energy-Related Tax Preferences and DOE's Support for Energy Technologies[5]



[4]Molly F. Sherlock, *Energy Tax Policy: Historical Perspectives on and Current Status of Energy Tax Expenditures*, CRS Report R41227, May 2, 2011, pp. 2-10.

[5]Terry Dinan and Philip Webre, *Federal Financial Support for the Development and Production of Fuels and Energy Technologies*, Congressional Budget Office, Issue Brief, March 2012, Table 1, p. 3 and Figure 2, p. 5 (http://www.cbo.gov/sites/default/files/cbofiles/attachments/03-06-FuelsandEnergy_Brief.pdf); and Department of Energy, *FY 2013 Congressional Budget Request* ***Budget Highlights***, Office of Chief Financial Officer, DOE/CF-0077, February 2012, p. 17 (http://www.mbe.doe.gov/budget/13budget/Content/Highlights.pdf).

[6]DOE's FY 2011 energy technologies financial support figures include budget authority (BA) for energy efficiency and renewable energy R&D and weatherization, fossil energy R&D, nuclear energy R&D and facilities management, electricity and energy reliability, and ARPA-E programs.

Current energy tax preferences and their FY 2011- FY 2015 cost are shown Table 1 and in Figure 3. The five-year total is $70.2 billion, with renewable energy accounting for $43.1 billion (61.4%), fossil energy for $12.5 billion (17.8%), other/miscellaneous for $7.6 billion (10.8%), energy efficiency and conservation for $4.5 billion (6.4%), and alternative technology vehicle for $2.5 billion (3.6%).

Table 1. Cost of Energy Tax Preferences: FY 2011-FY 2015[7]

Tax Preference	Cost 2011-2015 ($Billions)
Fossil Energy	
Expensing of percentage over cost depletion[a]	$5.5
Expensing of exploration and development costs	$4.4
Amortization of geological and geophysical expenditures associated with oil and gas exploration	$0.6
Coal Production Credits[a]	$0.2
Credits for investing in clean coal facilities	$1.0
Amortization of air and pollution control facilities	$0.8
Subtotal, Fossil Energy	***$12.5***
Renewable Energy Resources	
Credits for electricity production from renewable resources ("PTC" or "production tax credit")[b]	$9.1
Energy credit ("ITC" or "investment tax credit")[b]	$2.5
Section 1603 grants in lieu of tax credits	$15.9
Residential energy-efficient property credit	$0.9
Five-year cost recovery of certain energy property	$1.1
Credits for holders of clean renewable energy bonds	$0.4
Credit for alcohol fuels, biodiesel, and alternative fuels[a]	$11.8[8]
Advanced energy manufacturing tax credit	$1.4
Subtotal, Renewable Energy Resources	***$43.1***
Energy Efficiency and Conservation	
Credit for nonbusiness energy property[a]	$2.8
Deduction for expenditures on energy-efficient commercial property	$0.9
Exclusion of energy conservation subsidies provided by public utilities	$0.1
Energy-efficient new home credit[a]	$0.1
Credit for producing energy-efficient appliances[a]	$0.4
Qualified energy conservation bonds	$0.2
Subtotal, Energy Efficiency and Conservation Energy	***$4.5***
Alternative Technology Vehicle	
Hybrid vehicles, other alternative fuel vehicles, and plug-in electric vehicles	$2.2
Credits for clean fuel vehicle refueling property	$0.3
Subtotal, Alternative Technology Vehicle	***$2.5***
Other/Miscellaneous	
Election to expense 50% of qualified property used to refine liquid fuels	$3.0
Exceptions for energy-related publicly traded partnerships	$1.2
Exclusion of interest on State and local government private activity bonds for energy production facilities	$0.2
Depreciation recovery periods for energy specific items	$2.1
Deferral of gains from the sale of electric transmission property[a]	$1.1
Subtotal, Other/Miscellaneous	***$7.6***
Total, Energy Tax Provisions	***$70.2***

[a]Indicates that the provision was extended or modified by The Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010 (P.L. 111-312).

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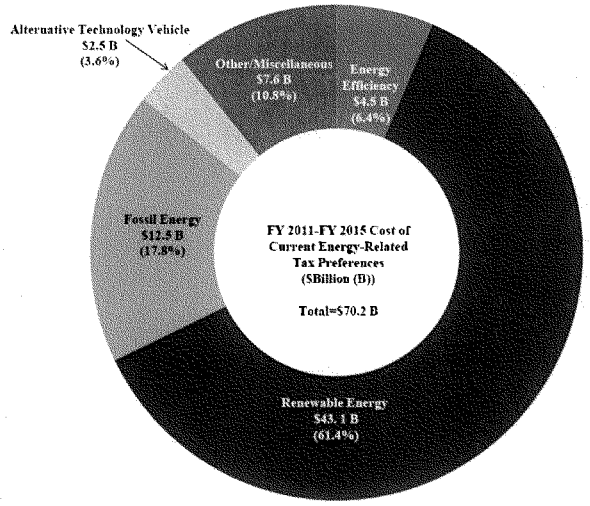
[7]Molly F. Sherlock and Margot L. Crandall-Hollick, Energy Tax Policy: Issues in the 112th Congress, CRS Report R41769, March 28, 2012, Table 1, pp. CRS-8 – CRS-13. Table excludes provisions estimated to have a revenue loss of less than $50 million over the 2011 through 2015 period. See Appendix 1 for more details.

[8]This figure includes the reduction in excise tax receipts for alcohol fuels, biodiesel, and alternative fuel.

[b]Qualifying property that was under construction prior to the end of 2011 may be eligible for the Section 1603 Grant in Lieu of Tax Credit.

Figure 3. Cost of Energy Tax Provisions: FY 2011-2015[9]



4. Renewable Energy-Related Tax Preferences

The hearing is expected to focus primarily on four major renewable energy-related tax preferences: the investment tax credit (ITC), the production tax credit (PTC), the Section 1603 Program, and the Advanced Energy Manufacturing Tax Credit ("48C") Program, each of which is discussed below. A subsection on the credit for alcohol fuels, biodiesel, and alternative fuels is also included.

4.1 Energy Investment Tax Credit (ITC)[10]

The Energy ITC , first established as part of the Energy Tax Act of 1978 (P.L. 95-618), has been modified many times since.

As shown in Table 2, section 48 of the Internal Revenue Code (IRC) provides a non-refundable income tax credit for business investments in solar, fuel cells, small wind turbines (up to 100 kilowatt (kW) in capacity), geothermal systems, microturbines, and combined heat and power

[9]Source: Molly F. Sherlock and Margot L. Crandall-Hollick, *Energy Tax Policy: Issues in the 112th Congress*, CRS Report R41769, March 28, 2012, Table 1, pp. CRS-8 – CRS-13.

[10]For additional background, see U.S. Senate, Committee on Budget, *Tax Expenditures: Compendium of Background Material on Individual Provisions*, prepared by the Congressional Research Service, S. Prt. 111-58, December 2010, pp. 185-190 (http://www.gpo.gov/fdsys/pkg/CPRT-111SPRT62799/pdf/CPRT-111SPRT62799.pdf).

(CHP). Solar, fuel cell, and small wind turbine investments qualify for a 30% credit. The tax credit for investments in geothermal systems, microturbines, and CHP is 10%. For fuel cells, the 30% credit is limited to $1,500 per 0.5 kW of capacity. For microturbines, the credit is limited to $200 per kW of capacity. Generally, the ITC is available for property placed in service by December 31, 2016. For geothermal property, except geothermal heat pumps, there is no sunset date for the credit (the credit for geothermal heat pumps expires at the end of 2016). In 2017, the credit rate for solar property becomes 10%. The estimated 2011-2015 cost is $2.5 billion.

Table 2. Summary of Energy ITC Provisions[11]

Qualified Energy Property (sec. 48)	Credit rate	Maximum credit	Expiration
Equipment to produce energy from a geothermal deposit	10%	None	None
Equipment to use ground or ground water for heating or cooling	10%	None	December 31, 2016
Microturbine property (< 2 Mw electrical generation power plants of >26% efficiency)	10%	$200 per Kw of capacity	December 31, 2016
Combined heat and power property (simultaneous production of electrical/mechanical power and useful heat > 60% efficiency)	10%	None	December 31, 2016
Solar electric or solar hot water property	30% (10% after December 31, 2016)	None	None
Fuel cell property (generates electricity through electrochemical process)	30%	$1,500 for each ½ Kw of capacity	December 31, 2016
Small (<100 Kw capacity) wind electrical generation property	30%	None	December 31, 2016

4.2 Production Tax Credit (PTC)[12]

The PTC, first adopted as part of the Energy Policy Act of 1992 (P.L. 102-486), has also undergone many modifications. Taxpayers producing energy from a qualified renewable energy resource—which include wind, closed-loop biomass, open-loop biomass, geothermal energy, solar energy, small irrigation power, municipal solid waste (trash combustion and landfill gas), qualified hydropower production, and marine and hydrokinetic renewable energy sources—may

[11] U.S. Congress, Joint Committee on Taxation, *Present Law and Analysis of Energy-Related Tax Expenditures*, JCX-28-12, March 27, 2012, p. 4 (http://www.jct.gov/publications.html?func=startdown&id=4414).

[12] For additional background, see U.S. Senate, Committee on Budget, *Tax Expenditures: Compendium of Background Material on Individual Provisions*, prepared by the Congressional Research Service, S. Prt. 111-58, December 2010, pp. 197-203 (http://www.gpo.gov/fdsys/pkg/CPRT-111SPRT62799/pdf/CPRT-111SPRT62799.pdf).

qualify for the PTC, which is generally available for 10 years, beginning on the date the facility is placed in service.[13] As shown in Table 3 below, the credit amount in 2011 for electricity produced using wind, closed-loop biomass, and geothermal energy resources was 2.2¢ per kilowatt hour (kWh). Other resources qualify for a credit equal to half the full credit amount, or 1.1¢ per kWh in 2011. The credit amount is based on the 1993 value of 1.5¢ per kWh, which is adjusted annually for inflation. The production tax credit (PTC) is generally available for 10 years, beginning on the date the facility is placed in service. Certain facilities placed in service prior to August 8, 2005 are only eligible to receive the PTC for 5 years. To qualify for the credit, wind facilities must be placed in service by December 31, 2012. The placed-in-service deadline for other technologies is December 31, 2013. The estimated 2011-2015 cost is $9.1 billion.

Table 3. Summary of PTC Provisions[14]

Eligible Electricity Production Activity (sec. 45)[1]	Credit Amount for 2011[2] (cents per kilowatt-hour)	Expiration[3]
Wind	2.2	December 31, 2012
Closed-loop biomass	2.2	December 31, 2013
Open-loop biomass (including agricultural livestock waste nutrient facilities)	1.1	December 31, 2013
Geothermal	2.2	December 31, 2013
Solar (pre-2006 facilities only)	2.2	December 31, 2005
Small irrigation power	1.1	December 31, 2013
Municipal solid waste (including landfill gas facilities and trash combustion facilities)	1.1	December 31, 2013
Qualified hydropower	1.1	December 31, 2013
Marine and hydrokinetic	1.1	December 31, 2013

[1] Except where otherwise provided, all section references are to the Internal Revenue Code of 1986, as amended.

[2] In general, the credit is available for electricity produced during the first 10 years after a facility has been placed in service. The inflation adjusted credit amount for 2012 is expected to be released in April. Taxpayers may also elect to get a 30-percent investment tax credit in lieu of this production tax credit.

[3] Expires for property placed in service after this date.

[13] Certain facilities placed in service prior to August 8, 2005 are only eligible to receive the PTC for 5 years.

[14] U.S. Congress, Joint Committee on Taxation, *Present Law and Analysis of Energy-Related Tax Expenditures*, JCX-28-12, March 27, 2012, p. 2 (http://www.jct.gov/publications.html?func=startdown&id=4414).

4.3 Section (§) 1603 Program[15]

Section 1603 of the ARRA provides cash grants for investments in renewable energy production projects in lieu of the PTC or the ITC available under Section 45 or Section 48 of the Internal Revenue Code, respectively, depending on the technology type. Qualifying technologies include biomass, combined heat and power, fuel cells, geothermal, incremental hydropower, landfill gas, marine hydrokinetic, microturbine, municipal solid waste, solar, and wind. The value of the grant is equivalent to 30 percent of the project's total eligible cost basis, except for geothermal heat pumps, microturbines, and combined heat and power projects, where the value is 10 percent. The estimated 2011-2015 cost is $15.9 billion.

The §1603 Program is administered by the Department of the Treasury's Office of Financial Secretary (OFAS). DOE's National Renewable Energy Laboratory (NREL) manages the technical review of Program applications and advises OFAS on award decisions.[16]

The Department of the Treasury recently reported that more than $11.0 billion had been paid to 5,529 awardees under the Program,[17] and in its most recent "Overview and Status Update of the §1603 Program" report, it noted that as of March 29, 2012:[18]

- 34,104 projects were funded for a total of $11.2 billion.
- Total private and federal investment in §1603 projects = $37 billion.
- Total installed capacity of funded projects = 16.5 billion watts (GW).
- Total estimated electricity generation from funded projects = 42 trillion watt-hours (TWh).

Projects located in all 50 States, the District of Columbia and Puerto Rico are eligible for §1603 grants. As shown in Table 4, as of March 29, 2012, California had the largest number of projects—17,250, or 50.6% of the total, Texas projects have received more than $1.7 billion, or 15.2% of the total, and Texas also had the most installed capacity under the program—2,962.8 megawatts (MW) or 17.9%.

Table 4. §1603 Program Grant Projects by Location[19]

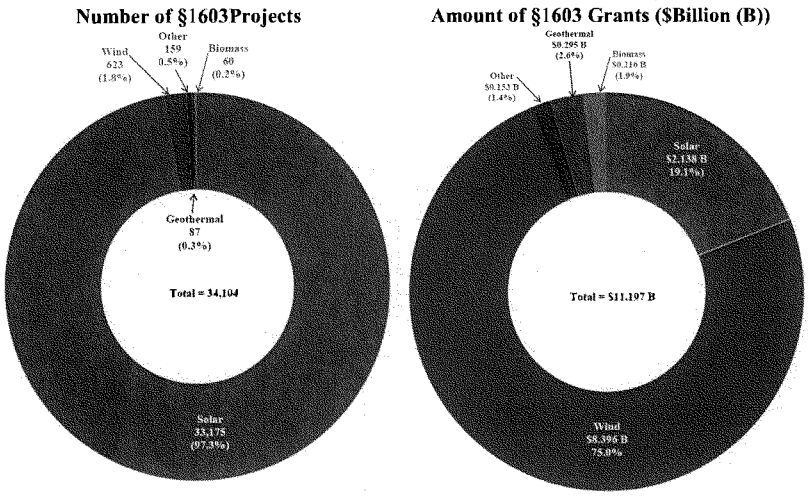
Location	Number	% Total	Amount ($Million)	% Total	Installed Capacity (MW)	% Total
Alabama	10	0.01%	50.1	0.00%	0.0	0.00%
Alaska	7	0.01%	30.7	0.01%	0.9	0.01%
Arizona	3,697	10.84%	3,271.4	2.42%	252.9	1.53%
Arkansas	9	0.03%	30.2	0.00%	0.1	0.00%
California	17,250	50.58%	21,460.7	15.85%	1,581.9	9.57%
Colorado	2,007	5.88%	1,546.7	1.1%	400.1	2.42%
Connecticut	953	2.79%	534.1	0.39%	18.4	0.11%

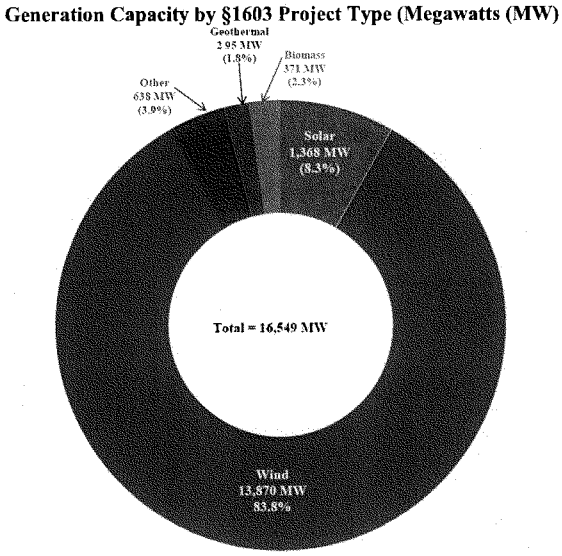
[15]For additional background, see Phillip Brown and Molly F. Sherlock, *ARRA Section 1603 Grants in Lieu of Tax Credits for Renewable Energy: Overview, Analysis, and Policy Options*, CRS Report R41635, November 9, 2011.
[16]OFAS makes the final decision on whether or not award §1603 Program funds.
[17]U.S. Department of the Treasury, "Section 1603 - Payments for Specified Renewable Energy Property in Lieu of Tax Credits, Awardees as of March 13, 2012" (http://www.treasury.gov/initiatives/recovery/Documents/Section%201603%20Awards.xlsx)
[18]"Overview and Status Update of the §1603 Program," U.S. Department of the Treasury, March 29, 2011, p. 1 (http://www.treasury.gov/initiatives/recovery/Documents/Status%20overview.pdf).
[19]Ibid., pp. 3-4 (http://www.treasury.gov/initiatives/recovery/Documents/Status%20overview.pdf).

Location	Number	% Total	Amount ($Million)	% Total	Installed Capacity (MW)	% Total
Delaware	62	0.18%	$41.1	0.37%	51.5	0.31%
District of Columbia	34	0.10%	$1.3	0.01%	0.2	0.00%
Florida	436	1.28%	$214.7	1.92%	64.4	0.39%
Georgia	110	0.32%	$37.5	0.33%	38.3	0.23%
Hawaii	374	1.10%	$64.2	0.57%	45.1	0.27%
Idaho	41	0.12%	$289.2	2.58%	477.2	2.88%
Illinois	73	0.21%	$925.9	8.27%	1,520.9	9.19%
Indiana	31	0.09%	$346.8	3.10%	608.0	3.67%
Iowa	103	0.30%	$310.2	2.77%	545.3	3.30%
Kansas	22	0.06%	$2.0	0.02%	2.3	0.01%
Kentucky	14	0.04%	$2.2	0.02%	2.1	0.01%
Louisiana	221	0.65%	$1.3	0.01%	0.5	0.00%
Maine	30	0.09%	$219.1	1.96%	332.0	2.01%
Maryland	229	0.67%	$89.7	0.80%	131.9	0.80%
Massachusetts	759	2.23%	$71.8	0.64%	45.1	0.27%
Michigan	120	0.35%	$50.4	0.45%	75.9	0.46%
Minnesota	148	0.43%	$213.7	1.91%	333.7	2.02%
Mississippi	10	0.03%	$0.3	0.00%	0.5	0.00%
Missouri	101	0.30%	$200.6	1.79%	301.5	1.82%
Montana	17	0.05%	$71.8	0.64%	133.1	0.80%
Nebraska	13	0.04%	$133.9	1.20%	183.6	1.11%
Nevada	108	0.32%	$147.1	1.31%	168.5	1.02%
New Hampshire	20	0.06%	$1.1	0.01%	0.6	0.00%
New Jersey	3,343	9.80%	$404.5	3.61%	267.6	1.62%
New Mexico	93	0.27%	$177.1	1.58%	259.4	1.57%
New York	500	1.47%	$417.3	3.73%	653.3	3.95%
North Carolina	155	0.45%	$51.3	0.46%	35.3	0.21%
North Dakota	11	0.03%	$263.2	2.35%	483.5	2.92%
Ohio	206	0.60%	$89.2	0.80%	158.5	0.96%
Oklahoma	35	0.10%	$246.9	2.21%	429.0	2.59%
Oregon	836	2.45%	$495.1	4.42%	876.9	5.30%
Pennsylvania	706	2.07%	$342.9	3.06%	417.6	2.52%
Puerto Rico	18	0.05%	$8.9	0.08%	5.0	0.03%
Rhode Island	10	0.03%	$0.5	0.00%	0.3	0.00%
South Carolina	54	0.16%	$10.9	0.10%	357.0	2.16%
South Dakota	11	0.03%	$257.1	2.30%	469.8	2.84%
Tennessee	202	0.59%	$21.8	0.19%	20.4	0.12%
Texas	387	1.13%	$1,700.6	15.19%	2,962.8	17.90%
Utah	92	0.27%	$236.7	2.11%	322.7	1.95%
Vermont	143	0.42%	$48.3	0.43%	47.4	0.29%
Virginia	58	0.17%	$4.4	0.04%	3.8	0.02%
Washington	50	0.15%	$570.2	5.09%	934.0	5.64%
West Virginia	4	0.01%	$152.5	1.36%	200.2	1.21%
Wisconsin	183	0.54%	$35.1	0.31%	36.7	0.22%
Wyoming	3	0.01%	$110.8	0.99%	200.0	1.21%
Total	**34,104**		**$11,197**		**16,549**	

Figure 4 shows §1603 grant projects by technology. The 34,104 solar projects, accounting for 97.3% of the total projects, have received $2.138 billion, or 19.1% of the total grant value. The 623 wind projects—1.8% of the total—have received over $8.396 billion, or 75.0% of the total grant value.

Figure 4. §1603 Projects by Technology[20]





[20] *Ibid.*, p. 2 (http://www.treasury.gov/initiatives/recovery/Documents/Status%20overview.pdf).

A recent NREL analysis[21] used its Jobs and Economic Development Impacts (JEDI) models to estimate the gross national employment and economic impacts of large wind and PV projects funded by the §1603 Program from the Program's inception in September 2009 through November 10, 2011. The analysis estimated that up to 75,000 direct and indirect jobs and up to $44 billion in total economic output were supported by the design, manufacturing, construction, and installation of solar photovoltaic (PV) and wind projects funded by the §1603 Program. In addition, the study estimated that the operation and maintenance of these solar and wind facilities would continue to sustain up to $1.8 billion per year in economic output over the lifetime of the facilities (20-30 years).[22]

However, as the authors note, "this analysis does not include impacts from displaced energy or associated jobs, earnings, and output related to existing or planned energy generation resources (e.g., jobs lost in the operation of natural gas or coal plants due to the need for less electricity production from these plants, given increased generation from wind) or increases or decreases in jobs related to changes in electric utility revenues and consumer energy bills, among other impacts."[23] And further, they state that "[t]he results presented in this report cannot be attributed to the §1603 grant program alone. Some projects supported by a §1603 award may have progressed without the award, while others may have progressed only as a direct result of the program; therefore, the jobs and economic impact estimates can only be attributed to the total investment in the projects."[24]

4.4 Advanced Energy Manufacturing Tax Credit ("48C") Program

Section 1302 of the ARRA amended the Internal Revenue Code by adding a new Advanced Energy Manufacturing Tax Credit ("48C") of 30 percent for investments in manufacturing facilities for clean energy technologies.[25] The estimated 2011-2015 cost is $1.4 billion.

The ARRA limited total credits to $2.3 billion, and required the Secretary of the Treasury, in consultation with the Secretary of Energy, to establish a program to consider and award

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[21]Daniel Stenberg, Gian Porro, and Marshall Goldberg, *Preliminary Analysis of the Jobs and Economic Impacts of Renewable Energy Projects Supported by the §1603 Treasury Grant Program*, NREL/TP-6A20-52739, April 2012 (http://www.nrel.gov/docs/fy12osti/52739.pdf).

[22]U.S. Department of Energy, "NREL Report Highlights Positive Economic Impact and Job Creation from 1603 Renewable Energy Grant Program," April 6, 2012 (http://energy.gov/articles/nrel-report-highlights-positive-economic-impact-and-job-creation-1603-renewable-energy).

[23]*Ibid.*, Footnote 2, p. iv.

[24]*Ibid.*, p. vi.

[25]Technically, the tax credit is provided for investment in "eligible property" used in a "qualifying advanced energy project." Under §48C(c)(1)(A)(i), a "qualifying advanced energy project" is a project that "re-equips, expands, or establishes a manufacturing facility for the production of": (1) property designed to produce energy from renewable resources; (2) fuel cells, microturbines, or an energy storage system for use with electric or hybrid-electric vehicles; (3) electric grids to support the transmission, including storage, of intermittent sources of renewable energy; (4) property designed to capture and sequester carbon dioxide emissions; (5) property designed to refine or blend renewable fuels or to produce energy conservation technologies; (6) electric drive motor vehicles that qualify for tax credits or components designed for use with such vehicles; and (7) other advanced energy property designed to reduce greenhouse gas emissions. §48C(e)(2) defines "eligible property" as any property: (1) that is necessary for the production of qualifying advanced energy project property; (2) that is tangible personal property or other tangible property (not including a building and its structural components) that is used as an integral part of a qualifying facility; and (3) with respect to which depreciation (or amortization in lieu of depreciation) is allowable. (See *General Explanations of the Administration's Fiscal Year 2013 Revenue Proposals*, U.S. Department of the Treasury, February 2012, p. 7 (http://www.treasury.gov/resource-center/tax-policy/Documents/General-Explanations-FY2013.pdf.))

certifications for qualified investments eligible for credits within 180 days of the date of enactment. Under §48C(d)(3)(A), credits may be allocated only to projects where there is a reasonable expectation of commercial viability. In addition, §48C(d)(3)(B) required consideration be given to which projects: (1) will provide the greatest domestic job creation (both direct and indirect) during the credit period (February 17, 2009 through February 17, 2013); (2) will have the greatest net impact in avoiding or reducing air pollutants or anthropogenic emissions of greenhouse gases (GHGs); (3) have the greatest potential for technological innovation and commercial deployment; (4) have the lowest levelized cost of generated or stored energy, or of measured reduction in energy consumption or GHG emission (based on the cost of the full supply chain); and (5) have the shortest completion time.[26]

Treasury's Internal Revenue Service (IRS) issued Notice 2009–72[27] containing detailed 48C Program guidance that was effective on August 14, 2009. The Notice stated that the IRS would consider projects under the 48C Program "only if" DOE provided "a recommendation and ranking for the project," and that DOE would "provide a recommendation and ranking only if it determines that the project has a reasonable expectation of commercial viability and merits a recommendation based on the criteria in §48C(d)(3)(B)".[28]

The DOE recommendations were to "include a ranking of projects in descending order (that is, first, second, third, etc.) with "[t]he project receiving the highest ranking)" being "allocated the full amount of credit requested before any credit" was "allocated to a lower-ranked project." The same process was to be repeated on the "second and lower-ranked projects until the amount available for allocation" was "exhausted." DOE was to "recommend and rank projects only to the extent necessary to exhaust the amount available for allocation."[29]

IRS Notice 2009–7 also elaborated on the project eligibility and evaluation criteria DOE would use to base its review of and recommendations on projects; these are shown in Table 5 below.[30]

Under the IRS criteria, companies applied for tax credits for 594 projects, requesting a total of $10,902,251,709; 176 requesting $2,783,932,005 were ineligible because they did not meet the specified requirements—leaving 418 eligible applicants requesting a total of $8,118,319,704 competing for the $2.3 billion available.[31]

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[26] *General Explanations of the Administration's Fiscal Year 2013 Revenue Proposals*, U.S. Department of the Treasury, February 2012, p. 7 (http://www.treasury.gov/resource-center/tax-policy/Documents/General-Explanations-FY2013.pdf).

[27] "Notice 2009–72, Qualifying Advanced Energy Project Credit," *Internal Revenue Bulletin*, Bulletin 3009-37, Department of the Treasury, Internal Revenue Service, September 14, 2009, pp. 325-362 (http://www.irs.gov/pub/irs-irbs/irb09-37.pdf).

[28] *Ibid.*, p. 326.

[29] *Ibid.*

[30] *Ibid.*, p. 334. Missing from these criteria is the §48C(d)(3)(B)(iv) requirement that the Secretary of the Treasury "shall take in to consideration which projects" "have the lowest levelized cost of generated or stored energy, or of measured reduction in energy consumption or greenhouse gas emission (based on the cost of the full supply chain)".

[31] Statement of Henry Kelly, Principal Deputy Assistant Secretary, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy Before the Subcommittee on Energy, Natural Resources, and Infrastructure Committee on Finance, United States Senate, Hearing on Re-establishing U.S. leadership in Clean Energy, High Technology Manufacturing, May 20, 2010, p. 6, footnote 11 (http://finance.senate.gov/imo/media/doc/052010HKtest.pdf).

Table 5. Notice 2009-7 48C Program Project Eligibility and Evaluation Criteria

• Evaluation Criterion 1: provides the greatest domestic job creation (both direct and indirect) during the credit period (February 17, 2009, through February 17, 2013).	
• Evaluation Criterion 2: provides the greatest net impact in avoiding or reducing air pollutants or anthropogenic emissions of greenhouse gases.	
• Evaluation Criterion 3: has the greatest potential for technological innovation and commercial deployment, as indicated by (i) the production of new or significantly improved technologies, (ii) improvements in levelized costs and performance, and (iii) manufacturing significance and value.	
• Evaluation Criterion 4: has shortest project time from certification to completion.	
• *Program Policy Factors* ✓ Program Policy Factor 1: Geographic Diversity ✓ Program Policy Factor 2: Technology Diversity	✓ Program Policy Factor 3: Project Size Diversity ✓ Program Policy Factor 4: Regional Economic Development

§48C(d)(5) required public disclosure of the names of companies allocated 48C Program credits and the amounts.[32] On January 8, 2010, President Obama announced awardees "competitively selected through a rigorous merit review process" of the entire $2.3 billion in available tax credits "for investments in 183 manufacturing facilities for clean energy products across 43 states."[33] The President's announcement also said that "the companies chosen say they will create more than 17,000 jobs."[34]

Of the nearly 600 project requests, tax credits were awarded to 183 projects submitted by 136 different companies. Descriptions for 140 projects were voluntary submitted by companies awarded $1,67 billion. There are also an additional 43 projects awarded $632 million that do not have any descriptions. In the interim, two of the companies awarded tax credits—Stirling Energy Systems, Inc.,[35] which received two tax credits totaling $10.4 million and United Solar Ovonic, LLC,[36] which received one totaling $13.2 million— have declared bankruptcy.

Table 6 presents 48C Program credits summary data by technology type. Based on information voluntarily submitted by companies, solar energy projects received the largest number of tax credits (48 or 26.2% of total) and the largest amount of tax credits ($861,312,199 or 37.5% total), followed by wind (35 tax credits or 19.1% of total, and $258,519,981 or 11.2% of total). Biomass, geothermal, solar, and wind technologies received 87 tax credits (47.5% of total) amounting to $1,158,190,786 (50.4% of total).

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[32]Internal Revenue Service. "Frequently Asked Questions About the Qualifying Advanced Energy Project Credit (Internal Revenue Code section 48C)" (http://www.irs.gov/businesses/article/0,,id=242505,00.html).

[33]"President Obama Awards $2.3 Billion for New Clean-Tech Manufacturing Jobs," The White House, Office of the Press Secretary, January 8, 2010 (http://www.whitehouse.gov/the-press-office/president-obama-awards-23-billion-new-clean-tech-manufacturing-jobs); and "Fact Sheet: $2.3 Billion in New Clean Energy Manufacturing Tax Credits," The White House, Office of the Press Secretary, January 8, 2010 at (http://www.whitehouse.gov/the-press-office/fact-sheet-23-billion-new-clean-energy-manufacturing-tax-credits).

[34]"President Obama Awards $2.3 Billion for New Clean-Tech Manufacturing Jobs," The White House, Office of the Press Secretary, January 8, 2010 (http://www.whitehouse.gov/the-press-office/president-obama-awards-23-billion-new-clean-tech-manufacturing-jobs).

[35]Jennifer Runyon, "Solar Shakeout Continues: Stirling Energy Systems Files for Chapter 7 Bankruptcy," RenewableEnergyWorld.com, September 28, 2011 http://www.renewableenergyworld.com/rea/news/article/2011/09/solar-shakeout-continues-stirling-energy-systems-files-for-chapter-7-bankruptcy).

[36]"Energy Conversion Devices, United Solar Ovonic File For Bankruptcy," Solar Industry Magazine, February 14 2012 (http://www.solarindustrymag.com/e107_plugins/content/content.php?content.9703).

Table 6. 48C Program Credits Summary Data by Technology Type[37]

Technology	Number of Tax Credits	% Total Number	Amount	% Total Amount
Battery	5	2.73%	$29,360,400	1.28%
Biomass	2	1.09%	$29,304,480	1.27%
Buildings	22	12.02%	$147,339,742	6.41%
CCS	2	1.09%	$4,842,438	0.21%
Fuel Cell	2	1.09%	$5,510,100	0.24%
Geothermal	2	1.09%	$9,054,126	0.39%
Industrial	8	4.37%	$166,503,955	7.24%
Nuclear	2	1.09%	$73,800,000	3.21%
Smart Grid	9	4.92%	$35,652,663	1.55%
Solar (all)	48	26.23%	$861,312,199	37.45%
Vehicles	3	1.64%	$46,790,145	2.03%
Wind (all)	35	19.13%	$258,519,981	11.24%
Subtotal	*140*	*76.50%*	*$1,667,990,229*	*72.52%*
Not specified	43	23.50%	$632,009,772	27.48%
Total	**183**		**$2,300,000,001**	

Table 7 lists the top 25 companies ranked by amount of tax credits received—33% of credits went to companies who are subsidiaries or affiliates of foreign-domiciled parents.[38]

Table 7. Top 20 Recipients of 48C Tax Credits

Rank	Company	Amount	% Total Amount	Parent or Affiliate Corporate Headquarters
1	REC Solar Grade Silicon LLC	$154,896,429	6.73%	Norway
2	Volkswagen Group of America Chattanooga Operations LLC	$150,000,000	6.52%	Germany
3	Hemlock Semiconductor Corp.	$141,870,000	6.17%	USA
4	Wacker Polysilicon North America LLC	$128,482,287	5.59%	Germany
5	United Technologies	$115,700,100	5.03%	USA
6	MiaSole	$101,800,200	4.43%	USA
7	General Electric Co.	$89,849,798	3.91%	USA
8	SolarWorld Industries America Inc.	$82,200,000	3.57%	Germany
9	Alstom Inc.	$65,725,800	2.86%	France
10	E.I. Du Pont de Nemours and Co., Inc.	$65,265,000	2.84%	USA
11	Vestas	$51,769,800	2.25%	Denmark
12	CaliSolar, Inc.	$51,563,980	2.24%	USA
13	Texas Instruments Inc.	$51,450,000	2.24%	USA
14	Dow Chemical Co. and Dow Corning Corp.	$47,334,621	2.06%	USA
15	AE Polysilicon Corp.	$44,850,000	1.95%	USA
16	Nanosolar, Inc.	$43,453,309	1.89%	Germany
17	Cree, Inc.	$39,087,000	1.70%	USA
18	Stion Corp.	$37,500,000	1.63%	USA
19	Siemens Industry, Inc.	$36,110,979	1.57%	Germany
20	Xunlight Corp.	$34,500,000	1.50%	USA
21	SCHOTT Solar, Inc.	$33,000,000	1.43%	Germany
22	SAGE Electrochromics, Inc.	$31,500,000	1.37%	USA
23	Gamesa	$30,946,582	1.35%	Spain
24	ZF Steering Systems, LLC	$28,560,000	1.24%	Germany
25	Novozymes Blair, Inc.	$28,401,000	1.23%	Denmark

[37]Derived from 48C award data available at http://www.whitehouse.gov/sites/default/files/48c_selection_011310.xls.

[38]Testimony of Kevin Book, Managing Director, Research, Clearview Energy Partners, LLC Before the Subcommittee on Energy, Natural Resources, and Infrastructure, Committee on Finance, United States Senate, Hearing on Re-establishing U.S. leadership in Clean Energy, High Technology Manufacturing, May 20, 2010, p. 4 (http://finance.senate.gov/imo/media/doc/052010KBtest.pdf).

4.5 Tax Credits for Alcohol Fuels, Biodiesel, and Alternative Fuels[39]

Tax credits for alcohol fuels were first enacted in 1980 as part of the Crude Oil Windfall Profit Tax Act of 1980 (P.L. 96-223) and subsequently modified many times in the interim. As shown in Table 8 below, almost all of the tax credits for alcohol fuels, biodiesel, and alternative fuels expired on December 31, 2011; the only exception being the $1.01per gallon credit for cellulosic biofuels, which expires on December 31, 2012. Even though these credits have expired, they have an estimated cost of $11.8 billion over the 2011-215 time period, with most of the cost coming from the impact they have on reducing excise tax receipts as opposed to revenue losses associated with income tax credits.[40]

Table 8. Summary of Alcohol Fuels, Biodiesel, and Alternative Fuels Provisions[41]

Fuel Type	Per Gallon Incentive Amount	Expiration
Agri-biodiesel and biodiesel (secs. 40A, 6426, and 6427)	$1.00 per gallon, plus $0.10 per gallon for small agri-biodiesel producers	December 31, 2011
Renewable diesel (secs. 40A, 6426, aud 6427)	$1.00 per gallon	December 31, 2011
Alcohol fuel (other than ethanol and alcohol from natural gas or coal) (secs. 40, 6426, aud 6427)	$0.60 per gallon	December 31, 2011
Ethanol fuel (secs. 40, 6426, and 6427)	$0.45 per gallon, plus $0.10 per gallon for small producers	December 31, 2011
Cellulosic biofuel (sec. 40)	$1.01 per gallon (including cellulosic alcohol)	December 31, 2012
Alternative fuel (secs. 6426 and 6427): • **liquefied petroleum gas** • **P Series Fuels** • **compressed or liquefied natural gas** • **liquefied hydrogen** • **any liqnid fuel derived from coal through the Fischer-Tropsch process** • **compressed or liquefied gas derived from biomass** • **liquid fuel derived from biomass**	$0.50 per gallon	December 31, 2011 (September 30, 2014, in the case of liquefied hydrogen)

[39]For additional background, see U.S. Senate, Committee on Budget, *Tax Expenditures: Compendium of Background Material on Individual Provisions*, prepared by the Congressional Research Service, S. Prt. 111-58, December 2010, pp. 163-170 (http://www.gpo.gov/fdsys/pkg/CPRT-111SPRT62799/pdf/CPRT-111SPRT62799.pdf).

[40]Molly F. Sherlock and Margot L. Crandall-Hollick, *Energy Tax Policy: Issues in the 112th Congress*, CRS Report R41769, March 28, 2012, Table 2 Notes, p. 16.

[41]U.S. Congress, Joint Committee on Taxation, *Present Law and Analysis of Energy-Related Tax Expenditures*, JCX-28-12, March 27, 2012, p. 3 (http://www.jct.gov/publications.html?func=startdown&id=4414).

5. Administration's FY 2013 Budget Proposal and Recent Congressional Action[42]

The President's FY 2013 revenue proposal for renewable energy includes extending the PTC and ITC for wind to facilities and property placed in service in 2013, extending the Treasury §1603 Program cash grant to all otherwise qualifying property placed in service in 2012 (including property on which construction begins in 2012), and extending tax credits for alcohol fuels, biodiesel, and alternative fuels by one year. For property that is placed in service after 2012, the proposal would replace the §1603 Program grant with a refundable tax credit administered by the IRS. The refundable tax credit would be available for property on which construction begins in 2009, 2010, 2011, 2012, or 2013. The credit would be allowed with respect to property placed in service in 2013 (in the case of property, including wind facility property, that is part of a facility eligible for the renewable electricity production tax credit) and for property placed in service in 2013, 2014, 2015, or 2016 (in the case of any other energy property). Qualification requirements for the refundable credit would be the same (except for the effective date provisions) as the qualification requirements currently applicable under the Treasury §1603 Program grant program.[43] It is estimated that enacting these proposals would cost $3.9 billion over 10 years.[44]

The Administration has once again proposed an additional $5.0 billion for the 48C Program,[45] identical to its FY 2011[46] and FY 2012[47], proposals, which Congress did not approve.

In recent Congressional action, the Senate has twice failed to approve an additional $4.6 billion for the 48C Program and a number of the renewable energy tax extensions proposed by the Administration contained in Senator Stabenow's amendment[48] to S. 1813, the "Moving Ahead for Progress in the 21st Century Act" ("MAP-21"), and in Section 112(a) of S. 2204, the Repeal Big Oil Tax Subsidies Act.[49] The Senate rejected Senator Stabenow's amendment on March 13 by 49-49 and S. 2204 on March 29 by 51-47 —in both cases falling short of the 60 votes needed for adoption.

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[42]For additional details, see *General Explanations of the Administration's Fiscal Year 2013 Revenue Proposals*, U.S. Department of the Treasury, February 2012, p. 7 (http://www.treasury.gov/resource-center/tax-policy/Documents/General-Explanations-FY2013.pdf.))

[43]*Ibid.*, pp. 35-36, and 207.

[44]Molly F. Sherlock and Margot L. Crandall-Hollick, *Energy Tax Policy: Issues in the 112th Congress*, CRS Report R41769, March 28, 2012, Table 2 Notes, p. 21.

[45]*General Explanations of the Administration's Fiscal Year 2013 Revenue Proposals*, U.S. Department of the Treasury, February 2012, pp. 7-8 (http://www.treasury.gov/resource-center/tax-policy/Documents/General-Explanations-FY2013.pdf).

[46]*General Explanations of the Administration's Fiscal Year 2011Revenue Proposals*, U.S. Department of the Treasury, February 2010, pp. 6-7(http://www.treasury.gov/resource-center/tax-policy/Documents/General-Explanations-FY2011.pdf).

[47]*General Explanations of the Administration's Fiscal Year 2012 Revenue Proposals*, U.S. Department of the Treasury, February 2011, pp. 15-16 (http://www.treasury.gov/resource-center/tax-policy/Documents/General-Explanations-FY2012.pdf).

[48] Available at (http://www.congress.gov/cgi-lis/query/R?r112:FLD001:S51598,S51598)

[49] Available at (http://www.gpo.gov/fdsys/pkg/BILLS-112s2204pcs/pdf/BILLS-112s2204pcs.pdf)

Appendix 1. Energy Tax Preferences[50]

Tax Preference	Description	Cost 2011-2015 ($Billions)	Expiration Date	Internal Revenue Code (IRC) Section
Fossil Energy Energy Tax Preferences				
Expensing of percentage over cost depletion[a]	Firms that extract oil or gas are permitted to deduct 15% of sales (up to 25% for marginal wells depending on oil prices) to recover their capital investment in a mineral reserve.	$5.5	None.	611, 612, 613, 613A, 291
Expensing of exploration and development costs	Firms engaged in exploration and development of oil, gas, or geothermal properties have the option of expensing (deducting in the year paid or incurred) rather than capitalizing (i.e., recovering such costs through depletion or depreciation) certain intangible drilling and development costs (IDCs).	$4.4	None.	263(c), 291, 616-617, 57(a)(2), 59(e), 1254
Amortization of geological and geophysical expenditures associated with oil and gas exploration	Under the Modified Accelerated Cost Recovery System (MACRS), the cost of selected types of geological and geophysical property is depreciated over 2 years for independent producers.	$0.6	None.	167(h)
Coal Production Credits[a]	A $6.27-per-ton production credit for refined coal used to produce steam, or a $2.20 per-ton production credit (all adjusted for inflation from 1992) for coal reserves owned by an Indian tribe.	$0.2	12/31/11 (refined coal excluding steel industry fuel).	45
Credits for investing in clean coal facilities	Tax credit of 20% of investment for integrated gasification combined cycle (IGCC) systems and 15% for other advanced coal technology credit allocations made under the Energy Policy Act of 2005 (P.L. 109-58). 30% credit for IGCC and other advanced coal technology credit allocations under the Energy Improvement and Extension Act of 2008 (P.L. 111-343).	$1.0	Credit allocation limit.	48A, 48B
Amortization of air and pollution control facilities	Allows the pre-1976 5-year amortization period for investments in pollution control equipment for coal-fired electric generation plants available to those plants placed in service on or after January 1, 1976. The 5-year amortization incentive for pre-1976 plants applies only to pollution control equipment with a useful life of 15 years or less. In that case 100% of the cost can be amortized over five years. If the property or equipment has a useful life greater than 15 years, then the proportion of costs that can be amortized over five years is less than 100%.	$0.8	None.	169
Subtotal, Fossil Energy Energy Tax Preferences		***$12.5***		
Renewable Energy Resources Energy Tax Preferences				
Credits for electricity production from renewable resources ("PTC" or "production tax credit")[b]	Tax credit of 2.2¢/kWh for electricity produced from wind, closed-loop biomass, and geothermal energy. Tax credit of 1.1¢/kWh for electricity produced from open-loop biomass, solar, small irrigation, landfill gas, trash combustion, qualified hydropower, marine and hydrokinetic sources. The tax credit is available for 10 years after the date the facility is placed in service.	$9.1	Property must be placed in be placed in service by 12/31/2013 (12/31/2012 for wind).	45

[50]Source: Molley F. Sherlock and Margot L. Crandall-Hollick, *Energy Tax Policy: Issues in the 112th Congress*, CRS Report R41769, March 28, 2012, Table 1, pp. CRS-8 – CRS-13. Table does not include provisions estimated to have a revenue loss of less than $50 million over the 2011 through 2015 period.

Tax Preference	Description	Cost 2011-2015 ($Billions)	Expiration Date	Internal Revenue Code (IRC) Section
Energy credit ("ITC" or "investment tax credit")[b]	Tax credit equal to 10% of investment in energy production using geothermal, microturbine, or combined heat and power methods. The tax credit is equal to 30% of investment in energy production using solar electric, solar hot water, fuel cell or small wind methods.	$2.5	None (geothermal excluding geothermal heat pumps); 12/31/16 (other technologies; solar has permanent 10% credit after 2012).	48
Section 1603 grants in lieu of tax credits	Section 1603 allows taxpayers eligible for the PTC and ITC to receive a one-time cash grant in lieu of tax credits. Eligible facilities may qualify for a grant equal to 10% or 30%, depending on technology type, of a qualifying project's eligible cost basis.	$15.9	Under construction by 12/12/11. Placed-in-service deadline conforms with PTC or ITC.	5,48
Residential energy-efficient property credit	Tax credit for 30% of the cost of the purchase of solar electric property, solar water heating property, geothermal heat pump property, or small wind energy property. Fuel cell power plants receive 30% credit, limited to $500 for each 0.5 kilowatt of capacity.	$0.9	12/31/2016.	25D
Five-year cost recovery of certain energy property	Accelerated depreciation allowances are provided under the modified accelerated cost recovery system (MARCs) for investments in certain energy property. Specifically, certain solar, wind, geothermal, fuel cell, combined heat and power (CHP), microturbine and biomass property has a five year recovery period. Cellulosic biofuel plant property is allowed an additional first-year depreciation deduction equal to 50% of the property's adjusted basis.	$1.1	12/31/2012 (placed in service date for cellulosic biofuel property). None (other technologies).	168
Credits for holders of clean renewable energy bonds	Provides a tax credit for the holder of the bond against its income tax. Clean Renewable Energy Bonds ("CREBs") are subject to a volume cap of $1.2 billion with a credit rate set to allow the bond to be issued at par and without interest. New Clean Renewable Energy Bonds ("New CREBs") are subject to a volume cap of $2.4 billion with a credit rate set at 70% of what would permit the bond to be issued at par and without interest.	$0.4	Volume limited (all authorized CREB and new CREB funds have been allocated).	54, 54C

Tax Preference	Description	Cost 2011-2015 ($Billions)	Expiration Date	Internal Revenue Code (IRC) Section
Credit for alcohol fuels, biodiesel, and alternative fuels[a]	Coordinated income and excise tax credits. Ethanol tax credit generally 45¢ per gallon (extra 10¢ for small producers); alcohol tax credit generally 60¢ per gallon for alcohol other than ethanol; $1 per gallon for biodiesel, agri-biodiesel, and renewable diesel (extra 10¢ for small producers of agri-biodiesel); alternative fuels generally 50¢ per gallon; cellulosic biofuels generally $1.01 per gallon. Passage of various legislation in 111th Congress made black liquor ineligible for both the cellulosic biofuel producer credit and the alternative fuels tax credit. Depending on the specific incentive, tax credits go to fuel producers and/or blenders.	$11.8[51]	12/31/2011 (except for cellulosic bio-fuels production credit)cellulosic biofuels production credit).	40, 40A, 6426, 6427(e)
Advanced energy manufacturing tax credit	30% tax credit for qualified investments in advanced energy property. A total of $2.3 billion was allocated for advanced energy property investment tax credits, which were competitively awarded by the Department of Energy (DOE) and the Treasury.	$1.4	Capped (all available credits were allocated in the first allocation round which ended 1/16/2009).	48C
Subtotal, Renewable Energy Resources Energy Tax Preferences		***$43.1***		
Energy Efficiency and Conservation Energy Tax Preferences				
Credit for nonbusiness energy property[a]	Tax credit for 10% of the amount paid for qualified energy-efficiency improvements and expenditures for residential energy property including qualifying improvements to the building's envelope, the HVAC system, furnaces, or boilers. Credit limited to $500. This credit replaces the 30% credit, up to $1,500, that was available during 2009 and 2010.	$2.8	12/31/2011.	25C
Deduction for expenditures on energy- efficient commercial property	Tax deduction for the cost of building envelope components, heating cooling systems, and lighting. The deduction is limited to $1.80 per square foot	$0.9	12/31/2013.	179D
Exclusion of energy conservation subsidies provided by public utilities	Subsidies are not taxable as income.	$0.1	None.	136
Energy-efficient new home credit[a]	Manufacturers of manufactured homes may claim $1,000 credit for building homes 30% more efficient than the standard; Contractors may claim $2,000 credit for building homes 50% more efficient than the standard.	$0.1	12/.31/2011.	45L
Credit for producing energy-efficient appliances[a]	Tax credit based on energy efficiency. Maximum credit is $75 for dishwashers, $200 for refrigerators, and $225 for clothes washers	$0.4	12/.31/2011.	45M
Qualified Energy Conservation Bonds (QECBs)	Federal government has authorized issue of $3.2 billion in QECBs,, which provide a tax credit worth 70% of the tax credit bond rate stipulated by Secretary of the Treasury. QEC bonds issued by state and local governments must fund an energy-savings project, such as the green renovation of a public building, R&D in alternative fuels, and public transportation projects.	$0.2	Volume limited.	54D

[51] This figure includes the reduction in excise tax receipts for alcohol fuels, biodiesel, and alternative fuel mixtures.

Tax Preference	Description	Cost 2011-2015 ($Million)	Expiration Date	Internal Revenue Code (IRC) Section
Subtotal, Energy Efficiency and Conservation Energy Tax Preferences		**$4.9**		
Alternative Technology Vehicles Energy Tax Preferences				
Hybrid vehicles, other alternative fuel vehicles, and plug-in electric vehicles	The law allows hybrid cars or light trucks sold by manufacturers are eligible for a credit of $400 to $2,400 (depending on fuel economy). An additional credit of $250 to $1,000 is available depending on a vehicle expected lifetime fuel savings. Heavy vehicles (those exceeding 8,500 pounds) qualify for up to $10,000 in credits which are not subject to a volume cap. Fuel cell vehicles receive a base credit of $4,000 (reduced to $2,000 after 2009) for vehicles weighing less than 8,500 pounds. Heavier vehicles qualify for up to a $40,000 credit. An additional credit of up to $4,000 is available for cars and light trucks that exceed the 2002 base fuel economy. A 10% credit, up to $2,500, is available for the cost of electric-drive low-speed neighborhood vehicles, motorcycles and three-wheeled vehicles. A 10% credit, up to $4,000, is available for conversion to a plug-in electric drive vehicle. Lease from vehicles eligible for same credit as hybrid vehicles. Alternative fuel vehicles can qualify for a credit of up to $5,000 for cars and light trucks and $32,000 for heavy vehicles. Credit amount varies according to vehicle's incremental cost and mix of alternative fuel use (research). Credits available for plug-in electric vehicles are available up to $7,500 depending on battery battery capacity of vehicle (prior to 2011 the credit base was higher, up to $15,000 for qualifying heavy vehicles).	$2.7	12/31/2010 for hybrids, 12/31/2009 for vehicles weighing more than 8,500 pounds; 12/31/2014 for fuel cell vehicles; 12/31/2011 for electric drive low-speed vehicles and conversions to plug-in vehicles; 12/31/2010 for alternative fuel lease from vehicles, and alternative fuel vehicles; Credit for plug-in electric vehicles volume capped for each manufacturer.	IR, 30B, 30D
Credits for clean fuel vehicle refueling property	A 30% credit for qualifying property, capped at $30,000 for business property and $1,000 for nonbusiness property. During 2009 and 2010, the credit was temporarily increased to 50%, capped at $50,000 for business property and $2,000 for nonbusiness property. During 2009 and 2010, hydrogen property was eligible for a credit up to $200,000.	$0.10	12/31/2011 (12/31/2014 for hydrogen refueling property).	30C
Subtotal, Alternative Technology Vehicles Energy Tax Preferences		**$2.5**		
Other Miscellaneous Energy Tax Preferences				
Election to expense 50% of qualified property used to refine liquid fuels	A taxpayer may elect to expense 50% of the cost of any qualified property used for processing liquid fuel from crude oil or qualified fuels. The remainder is recovered using a 10-year recovery period under the modified accelerated cost recovery system (MACRS).	$1.0	12/31/2013 (property must be under contract for construction by 12/31/09).	179A(c)

Tax Preference	Description	Cost 2011-2015 ($Billions)	Expiration Date	Internal Revenue Code (IRC) Section
Exceptions for energy-related publicly traded partnerships	Publicly traded partnerships are generally treated as corporations. The exception from this rule occurs if at least 90 percent of its gross income is derived from interest, dividends, real property rents, or certain other types of qualifying income. Qualifying income includes income derived from certain energy-related activities.	$1.2	None.	7704, 851
Exclusion of interest on State and local government private activity bonds for energy production facilities	Exclusion of interest from private activity bonds used to finance privately owned or operated sewage, water, solid waste disposal, and heating and cooling facilities, certain private electric and gas facilities, hydroelectric dam enhancements, qualified green building and sustainable design projects from tax.	$0.2	None.	141, 142
Depreciation recovery periods for energy specific items	Smart electric distribution property is allowed 10-year depreciation under the modified accelerated cost recovery system (MARCs). Certain electric transmission property is allowed a 15-year depreciation. Natural gas distribution lines are also allowed a 15-year depreciation.	$2.1	Various.	168(e)
Deferral of gains from the sale of electric transmission property[a]	A taxpayer may elect to recognize the gain from the sale of certain electric transmission property over an eight year period.	$1.1	12/31/2011.	451
Subtotal, Other/Miscellaneous Energy Tax Preferences		***$7.6***		
Total, Energy Tax Preferences		***$70.2***		

[a]Indicates that the provision was extended or modified by The Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010 (P.L. 111-312).

[b]Qualifying property that was under construction prior to the end of 2011 may be eligible for the Section 1603 Grant in Lieu of Tax Credit.

Chairman BROUN. Good morning. This is a joint hearing of the Subcommittee of Investigations and Oversight as well as the Subcommittee on Energy and Environment. I call this meeting to order.

Good morning. Welcome to today's joint hearing entitled, "Impact of Tax Policies on the Commercial Application of Renewable Energy Technology." In front of you are packets containing the written testimony, biographies, and truth in testimony disclosures for today's witnesses.

Before we get started, since this is a joint hearing involving two Subcommittees, I want to explain how we will operate procedurally so all Members will understand how the question-and-answer period will be handled. As always, we will alternate between the Majority and Minority Members to allow all Members an opportunity for questioning before recognizing a Member for a second round of questions. We will recognize those Members present in the gavel in order of seniority on the full Committee and those coming in after the gavel will be recognized in order of their arrival.

And I recognize myself for five minutes for my opening statement.

Taxes were due to the IRS two days ago. With this fresh on everyone's mind, it is timely for the Committee to fulfill its obligation under House Rule X Clause 2(c) to "review and study on a continuing basis the impact or probable impact of tax policies affecting subjects within its jurisdiction." In this instance we are looking at an important piece of our Committee's jurisdiction, the commercialization of energy technology.

As Congress debates extending renewable energy tax provisions, it is important for this Committee to evaluate the merits of these provisions as well as the President's overall request. At a fundamental level, we have to understand whether these subsidies have a positive net affect, not only on energy production but also on jobs and the economy as a whole.

More specifically, we also need to evaluate whether the mechanisms previously employed, the tax credits and grants, are the most efficient ways to proceed.

Until the passage of the stimulus bill, the primary tax mechanisms for incentivizing renewable energy were the Production Tax Credit and Investment Tax Credit. The passage of the Stimulus Bill brought about additional methods, including the *Advanced Energy Manufacturing Tax Credit*, also known as 48C, and the 1603 Program, which provided cash grants in lieu of tax credits. Both of these are administered by the Department of Treasury with support from the Department of Energy and the National Renewable Energy Laboratory. Altogether the PTC, ITC, 1603, and the 48C and other renewable energy provisions are estimated to cost $43.1 billion between 2011 and 2015.

A lot of attention has been paid to the failures of Solyndra, Beacon Power, and Ecotality, which received questionable support from DOE, and rightfully so. What many don't realize, however, is that these direct expenditures from DOE are a mere drop in the bucket compared to what these technologies received from tax provisions. In 2011 alone, tax preferences for all energy technologies cost $20.5 billion, far exceeding the $3.2 billion in direct support from DOE.

Unfortunately, these significantly greater expenditures have not shared the same level of oversight.

Today's hearing will examine the efficacy of renewable energy tax policy, the Administration's 2013 renewable tax energy proposals, and the 1603 and 48C Programs in detail.

Regarding the 1603 Program, it is important to understand just how many new jobs were actually observed as opposed to how many jobs a model predicts could have been created. It is also important to understand the net impact on jobs and energy production as a result of this specific provision, not simply what is happening on one side of the ledger. I also want to know how many of these jobs were actually created here in the United States as opposed to overseas.

Ultimately, our goal should be to ensure an efficient, all-of-the-above strategy with—that respects market decision and does not pile more debt on our children and grandchildren that they will have to pay in years to come. The current national debt is over $15.6 trillion. China currently holds 1.18 trillion of our Nation's $5.1 trillion foreign-owned debt. It doesn't make any sense for us to borrow more money from China and then use it to buy foreign renewable energy components. These technologies, I might add, are unfortunately not cost competitive and will make our domestic energy more expensive.

All of this, by the way, is done to reduce our own greenhouse gas emissions when China and the rest of the developing world account for most of the emissions growth.

[The prepared statement of Mr. Broun follows:]

OPENING STATEMENT
The Honorable Paul Broun M.D. (R-GA), Chairman
Subcommittee on Investigations & Oversight
Joint hearing with
Subcommittee on Energy and Environment
Impact of Tax Policies on the Commercial Application of Renewable Energy Technology

April 19, 2012

Taxes were due to the IRS two days ago. With this fresh on everyone's mind, it is timely for the Committee to fulfill its obligation under House Rule X clause 2(c) to "review and study on a continuing basis the impact or probable impact of tax policies affecting subjects within its jurisdiction." In this instance, we are looking at an important piece of our Committee's jurisdiction, the "Commercialization of Energy Technology." As Congress debates extending renewable energy tax provisions, it is important for this Committee to evaluate the merits of these provisions as well as the President's overall request. At a fundamental level, we have to understand whether these subsidies have a positive net effect on not only energy production, but also jobs, and the economy as a whole. More specifically, we also need to evaluate whether the mechanisms previously employed – tax credits and grants – are the most efficient ways to proceed.

Until the passage of the stimulus bill, the primary tax mechanisms for incentivizing renewable energy were the Production Tax Credit and the Investment Tax Credit. The passage of the stimulus bill brought about additional methods including the Advanced Energy Manufacturing Tax Credit, known as "48C," and the 1603 program which provided cash grants in lieu of tax credits. Both of these are administered by the Department of Treasury with support from the Department of Energy and the National Renewable Energy Laboratory. Altogether, the PTC, ITC, 1603, 48C and other renewable energy provisions are estimated to cost $43.1 billion between 2011 and 2015.

A lot of attention has been paid to the failures of Solyndra, Beacon Power, and Ecotality which received questionable support from DOE, and rightfully so. What many don't realize, however, is that these direct expenditures from DOE are a mere drop-in-the-bucket compared to what these technologies received from tax provisions. In 2011 alone, tax preferences for all energy technologies cost $20.5 billion, far exceeding the $3.2 billion in direct support from DOE. Unfortunately, these significantly greater expenditures have not shared the same level of oversight.

Today's hearing will examine the efficacy of renewable energy tax policy, the Administration's FY 2013 renewable energy tax proposals, and the 1603 and 48C programs in detail. Regarding the 1603 program, it is important to understand just how many new jobs were actually observed, as opposed to how many jobs a model predicts could have been created. It's also important to understand the net impact on jobs and energy production as a result of this specific provision, not simply what is happening on one side of the ledger. I also want to know how many of these jobs were actually created here in the U.S. as opposed to overseas.

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Chairman BROUN. Now the Chair will recognize Mr. Miller, I guess, for his opening statement.

Or Mr. Tonko. I didn't see you sitting over there, my friend. I will recognize Mr. Tonko, my counterpart on I & O.

Mr. TONKO. Thank you, Chairman.

To Chairs Broun and Harris, thank you for holding the hearing today on renewable energy tax credits. Although the legislation authorizing these incentive programs is not in our jurisdiction, it is good for this Committee, I believe, to examine the subsidies that can influence markets in those technology sectors where we authorize research.

Here in the Science Committee we authorize the full suite of research, development, and technology demonstration programs that bring new ideas and new technologies forward. Many things fall by the wayside along that path, but even the most promising demonstrated technology still has to overcome many barriers to entry into the marketplace.

We have a long tradition of government support for business, particularly for the energy business: government procurement, tax credits, government certification programs, patent and copyright laws, and public, private partnerships to name a few. All of these instruments and more have been used to help businesses get established and flourish.

We have a pressing need for an affordable staple supply of energy. Renewable energy must move forward and become a larger share of our energy supply. The investment and production tax credits, the 1603 Program, and the depreciation benefits for renewable energy properties are all needed to accelerate the entry into the market of renewable energy technologies, grow the domestic market for these technologies, and certainly create jobs.

I support these programs because they work. Some of them need to be expanded to promote wider applications of new energy technologies. A number of them need to be sustained for longer periods of time that are more appropriate to invest horizons, to investment horizons than the Congressional budget cycle.

On April 15 of last year I introduced H.R. 1659, a bill to expand the existing credit for fuel cell motor vehicles to include industrial-use vehicles. The United States is currently the leader in the manufacture of fuel cell technologies. If we grow the domestic market, we will continue to lead in this area. But if we withdraw our support, as we did with solar in the 1980s, we risk losing this manufacturing edge.

In my former position as president and CEO of the New York State Energy Research and Development Authority, I saw how effective and essential State and federal investment was to the development of these businesses. The partnership between the federal and State government, universities, and entrepreneurs in New York State is paying dividends in the form of jobs and energy.

I am very pleased to have Mr. Steven Erby sit before the committee today. He is the vice president of Monolith Solar Associates, which is a solar energy company from my district. Mr. Erby and his associates know firsthand the value of these tax policies to entrepreneurs. Starting your own business is not a task for the faint of heart. Convincing customers to try something new is, indeed, dif-

ficult. But, Mr. Erby and his partner, Mark Fobare, have achieved success and continue to create jobs and hire residents in the Capital Region.

This is an economic success story that I would like to see repeated throughout our country. The 1603 Program helped them to achieve success. It made the Federal Government a true partner in job creation and deployment of solar energy in the Northeast Region, and it put government on their side, not on their backs. We need to make a sustained commitment to expand alternative energy production and to improve energy efficiency, the two most reliable ways to reduce our dependence on foreign oil, insulate ourselves from volatile fuel prices, and maintain a clean environment.

We have relied on fossil fuel since the start of the Industrial Revolution, and we have invested a tremendous amount of taxpayer funds to support the oil, gas, and coal industries. Nuclear energy, the newer kid on the block, has received federal support for over 70 years as we all know. The oil industry has been in business since 1918, and made profits of over $100 billion last year alone, and they will still receive over $4 billion in subsidies each year.

It is impossible to make a case for the necessity of maintaining this level of support for such a mature industry. In fact, we might say it is mindless in terms of the handout of that benefit.

Renewable energy technologies must compete against the existing energy sources with federal support that constantly threatens to pull the rug out from under their feet. A move to renewable energy sources requires a similar level of support and commitment to the one we offer to oil and gas and our nuclear industry.

The renewable tax credits we are examining today are working. They are working and need to be continued. We talk a lot about supporting small business, having affordable domestically produced energy, and a healthy environment. It is meaningless if we do not back that rhetoric with real resources.

I look forward to hearing from our witnesses today. It is unfortunate that we are only examining the tax provisions relevant to the renewable energy community. A fair evaluation of our tax policy requires a view of the entire energy tax landscape, including century-old oil and gas tax breaks. I hope our colleagues on Ways and Means will move forward with the renewal of these important clean energy tax provisions so that companies eager to provide the market with clean energy technologies will, indeed, have a fair chance, a fair chance to deliver them.

With that I thank you and yield back, Mr. Chair.

[The prepared statement of Mr. Tonko follows:]

Opening Statement
Rep. Paul D. Tonko, Ranking Member
Subcommittee on Investigations and Oversight
Hearing on:
The Impact of Tax Policies on the Commercial Application of Renewable Energy Technology

April 19, 2012

Thank you, Chairman Broun and Chairman Harris for holding the hearing today on renewable energy tax credits. Although the legislation authorizing these incentive programs are not in our jurisdiction, it is good for this Committee to examine the subsidies that can influence markets in those technology sectors where we authorize research.

Here in the Science Committee we authorize the full suite of research, development, and technology demonstration programs that bring new ideas and new technologies forward. Many things fall by the wayside along that path, but even the most promising demonstrated technology still has to overcome many barriers to entry into the marketplace.

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We have a pressing need for an affordable, stable supply of energy. Renewable energy must move forward and become a larger share of our energy supply. The investment and production tax credits, the 1603 program, and the depreciation benefits for renewable energy properties are all needed to accelerate the entry into the market of renewable energy technologies, grow the domestic market for these technologies, and create jobs. I support these programs because they work. Some of them need to be expanded to promote wider applications of new energy technologies. A number of them need to be sustained for longer periods of time that are more appropriate to investment horizons than the Congressional budget cycle.

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We need to make a sustained commitment to expand alternative energy production and to improve energy efficiency – the two most reliable ways to reduce our dependence on foreign oil, insulate ourselves from volatile fuel prices, and maintain a clean environment. We have relied on fossil fuels since the start of the industrial revolution, and we have invested a tremendous amount of taxpayer funds to support the oil, gas, and coal industries. Nuclear energy, the newer kid on the block, has received federal support for over 70 years. The oil industry has been in business since 1918 and made profits of over $100 billion last year alone. And they will still receive over $4 billion in subsidies each year. It is impossible to make a case for the necessity of maintaining this level of support for such a mature industry.

Renewable energy technologies must compete against the existing energy sources with federal support that constantly threatens to pull the rug out from under their feet. A move to renewable energy sources requires a similar level of support and commitment to the one we offered to oil and gas and the nuclear industry. The renewable tax credits we are examining today are working and need to be

continued. We talk a lot about supporting small business, having affordable domestically-produced energy, and a healthy environment. It is meaningless if we do not back the rhetoric with real resources.

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Chairman BROUN. Thank you, Mr. Tonko. The Chair now recognizes the Chairman of the Subcommittee on Energy and Environment, Dr. Harris, for your opening statement. You have five minutes, sir.

Dr. HARRIS. Thank you very much, Mr. Chairman. As you said, as millions of Americans filed their taxes this week, many surely stopped to ponder what happens to the thousands of dollars they send to Uncle Sam. A good chunk of that money, nearly $14 billion last year, according to CBO, is spent offsetting the cost of renewable energy tax credits. Despite their staggering price tag, which is more than five times greater than renewable energy research and development spending, these programs have operated in relative obscurity. Today's hearing is intended to examine the impact and effectiveness of these credits as Congress considers President Obama's call to extend funding them with taxes on hardworking American taxpayers.

As we evaluate these subsidies, it is important to remember that the President promoted them as not only central to his effort to fight global warming but also as generating jobs that would drive America's economic recovery. By this metric, the results have been extremely disappointing.

For example, a recent *Wall Street Journal* report found that the Section 1603 Program created in the Stimulus Bill to provide companies lump sum cash payments of up to 30 percent of a project's cost resulted in far fewer jobs than expected. The report noted that collectively applicants stated in program applications that their projects would create more than 100,000 jobs. However, the *Journal's* analysis of $4.3 billion of those wind projects, representing about 40 percent of the total program funding, estimated that only 7,200 jobs were created at the peak of construction and that those projects now employ only 300 people.

Similarly, Reuters reported last week that the wind industry has lost 10,000 jobs since 2009, while the oil and gas industry added 75,000 jobs during that time.

In addition to concerns associated with the high cost and weak job creation resulting from these programs, the electricity produced by wind and solar represents less than three percent of current generation, can cost up to five times as much to produce per kilowatt hour, and must be backed by additional baseload capacity to take over when the wind doesn't blow and the sun doesn't shine.

Perhaps most importantly even with generous government subsidies consumers are ultimately required to shoulder the costs of renewable electricity directly in the forms of higher electric bills and indirectly in the higher costs passed onto them by businesses that also pay more for electricity.

This exact situation is currently under consideration in my home State of Maryland, where Governor O'Malley continues to push and mandate, push to mandate and subsidized with federal taxpayer dollars development of a $1.5 billion offshore wind farm. If adopted, his plan would increase significantly the electricity bills of nearly every resident in the State.

I would note as an aside that this proposal has generated concerns of Solyndra-like cronyism, as the governor's former chief of

staff is now managing partner at an offshore wind energy firm that could stand to benefit from passage of the plan.

As this debate continues, the free market in energy is already providing a cost saving alternative in the form of a technology-driven revolution in natural gas production that can deliver clean, reliable, baseload electricity to consumers at lower prices.

The contrast between these two paths is stark. The President's one is a centrally planned, politically driven path requiring taxpayers and ratepayers to pick up the tab for more expensive energy. The alternative would allow technology in the free market to determine the best and most affordable mix of electricity sources without burdening hardworking taxpayers and driving up already huge federal deficits.

As Congress considers the President's call to extend these subsidies, I hope these choices are the subject of thorough and open debate, taking into account the hardworking American taxpayer and the hardworking American electricity rate payer.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Harris follows:]

OPENING STATEMENT
The Honorable Andy Harris (R-MD), Chairman
Subcommittee on Energy and Environment
Joint hearing with
Subcommittee on Investigations & Oversight
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The report noted that, collectively, applicants stated in program applications that their projects would create more than 100,000 jobs. However, the Journal's analysis of $4.3 billion of wind projects—representing about 40 percent of total program funding—estimated that only 7,200 jobs were created at the peak of construction, and that those projects now employ only 300 people. Similarly, Reuters reported last week that the wind industry has lost 10,000 jobs since 2009, while the oil and gas industry added 75,000 jobs during that time.

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This exact situation is currently under consideration in my state of Maryland, where Governor O'Malley continues to push to mandate and subsidize development of a $1.5 billion offshore

wind farm. If adopted, his plan would increase significantly the electricity bills of nearly every resident in the state. I would note as an aside that this proposal has generated concerns of Solyndra-like cronyism, as the Governor's former chief of staff is now managing partner at an energy firm that could stand to benefit from passage of the plan.

As this debate continues, the free market in energy is providing a cost-saving alternative in the form of a technology-driven revolution in natural gas production that can deliver clean, reliable baseload electricity to consumers at lower prices. The contrast between these two paths is stark—one is a centrally-planned, politically-driven path requiring taxpayers and ratepayers pick up the tab for more expensive energy; the other allows technology and the free market to determine the best and most affordable mix of electricity sources without burdening taxpayers and driving up federal deficits.

As Congress considers the President's call to extend these tax preferences, I hope these choices are the subject of thorough and open debate, taking into account the hard-working American taxpayer.

Chairman BROUN. Thank you, Dr. Harris.

The Chair now recognizes Mr. Miller for your opening statement. You have five minutes, sir.

Mr. MILLER. Thank you, Mr. Chairman.

It is funny to remember that when I was first elected to Congress, first entered Congress nine years ago, I found partisan warfare tedious and wanted to pick committee assignments that would not just put me in one litmus test battle after another. The issues I had worked on the state legislature would have been in the jurisdiction more of the Judiciary Committee or of the Education and Labor or Education and the Workforce Committee, but those Committees were just seen as partisan battlegrounds with one litmus test vote after another and no real opportunities for imaginative, constructive work by Members of Congress.

I apologize to the Members of those Committees if they think that is an unfair characterization, but that was the impression of those Committees and why I did not particularly want to be on those Committees. I picked Committees that traditionally had not been divided along partisan lines—Financial Services and Science and Technology—now two Committees that are one partisan litmus test after another, it appears.

In the past, there seemed to be broad agreement about the importance of science, the importance of research for its own sake, to satisfy our curiosity—a deep human need—but also in recognition that our economy depended upon research, and it depended upon getting ideas from the laboratory to the marketplace; that we prospered because we were the most agile, innovative, energetic economy in the world.

Within our lifetimes, we have seen our economy transformed by information technology, and that revolution, that technological revolution, like others, has not been the result just of an unfettered free market, but it has been the work of the whole Nation—the public sector and the private sector. The internet began as a DARPANET, created by government research, and it is very clear, or should be very clear, that our energy future is going to be different from our energy past, and we need to be in the forefront of developing those new technologies as well.

But instead of having that broad agreement about the need to help emerging technologies that are obviously our future, it leaves—had one partisan litmus test, vote, or issue after another. There is doctrinaire opposition to clean energy as picking winners or losers or crowding out private investment, when in fact the conventional sources of energy have benefited spectacularly over the last century from hundreds of billions of dollars of taxpayer support. They have not been the result of a free market, whether it is from outright subsidies or tax breaks, limitations of liability. And if you wonder if the Price-Anderson Act really is a significant subsidy for the nuclear industry, look at what is happening right now in Japan.

Yes, there has been a large government involvement in encouraging new energy sources. The ones that we have now had benefited from that, and the energy sources of our future need to as well.

I think we all on this Committee sometimes covet the jurisdiction of other Committees, and we are frustrated at the limitations of our legislative authority, our legislative jurisdiction, and we take a more expansive view of our jurisdiction for hearings. I was guilty of that when I was Chairman of the Subcommittee, Oversight Subcommittee, this Committee, for four years. We certainly had hearings where if we had actually legislated, we probably would have been in a fistfight with the Energy and Commerce Committee or other Committees.

But this hearing does not appear to be within hailing distance, within sight, of this Committee's jurisdiction if we actually try to legislate in this area. I think we are interested in how we need to help, or whether we should help emerging energy technologies, but this is a very imaginative reading of the Committee's jurisdiction.

With that, I look forward to hearing the testimony of our witnesses today. Thank you.

[The prepared statement of Mr. Miller follows:]

OPENING STATEMENT
RANKING MEMBER BRAD MILLER
Joint I&O and E&E hearing, "*Impact of Tax Policies on the Commercial Application of Renewable Energy Technology*"

Thank you, Mr. Chairman.

During the first eight years that I served on this committee there was a genuine feeling of bipartisanship. What united the Members of this committee was a support for new and emerging technologies and a belief that American innovation was going to create and sustain our future economy.

After this past experience I have been suprised that my Republican colleagues in this Congress, spend so much of our time trying to tear down the clean energy industry. It appears that my colleagues believe that sacrificing a homegrown, fledgling industrial sector is a small price to pay for scoring a few political points against the President.

The American public rejects the Republican's assertions that we cannot innovate our way into a cleaner, more sustainable, and more affordable energy future for the country.

Will it happen overnight, or even with the first-term of a Presidency? Nope. The problem is too big. Will the conventional technologies be a part of our economy for the foreseeable future? You bet. For the most part, they are plentiful enough and the infrastructure is in-place. And they're not going anywhere soon.

But, by starting now we can capitalize on the innovative capacity of our country and build the momentum required to upgrade our aging energy infrastructure with new, more sustainable technologies, meanwhile keeping our wealth at home. By taking these steps now, we'll have another system in place as those conventional resources run out or get too expensive, or prove to be too toxic to our health.

That common sense approach gets mired in a tired and stale policy debate about the government "picking winners and losers" and "crowding out private investment". As if, any government support for clean energy – from basic research to tax credits - amounts to unacceptable interference in the free market.

So, to my colleagues, if you don't like tax incentives for clean energy projects, then I've got something that you should really hate – it is the hundreds of billions of taxpayer dollars spent over the last century subsidizing the oil, gas, nuclear and coal industries.

If we are sitting here to ostensibly meet some House rule requiring us to examine the implications of tax incentives on programs in our jurisdiction – which this is not – then why are we not looking at tax and other forms of subsidies for ALL of the energy sector.

From straight tax breaks, to land deals, to limiting corporate liability in the case of accidents, let's at least be honest about what picking a winner really looks like. What we started recently doing for renewables is tiny in comparison to the decades of government support for conventional energy technologies.

For those that still think that we should let the free market decide on the best energy technologies, I have some bad news. There is no "free" market. Winners were chosen a long time ago, and Americans just have to make do with what we have, no matter the cost to our pocket books, national security, environment, and public health.

What we are trying to do with instruments like the 1603 program is level the playing field, and for the first time introduce REAL competition into the energy marketplace. Only when these vibrant new industries are up and running will consumers have a genuine choice about their energy use, and will America once again secure its position as a leader in a global technology race.

Thank you, and I yield back.

Chairman BROUN. Thank you, Mr. Miller. I would like to remind you that the hearing is conducted pursuant to Clause 1P6 of House Rule X, which assigns the Committee on Science, Space, and Technology jurisdiction over the commercial application of energy technology, and Clause 2C of House Rule X, which requires each standing committee to review and study on a continuing basis the impact or probable impact of tax policies affecting subjects within its jurisdiction.

So we do have jurisdiction over this subject today, and I am sure my good friend from North Carolina has probably just overlooked that.

Going forward, I thank Mr. Miller for your opening statements and wish—if there are any other Members who wish to submit additional opening statements, your statements will be added to the record at this point.

At this time, I would like to introduce our first panel of witnesses. First is Dr. Molly Sherlock, a Specialist in Public Finance to the Congressional Research Service. Mr. John Parcell, the Acting Deputy Tax Legislative Counsel of the U.S. Department of Treasury, and Mr. Michael Pacheco, the Vice President of Deployment and Market Transformation at the National Renewable Energy Laboratory.

As our witnesses know, I think you all know, spoken testimony is limited to five minutes each, after which Members of the Committee will have five minutes each to ask questions. Your written testimony will be included in the record of the hearing. It is the practice of the Subcommittee on Investigations and Oversight to receive testimony under oath. We will use that practice as well today.

Do any of you have an objection of taking an oath?

Let the record reflect that all witnesses shook their head from side to side in the common notion of no.

You also may be represented by counsel. Do any of you have counsel here today with you?

No. Okay. Let the record reflect also that the witnesses have indicated that none have counsel.

If you would now please stand, raise your right hand.

[Witnesses sworn.]

Chairman BROUN. Yes. Okay. Let the record reflect, you all may be seated, that all the witnesses have taken the oath of truth.

We will now recognize our first witness from the first panel, Dr. Sherlock, with the Congressional Record Service. You have five minutes.

STATEMENT OF DR. MOLLY F. SHERLOCK, SPECIALIST IN PUBLIC FINANCE, CONGRESSIONAL RESEARCH SERVICE

Dr. SHERLOCK. Thank you. Mr. Chairman and Members of the Subcommittee, on behalf of the Congressional Research Service, I thank you for the opportunity to appear before you today.

There are three main points I was asked to discuss in today's testimony. First, I will identify the primary tax incentives that support renewable energy. Second, I will briefly discuss renewable energy proposals in the President's fiscal year 2013 budget request.

Finally, I will note the characteristics of an economically efficient energy tax policy. These comments summarize longer written testimony, which has been submitted for the record.

Historically, the primary tax incentives for renewables have been the Renewable Energy Investment Tax Credit, or ITC, and the Renewable Energy Production Tax Credit, or PTC. The ITC was first introduced in 1978. Currently, a 30 percent tax credit is available for investments in solar energy property, fuel cells, and small wind systems. A 10 percent tax credit is available for geothermal systems, microturbines, and combined heat and power property. The ITC is scheduled to expire at the end of 2016, although there is a permanent 10 percent ITC for certain solar property. In fiscal year 2011, the renewable energy ITC cost $300 million in terms of foregone revenue.

The PTC was first introduced in 1992. While the PTC was introduced as a temporary tax incentive, in the past it has regularly been extended. The PTC for wind is scheduled to expire at the end of 2012. The PTC for other eligible technologies, including biomass, geothermal, landfill gas, municipal solid waste, certain hydroelectric, and marine and hydrokinetic technologies, is scheduled to expire at the end of 2013. In fiscal year 2011, the renewable energy PTC cost $1.4 billion in terms of foregone revenue.

The American Recovery and Reinvestment Act of 2009 introduced two new tax-related provisions for renewable energy that have increased the overall cost of renewable energy tax incentives in recent years.

First, investors eligible for the renewable energy ITC or PTC could elect to receive a one-time grant from the Treasury in lieu of these tax benefits. This provision, often referred to as the Section 1603 Grant, is only available to projects that were under construction before the end of 2011.

As of March, more than $11 billion has been paid out under the Section 1603 Grant Program. Of this, $4.7 billion was paid out in 2011. Additional grants will be paid out as qualifying projects are completed. Through the end of 2017, it has been estimated that an additional $11.5 billion will be paid out in Section 1603 grants, bringing the total estimated cost of the program to $22.6 billion.

Also established as part of the Recovery Act was the Advanced Energy Manufacturing Tax Credit. In January, 2010, $2.3 billion in tax credits were awarded to 183 advanced energy manufacturing projects. These tax credits were allocated through a competitive process, and a number of technically eligible projects were not awarded tax credits.

The President's fiscal year 2013 budget contains a number of proposals that would extend and modify certain tax incentives for renewable energy. The Administration supports extending the PTC for wind, as well as an extension of the Section 1603 Grant Program. Under the Administration's proposal, the Section 1603 grant would be replaced with a refundable tax credit starting in 2013. The Joint Committee on Taxation has estimated that these proposals would cost $5.7 billion. The Administration has also proposed an additional $5 billion allocation for advanced energy manufacturing tax credits.

I would like to conclude by noting some characteristics of an economically efficient energy tax policy.

First, cost-effective incentives are those that encourage changes in behavior rather than those that reward current practices.

Second, incentives made available to a broad range of technologies avoid picking winners.

Third, if the goal is renewable energy production, incentives that reward production are preferred to those that reward investment.

And finally, energy tax policy does not exist in a vacuum. Tax policies may interact with, or be redundant to, other policies supporting renewable energy.

Thank you, again, for inviting me to appear today. I am happy to respond to your questions.

[The prepared statement of Dr. Sherlock follows:]

Statement of Molly Sherlock
Specialist in Public Finance
Congressional Research Service

Before

House Committee on Science, Space, and Technology
Subcommittee on Investigations and Oversight
&
Subcommittee on Energy and Environment

April 19, 2012

on

Impact of Tax Policies on the Commercial Application of Renewable Energy Technology

Mr. Chairmen and Members of the Subcommittees—on behalf of the Congressional Research Service, I thank you for the opportunity to appear before you today.

I have been invited here to discuss tax incentives for renewable energy. In this testimony, I will provide background on tax incentives designed to support renewable energy technologies. In doing so, I will highlight several recently expired provisions that were enacted as part of the American Recovery and Reinvestment Act in 2009. I will also provide a brief overview of the renewable energy tax policy proposals contained in the President's FY2013 Budget request. Finally, I will comment on the characteristics of an economically efficient renewable energy tax policy.

I. Tax Incentives for Renewable Energy

Tax incentives for renewable energy were first introduced in the 1970s. Historically, the renewable energy investment tax credit (ITC), and later the renewable energy production

tax credit (PTC), have been the primary tax incentives supporting renewable energy technologies.[1]

Investment tax credit

The investment tax credit (ITC) for renewable energy was first introduced in 1978.[2] The 1978 version of this incentive was scheduled to expire in 1982. Prior to the scheduled expiration date, the provision was further extended through 1985. Since the mid-1980s, the renewable energy ITC has repeatedly been modified and extended.[3] For most technologies, the ITC is set to expire at the end of 2016.

Currently, several renewable energy technologies qualify for the ITC. A 30% tax credit is available for investments in solar energy property, fuel cells, and small wind systems. Geothermal systems, microturbines, and combined heat and power (CHP) property can qualify for a 10% tax credit.[4] There is a permanent 10% ITC for solar that will remain available after the 30% rate expires at the end of 2016.

Historically, the annual revenue cost associated with the renewable energy ITC has been small. Prior to 2011, Joint Committee on Taxation (JCT) estimates of annual revenue loss from the renewable energy ITC were less than $100 million.[5] The estimated annual revenue cost of the renewable energy ITC is expected to increase in coming years. For

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[1] For background information on the current status of U.S. energy tax policy, see CRS Report R41769, *Energy Tax Policy: Issues in the 112th Congress*, by Molly F. Sherlock and Margot L. Crandall-Hollick and U.S. Congress, Joint Committee on Taxation, *Present Law And Analysis of Energy-Related Tax Expenditures*, committee print, 112th Cong., March 23, 2012, JCX-28-12, available at: http://www.jct.gov/publications.html?func=startdown&id=4414.

[2] A history of U.S. energy tax policy can be found in CRS Report R41227, *Energy Tax Policy: Historical Perspectives on and Current Status of Energy Tax Expenditures*, by Molly F. Sherlock.

[3] The investment tax credit for solar was allowed to lapse at the beginning of 1986, before being retroactively extended through the end of 1988. The credit was again extended in 1989 and 1991. In 1992, the 10% investment tax credit was made permanent. Legislation in 2005 temporarily increased the renewable energy investment tax credit for solar from 10% to 30%. Subsequent legislation in 2006 and 2008 extended this 30% rate through the end of 2016.

[4] Currently, PTC-eligible property can elect to receive a 30% ITC in lieu of this PTC. This option is available through 2012 for wind, and through 2013 for other PTC-eligible technologies.

[5] Past JCT tax expenditure tables are available online at: http://www.jct.gov/publications.html?func=select&id=5.

2011, the JCT tax expenditure estimate for the renewable energy ITC was $300 million. Over the 2011 – 2015 budget window, the JCT estimates that the renewable energy ITC will cost $2.3 billion. The JCT estimates also indicate that nearly all of the expected revenue loss is due to investment in solar technologies, as opposed to other qualifying resources.

Production tax credit

Since being introduced in 1992, the renewable energy production tax credit (PTC) has been the primary federal incentive supporting wind power. While the PTC is a temporary tax provision, in the past, it has regularly been extended.[6] Under current law, the PTC for wind-produced electricity will expire at the end of 2012.

Several other technologies also qualify for the renewable energy PTC, including closed-loop and open-loop biomass, geothermal energy, landfill gas, municipal solid waste, certain hydroelectric, and marine and hydrokinetic technologies.[7] The PTC expiration date for qualifying technologies other than wind is the end of 2013.

The JCT has estimated that the renewable energy PTC resulted in $1.4 billion of forgone revenue in 2011. Of this, roughly 80% (or $1.1 billion), was claimed by wind. Between 1992 and 2010, cumulative PTC revenue losses were approximately $7.9 billion (in 2010 dollars).[8] Over the 2011—2015 budget window, the JCT estimates that the renewable energy PTC will cost $9.1 billion.[9] Of this $9.1 billion in revenue cost, roughly 75% (or $6.8 billion) is for credits paid for the production of electricity using wind.

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[6] The PTC has been extended seven times since 1992. In three of these cases, the PTC was allowed to lapse prior to being extended.

[7] Open-loop biomass, geothermal energy, landfill gas, municipal solid waste, hydroelectric, and marine and hydrokinetic technologies qualify for a tax credit that is half of the amount available to other qualifying technologies.

[8] See CRS Report R41227, *Energy Tax Policy: Historical Perspectives on and Current Status of Energy Tax Expenditures*, by Molly F. Sherlock, Appendix B.

[9] This cost likely would have been higher absent the Section 1603 grants in lieu of tax credit program discussed below.

Other incentives for renewable energy

A number of other specially targeted tax incentives are available for renewable energy. Technologies that qualify for the renewable energy ITC or PTC also qualify for accelerated depreciation under the Modified Accelerated Cost Recovery System (MACRS). The cost of investments in most renewable energy property is recovered over a five-year period.[10]

Other provisions that have supported renewable energy in recent years include tax-credit bonds (specifically, Clean Renewable Energy Bonds (CREBs) and Qualified Energy Conservation Bonds (QECBs)).[11] Further, renewable energy benefits from a number of other tax provisions that are not industry-specific. For example, investments in renewable energy may be eligible for temporary bonus depreciation deductions[12] and those producing electricity using renewable energy resources may qualify for the Section 199 domestic production activities deduction.[13]

2. Incentives for Renewable Energy in the American Recovery and Reinvestment Act

The American Recovery and Reinvestment Act of 2009 (ARRA; P.L. 111-5) introduced two new tax-related provisions for renewable energy.[14] First, under ARRA, investors eligible for the renewable energy PTC or ITC could elect to receive a one-time grant from the Treasury in lieu of these tax benefits. Second, ARRA provided funds for an

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[10] Certain biomass property is treated as seven-year property under MACRS. Accelerated depreciation for renewable energy property is a permanent feature of the tax code.

[11] CREB financing is not currently available, as all CREB authority has been allocated. For additional background, see CRS Report R41573, *Tax-Favored Financing for Renewable Energy Resources and Energy Efficiency*, by Molly F. Sherlock and Steven Maguire.

[12] For more information on bonus depreciation, see CRS Report RL31852, *Section 179 and Bonus Depreciation Expensing Allowances: Current Law, Legislative Proposals in the 112th Congress, and Economic Effects*, by Gary Guenther.

[13] For more information on the Section 199 production activities deduction, see CRS Report R41988, *The Section 199 Production Activities Deduction: Background and Analysis*, by Molly F. Sherlock.

[14] For information on all energy-related provisions in ARRA, see CRS Report R40412, *Energy Provisions in the American Recovery and Reinvestment Act of 2009 (P.L. 111-5)*, coordinated by Fred Sissine.

advanced energy technology manufacturing tax credit. Many of the beneficiaries of this program were in the renewable energy sector.

Allowing PTC-property to claim the ITC and the introduction of Section 1603 grants

Under ARRA, property that was generally eligible for the PTC could instead elect to receive a 30% ITC. This option is scheduled to remain available until the current PTC expires at the end of 2012 for wind, and at the end of 2013 for other technologies.

In addition, under ARRA, in lieu of either the PTC or ITC, renewable energy investors could elect to receive a one-time grant from the U.S. Treasury.[15] This provision—commonly referred to as the "Section 1603 grant"—was intended to compensate for weak tax-equity markets.[16] Initially, the Section 1603 grant program was made available for property either placed-in-service or under construction in 2009 and 2010. The placed-in-service and construction start date was extended through 2011 as part of the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010 (P.L. 111-312). As of the end of 2011, the grant option is not available for new projects.[17]

As of March 15, 2012, more than $11.0 billion had been paid out under the Section 1603 grant program.[18,19] Through the end of 2017, it has been estimated that another $11.5 billion will be paid out in Section 1603 grants,[20] bringing the total estimated cost of the

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[15] See CRS Report R41635, *ARRA Section 1603 Grants in Lieu of Tax Credits for Renewable Energy: Overview, Analysis, and Policy Options*, by Phillip Brown and Molly F. Sherlock.

[16] Before the recession, large-scale renewable energy projects relied on tax-equity markets to convert tax credits into cash. Tax-equity markets dried up during the recession, making it harder for many market participants to realize the value of renewable energy tax benefits. The Treasury grants in lieu of tax credits program supported the renewable energy industry during the recession, when tax equity availability was limited.

[17] Tax credits for wind are scheduled to remain available for one year, through the end of 2012. Currently available credits for other technologies are scheduled to expire in 2013 or 2016. Grants are still being paid out to qualifying projects as these projects come online.

[18] A frequently updated list of Section 1603 grant awards can be found on the Treasury Department's website, available at: http://www.treasury.gov/initiatives/recovery/Pages/1603.aspx.

[19] This includes $1.7 billion paid out in 2009, $3.3 billion paid out in 2010, $4.7 billion paid out in 2011, and $1.3 billion paid out through March 15, 2012.

[20] See Analytical Perspectives, Budget of the United States Government, FY2013, available at: http://www.whitehouse.gov/omb/budget/Analytical_Perspectives.

program to nearly $22.6 billion. Through March 15, 2012, $8.2 billion (74.7%) of the grants paid were for wind and another $2.0 billion (17.4%) were for solar electricity.

The advanced energy manufacturing tax credit

The advanced energy manufacturing tax credit (Internal Revenue Code (IRC) § 48C) was also established in ARRA. This provision allowed the Treasury to award up to $2.3 billion in tax credits for qualified advanced energy manufacturing projects. These tax credits were competitively awarded. Selection criteria for projects, as laid out in ARRA, included: 1) commercial viability; 2) job creation; 3) pollution or greenhouse gas emissions reduction; 4) potential for technological innovation; 5) cost-effectiveness; and 6) time to completion.[21]

In January 2010, all $2.3 billion in advanced energy manufacturing tax credits were awarded to 183 projects.[22] There were a number of technically eligible projects that were not awarded tax credits through the competitive process. Specifically, the DOE and Treasury identified 235 technically eligible projects requesting a total of $5.8 billion in tax credits for which funding was not available.[23]

While the advanced energy manufacturing tax credit was available for a range of technologies, renewables accounted for an estimated 69% of credit recipients, in 2010.[24] Manufacturers of solar photovoltaics (PV) and wind turbines and related equipment among the largest recipients.

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[21] Section 1302 of ARRA.
[22] A full list of awards was included in a White House press release, available at: http://www.whitehouse.gov/the-press-office/president-obama-awards-23-billion-new-clean-tech-manufacturing-jobs.
[23] Testimony of Senior Advisor to the Secretary of Energy Matt Rogers, in U.S. Congress, Committee on Ways and Means, *Hearing on Energy Tax Incentives Driving the Green Job Economy*, hearings, 111th Cong., 2nd sess., April 14, 2010 (Washington, DC: GPO, 2010). Testimony available online at: http://energy.gov/sites/prod/files/ciprod/documents/Final_Testimony%286%29.pdf.
[24] U.S. Energy Information Administration (EIA), *Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2010*, Washington, DC, July 2011, available at: http://www.eia.gov/analysis/requests/subsidy/pdf/subsidy.pdf.

The actual cost of the advanced energy manufacturing tax credit program will likely be less than the $2.3 billion in tax credits awarded. Ultimately, the value of the credits that are actually claimed may be less than the amount that was allocated. This is because some credit recipients may have limited profits, or credits may be carried forward outside of the budget window. When ARRA was enacted, it was estimated that the program would have a 10-year revenue cost of $1.6 billion.[25]

3. Renewable Energy Tax Policy in the President's FY2013 Budget Request

The President's FY2013 Budget contains a number of proposals that would extend, expand, or reinstate certain tax incentives for renewable energy.[26]

Modify and extend the Section 1603 program

The President's FY2013 Budget proposes to extend the Section 1603 grant program, making the grant option available to property with a construction start date of 2012. This extended grant option would only be available to property that is also placed in service in 2012. The proposal would also extend the PTC for wind, as well as the option to elect the ITC in lieu of the PTC, through 2013.

For property that is placed in service after 2012, the Administration proposes replacing the Section 1603 grant with a refundable tax credit. Thus, PTC-eligible property placed in service during 2013, including wind energy property, would qualify for a 30% refundable tax credit. ITC-eligible property placed in service between 2013 and 2016 would also have the option of receiving a refundable tax credit under the Administration's proposal.

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[25] U.S. Congress, Joint Committee on Taxation, *General Explanation of Tax Legislation Enacted in the 111th Congress*, committee print, 111th Cong., March 2011, JCS-2-11. Between 2010 and 2015, JCT estimates suggest forgone revenues of $1.8 billion due to advanced energy manufacturing tax credit awards.

[26] Additional details on the Administration's tax policy proposals can be found in Department of the Treasury, *General Explanations of the Administration's Fiscal Year 2013 Revenue Proposals*, Washington, DC, February 2012, available at: http://www.treasury.gov/resource-center/tax-policy/Documents/General-Explanations-FY2013.pdf

The JCT has estimated that extending the PTC and the option to elect the ITC in lieu of the PTC for wind through 2013, extending the Section 1603 grant in lieu of tax credit program through 2012, and converting the Section 1603 grant into a refundable tax credit for 2013 through 2016, would cost an estimated $5.7 billion over the 2012 – 2022 budget window.[27]

Provide an additional allocation for advanced energy manufacturing tax credits

The President's FY2013 Budget proposes to provide an additional $5 billion allocation for advanced energy manufacturing tax credits. The President's FY2012 Budget contained a similar proposal, which was not enacted.

The JCT has estimated that providing an additional allocation of $5 billion in tax credits would have a 10-year revenue cost of $3.3 billion.[28]

Extend certain expired and expiring energy tax provisions

As was mentioned above, the President's FY2013 budget proposes extending the PTC for wind through 2013. Under this proposal, the option to claim a 30% ITC instead of the PTC would also be extended. The President's FY2013 Budget also proposes to extend a number of other energy-related (but not necessarily renewable energy) provisions.[29]

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[27] See U.S. Congress, Joint Committee on Taxation, *Estimated Budget Effects Of The Revenue Provisions Contained In the President's Fiscal Year 2013 Budget Proposal*, committee print, 112th Cong., March 21, 2012, JCX-27-12, available at: http://www.jct.gov/publications.html?func=startdown&id=4413. The Treasury estimated that this provision would cost $4.3 billion over the same time period. Both the JCT and the Treasury estimates include outlay effects. The Treasury estimates that outlays resulting from extending the Section 1603 grant program will be $1.3 billion, while the JCT estimates that outlays from extending the Section 1603 grant program under this proposal will be $4.7 billion.

[28] U.S. Congress, Joint Committee on Taxation, *Estimated Budget Effects Of The Revenue Provisions Contained In the President's Fiscal Year 2013 Budget Proposal*, committee print, 112th Cong., March 21, 2012, JCX-27-12, available at: http://www.jct.gov/publications.html?func=startdown&id=4413.

[29] In addition, the President's FY2013 Budget would extend a number of other recently expired energy tax provisions. These provisions include those designed to support renewable and alternative fuels (e.g., incentives for biodiesel, renewable diesel, and alternative fuels; incentives for cellulosic biofuels and cellulosic biofuel plant property; and incentives for alternative fuel vehicle refueling property) as well as a number of incentives designed to promote energy efficiency (e.g., tax credits for energy-efficient new

Revenue estimates of provisions in the President's FY2013 Budget proposal do not separately estimate the cost of extending the PTC as a stand alone provision. The cost of extending the current PTC for one year, through 2013 for wind and 2014 for other eligible technologies, was estimated to cost $4.1 billion over the 10-year budget window.[30]

4. Characteristics of Economically Efficient Renewable Energy Tax Policy

From an economie perspective, energy prices would ideally reflect the full social cost of energy production and consumption. Having accurate cost and price signals would direct economic resources towards their most productive use. An economically efficient way to achieve this outcome would be to tax energy resources that have negative external social costs, such as pollution. Increasing the price of energy resources would not only reduce overall demand for energy, but would also create incentives for investment in non-polluting alternatives.

The history of U.S. energy tax policy indicates a preference for subsidies, rather than direct taxes. Given this preference, this testimony provides some economic analysis related to designing efficient energy tax incentives.

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homes; tax credits for energy-efficient appliance manufacturers; and residential energy efficiency tax incentives). The President's FY2013 Budget also proposes modifications to a number of other tax incentives related to energy efficiency and alternative technology vehicles.

[30] U.S. Congress, Joint Committee on Taxation, *Estimated Budget Effects of S. 2204, the "Repeal Big Oil Tax Subsidies Act" Scheduled for Consideration on the Senate Floor March 26, 2012*, committee print, 112th Cong., March 23, 2012, JCX-29-12, available at: http://www.jct.gov/publications.html?func=startdown&id=4415.

Cost-effective incentives are those that encourage changes in behavior, rather than simply rewarding current practices

The goal of energy tax incentives is to encourage, promote, or support production or consumption of targeted energy resources. Tax subsidies for residential energy efficiency, for example, are intended to promote investment in residential energy-saving property. Tax subsidies for residential energy efficiency (as well as other energy-related tax subsidies) reward two types of consumers: those who would not have installed the energy-saving property without the tax incentive, and those who would have installed the energy-saving property even if a tax incentive were not available. In practice, it is very difficult to target tax incentives such that only the first group benefits.

Economists find that tax incentives are more efficient (and cost-effective) when a larger proportion of taxpayers change their behavior to become eligible for the tax incentive. If few taxpayers actually change their behavior to benefit from a tax incentive, tax incentives either 1) provide windfall gains to taxpayers already engaged in the activity the incentive was designed to promote; or 2) the incentive is ineffective.

For renewable energy projects with longer planning horizons, tax uncertainty might prevent marginal projects from moving forward. These marginal projects are those that would likely respond directly to the tax incentive, but without a tax incentive, are not viable. In the face of tax uncertainty, other investments in renewable energy are still likely to take place. These investments, however, are not those that are motivated by tax incentives. If tax incentives happen to be available when these projects are placed in service, these projects will benefit. For the latter class of projects, however, tax incentives did not cause additional renewable energy investment. Instead, tax incentives provided a windfall benefit without motivating additional investment in renewable energy.

To the extent that tax uncertainty prevents marginal projects from moving forward, and allows other projects to receive windfall benefits, tax uncertainty is inefficient and diminishes the cost-effectiveness of tax policies.

Effective energy tax incentives support technologies that would be competitive if energy prices reflected the full social cost of energy consumption and production

Subsidies for low-carbon energy resources can be viewed as compensating for the fact that polluting energy resources are under-priced. In other words, in a market where pollution is not priced, subsidies for clean energy can help level the playing field. Overly generous subsidies, however, might support technologies that would otherwise not be viable (or do not have the potential to become viable at some point in the future). Supporting technologies with limited viability can create economic distortions, diverting economic resources away from more promising alternatives.

Incentives made available to a broad range of technologies avoid "picking winners"

Renewable energy tax incentives may seek to achieve varied policy goals. One goal might be reduced CO_2 emissions. Another goal might be to strengthen domestic manufacturing and promote job creation. A third goal might be to enhance energy security. Ideally, energy tax policy should be designed to allow markets to choose which technologies best meet energy policy objectives. This point is illustrated by expanding on the policy goal of reducing CO_2 emissions.

If the policy goal is to reduce carbon emissions, a tax on carbon would create market incentives for businesses and individuals to find low-cost, low-carbon alternatives. A direct tax on carbon would prevent policymakers from making explicit choices regarding which low-carbon technologies should be employed. In contrast, subsidies for low-carbon technologies require the identification of certain technologies as being explicitly eligible for the subsidy. This may create a bias against newly emerging technologies, as it takes time to update the tax code to expand the list of qualifying technologies.[31]

[31] This point was made in U.S. Congress, House Committee on Ways and Means, Subcommittee on Select Revenue Measures, *Energy Policy and Tax Reform*, Statement of Donald B. Marron, 112th Cong., 1st sess., September 22, 2011.

If the goal is renewable energy production, incentives that reward production are preferred to those that reward investment

Production incentives reward the generation of electricity using renewable energy resources. When production is rewarded, investors will strive to maximize the output of qualifying energy, given the resources available. Alternatively, instead of directly rewarding energy production, investment tax incentives reward capital investment. By rewarding investment rather than production, there is a concern that investments may not translate into maximum production capacity. Further, incentives that reward investment as opposed to production may lead firms to use more capital at the expense of labor.[32]

Energy tax policy does not exist in a vacuum; tax policies may interact with or be redundant to other policies supporting energy

Tax incentives are one of many tools that can be used to support energy policy objectives. One goal for the design of energy-related tax incentives should be to avoid policy redundancy: if policy goals are being achieved through the use of another policy instrument, tax incentives may not achieve purported policy goals efficiently.

In the case of renewable energy tax credits, one concern is that state-level Renewable Portfolio Standards (RPS) might drive up the costs associated with federal tax incentives.[33] If energy investment is being driven by state-level policies mandating renewable energy use, then tax expenditures for renewable energy incentives may increase without an associated increase in renewable energy investment. In other words, if investment is being driven by state-level renewable energy policies, tax credits might simply be rewarding existing activity.[34]

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[32] This point was made in U.S. Congress, House Committee on Ways and Means, Subcommittee on Select Revenue Measures, *Energy Policy and Tax Reform*, Statement of Donald B. Marron, 112th Cong., 1st sess., September 22, 2011.

[33] Gilbert E. Metcalf, "Tax Policies for Low-Carbon Technologies," *National Tax Journal*, vol. 62, no. 3 (September 2009), p. 517.

[34] Similar concerns have been raised with respect to tax incentives for biofuels under the Renewable Fuel Standard (RFS). Consumption of biofuels is largely driven by the RFS. To the extent that biofuel consumption is driven by this mandate, tax credits do not lead to additional production. While tax

Thank you again for inviting me to appear today. I am happy to respond to your questions.

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incentives for biofuels may have limited effects on production under the RFS, the tax credits still provide financial support to biofuel blenders, producers, as well as purchasers of blended fuel. See Congressional Budget Office, *Using Biofuel Tax Credits to Achieve Energy and Environmental Policy Goals*, Washington, DC, July 2010, p. 18 and U.S. Government Accountability Office, *Biofuels: Potential Effects and Challenges of Required Increases in Production and Use*, GAO-09-446, August 2009, pp. 99-105, http://www.gao.gov/new.items/d09446.pdf.

Chairman BROUN. Thank you, Doctor.

Our next witness is John Parcell, Department of Treasury. You have five minutes, sir.

STATEMENT OF MR. JOHN PARCELL,

ACTING DEPUTY TAX LEGISLATIVE COUNSEL,

U.S. DEPARTMENT OF THE TREASURY

Mr. PARCELL. Good morning, Chairman Broun, Chairman Harris, Ranking Member Tonko, Ranking Member Miller, and Members of the Subcommittees. Thank you for inviting me to testify before your Subcommittees today. I appreciate this opportunity to discuss the energy proposals in the President's fiscal year 2013 budget.

By way of background, the Administration believes in an all-of-the-above energy strategy, a strategy that relies on producing more oil and gas here in America but also producing more wind power, more solar power, more fuel-efficient cars, and other renewable power and energy-efficiency improvements. *The American Recovery and Reinvestment Act of 2009*, or the Recovery Act, took an important step in that direction by providing more than $80 billion for investment in clean energy technologies, the largest investment in clean energy in history. As a result, the United States has nearly doubled renewable energy generation since 2008.

With this as background, let me turn to the tax-related proposals in our budget relating to renewable energy and energy conservation.

First, the budget proposes to expand the Recovery Act tax credit for investments in advanced energy manufacturing facilities. This credit, under Section 48C of the Code, was designed to help America take the lead in the manufacture of wind turbines, solar panels, electric vehicles, and other clean energy and energy conservation products.

The Treasury Department and the Department of Energy have cooperated in awarding the $2.3 billion of credits authorized by the Recovery Act, awarding credits to 183 projects in 43 States to support the development of a clean, of a domestic clean energy manufacturing base and the new clean energy jobs that entails.

The $2.3 billion cap on the credit has resulted in the funding of less than one-half of the technically acceptable applications that have been received. The budget proposes an additional $5 billion in credits that would support at least $15 billion in total capital investment. Because there is already an existing pipeline of worthy projects and substantial interest, this additional credit could be deployed quickly to create jobs and support economic activity.

Second, the budget proposes to extend the Production Tax Credit under Section 45 of the Code, and the Investment Tax Credit under Section 48 of the Code, for wind facilities for an additional year. Thus, the two credits would apply to wind facilities placed in service in 2013.

In addition, the budget proposes to extend the Section 1603 Program. This program, as Dr. Sherlock pointed out, allows taxpayers to receive a cash payment instead of the Section 45 and Section 48 credits. The proposal would extend the Section 1603 Program to all

otherwise qualifying property placed in service in calendar year 2012.

Under current law, property placed in service in 2012 would be eligible for a Section 1603 payment only if construction had begun before the end of 2011.

For property placed in service after 2012, the budget proposes to replace Section 1603 Program with the Refundable Tax Credit. This refundable credit would apply to all property placed in service after 2012 that would be eligible for a Section 1603 payment under current law, as well as to otherwise eligible property that would not have been eligible under current law because construction on the property began in 2012 or 2013.

Next, I would like to briefly mention some other tax initiatives in the budget that will help spur the development of America's renewable energy potential.

The budget proposes to focus the current nine percent credit for domestic production activities more narrowly on manufacturing and to increase the deduction for the manufacture of advanced technology property to approximately 18 percent.

The budget also proposes to make permanent an expanded research and experimentation credit to expand the tax credit for advanced technology vehicles, provide a new credit for alternative fuel trucks, and to convert the existing deduction for energy-efficient commercial buildings into a more valuable tax credit.

Finally, the budget proposes to extend through 2013 a number of expired or expiring energy-related tax provisions.

The invitation to testify requested discussion of the implementation of the Section 1603 and 48C Programs. I will focus on the 48C Program and leave the Section 1603 Program to Dr. Pacheco.

The 48C Program is administered by the Internal Revenue Service. As in the case of Section 1603, it requires energy and—engineering and scientific expertise from the Energy Department, and we have contracted with the Office of Energy Efficiency and Renewable Energy and DOE to assist in the review process, which is largely complete at this point.

I see my time has expired. I thank you.

[The prepared statement of Mr. Parcell follows:]

STATEMENT OF JOHN H. PARCELL
DEPUTY TAX LEGISLATIVE COUNSEL
DEPARTMENT OF THE TREASURY
BEFORE THE
HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT
AND
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT

April 19, 2012

Good morning Chairman Broun, Chairman Harris, Ranking Member Tonko, Ranking Member Miller, and members of the Subcommittees. Thank you for inviting me to testify before your Subcommittees today. I appreciate this opportunity to discuss the energy proposals in the President's FY 2013 Budget.

Overview of the Administration's Environmental and Energy Policy

First, I will briefly discuss the Administration's environmental and energy policy in order to provide context for a discussion of tax incentives for renewable energy.

The Administration believes in an all-of-the-above energy strategy – a strategy that relies on producing more oil and gas here in America, but also producing more wind power, more solar power, other renewable power, more fuel-efficient cars, and energy efficiency improvements. The American Recovery and Reinvestment Act of 2009 (Recovery Act) took an important step in that direction by providing more than $80 billion for investment in clean energy technologies. As a result, the United States has nearly doubled renewable energy generation since 2008. Since 2009, the Department of Interior has approved 29 onshore renewable energy projects on public lands with a total capacity of 6,000 megawatts. Through loan programs, the Department of Energy has supported nearly 40 clean energy projects. Some of these are expected to generate enough clean electricity to power nearly 3 million homes. Others are expected to displace nearly 300 million gallons of gasoline annually. These loan programs support the world's largest wind farm, the first new U.S. nuclear plant in three decades, and several of the world's largest solar photovoltaic generation facilities. In addition, the Administration has proposed new fuel economy standards that by 2025 will require automobile fleets to average 54.5 miles per gallon. The new standards will save consumers $1.7 trillion at the pump – roughly $8,200 per vehicle. In addition, the new standards will reduce oil consumption by 2.2 million barrels per day by 2025 and reduce greenhouse gas emissions by 6 billion metric tons over the lifetime of vehicles covered by the new standards. The President has also called on Congress to invest in a new HomeStar program of rebates for consumers who make energy efficiency retrofits to their homes. Such a program will harness the power of the private sector to help drive consumers to make energy-saving and cost-saving investments in their homes.

Budget Tax Proposals Relating to Energy

With this as background, let me turn to the tax proposals in the President's FY 2013 Budget relating to energy. More details on the proposals (other than those that involve only an extension of an existing tax provision) can be found in the Appendix.

1. Provide additional tax credits for advanced energy manufacturing facilities

The Recovery Act provided $2.3 billion in tax credits for investments in advanced energy manufacturing facilities. The credit, under section 48C of the Internal Revenue Code (Code), was designed to help our country take the lead in the manufacture of wind turbines, solar panels, electric vehicles, and other clean energy and energy conservation products. Eligible manufacturers receive a 30-percent credit for their investments in facilities to manufacture these products.

The Treasury Department and the Department of Energy cooperated to award the $2.3 billion of credits authorized by the Recovery Act. Credits were awarded to 183 projects in 43 states to support tens of thousands of high quality clean energy jobs and the development of a domestic clean energy manufacturing base.

The $2.3 billion cap on the credit has resulted in the funding of less than one-half of the technically acceptable applications that were received. The President's FY 2013 Budget proposes an additional $5 billion in credits that would support at least $15 billion in total capital investment. Because there is already an existing pipeline of worthy projects and substantial interest, the additional credit could be deployed quickly to create jobs and support economic activity.

2. Extend and modify renewable energy incentives

A production tax credit (Code section 45) is provided for the production of renewable energy from wind, solar, biomass, and various other sources. For most facilities, including wind facilities, the credit rate is 2.2 cents per kilowatt hour[1] and the credit is allowed for the electricity produced at a facility for the first ten years after it is placed in service. In addition, an investment tax credit (Code section 48), generally at a 30-percent rate, is available for energy property. Energy property includes any property that is part of a facility that could qualify for the production tax credit as well as certain other listed energy-related property. (A taxpayer must choose between the production tax credit and the investment tax credit and may not claim both credits for the same facility.) Finally, section 1603 of Division B of the Recovery Act requires the Treasury Department to make payments, generally at a 30-percent rate, to persons that place in service property that would otherwise qualify for the investment tax credit for energy property (the section 1603 program). (Again, a taxpayer must choose between the payment, the investment tax credit, and the production tax credit, and may not claim more than one of the incentives for the same facility.) To date, the section 1603 program has helped fund over 34,000 projects located in every state.

[1] The rate is subject to an annual inflation adjustment.

The production credit is available for wind facilities placed in service before the end of 2012 and for other renewable energy facilities placed in service before 2014. The investment tax credit is also available for these facilities. Certain other property may qualify for an investment tax credit even if placed in service after 2013. For example, the investment credit is available for solar facilities at a 30-percent rate through 2016 and at a 10-percent rate thereafter. Payments under the section 1603 program are subject to the same expiration dates as the investment tax credit, with two exceptions. First, no payments are allowed under the section 1603 program for property placed in service after 2016. Second, no payments are allowed for property placed in service after 2011 unless construction of the property began during 2009, 2010, or 2011.

Investments in property qualifying for these renewable energy incentives further the Administration's policy of supporting a clean energy economy, reducing reliance on oil, and cutting greenhouse gas emissions. The extension of incentives for these investments is necessary to the continued success of that policy.

The President's FY 2013 Budget would extend the production tax credit for wind facilities and the investment tax credit for wind facility property to facilities and property placed in service in 2013. The proposal would also extend the section 1603 program to all otherwise qualifying property placed in service in 2012 (including property on which construction begins in 2012). For property that is placed in service after 2012, the proposal would replace the payment under the section 1603 program with a refundable tax credit administered by the Internal Revenue Service. The credit would be allowed with respect to property placed in service in 2013 (in the case of property, including wind facility property, that is part of a facility eligible for the renewable electricity production tax credit) and for property placed in service during the period 2013-2016 (in the case of any other energy property). The refundable tax credit would be available for property on which construction begins during the period 2009-2013. Qualification requirements for the refundable credit would be the same (except for the effective date provisions) as the qualification requirements currently applicable under the section 1603 program.

3. Additional energy-related tax initiatives

The President's FY 2013 Budget proposes a number of other tax initiatives that will help spur the development of America's renewable energy potential, including the following:

- A proposal to focus the 9-percent deduction for domestic production activities more narrowly on manufacturing activities. The savings would be invested in a two-tier increase in the deduction, with the larger increase (to approximately 18 percent) going to manufacturers of advanced technology property, including renewable energy property.
- A proposal to make permanent an expanded research and experimentation credit. This change would contribute to the domestic development of cutting-edge renewable energy technologies.
- Making advanced vehicles more affordable by expanding the tax credit for electric vehicles to a broader range of advanced vehicle technologies, making the credit scalable based on performance up to a maximum cap of $10,000, making the credit available to

dealers so it can be provided to consumers as a point-of-sale rebate, and replacing the per-manufacturer cap with a phase-out of the credit over time.

- Providing a tax credit for 50 percent of the incremental cost (relative to the cost of a comparable diesel or gasoline vehicle) of a dedicated alternative-fuel truck, including one powered by natural gas or electricity. The credit would be allowed for a five-year period, with a phase-down in the last year of the period.
- Converting the existing deduction for energy efficient commercial buildings into a more valuable tax credit, making the credit scalable (from $0.60 per square foot to $1.80 per square foot) depending on the energy efficiency achieved, specifying prescriptive standards that can be used to qualify for the credit (in lieu of the whole-building auditing, modeling, and simulation required under current law), and allowing the credit to benefit a real estate investment trust (REIT) or its shareholders.

4. *Extend expiring provisions*

The Budget proposes to extend through 2013, without other changes, a number of tax provisions that either have expired or are scheduled to expire at the end of 2012. The following energy incentives are included in the extension proposal:

- *Incentives for biodiesel and renewable diesel.* A $1.00-per-gallon incentive for biodiesel and renewable diesel is provided as an income tax credit, an excise tax credit, or a refundable payment. In addition, a $0.10-per-gallon income tax credit is available for small producers. The incentives expired at the end of 2011.
- *Incentives for alternative fuels.* A $0.50-per-gallon (or gasoline gallon equivalent) excise tax credit or refundable payment is provided for alternative fuels such as liquefied hydrogen, natural gas fuels, liquefied petroleum gas, liquid fuels derived from coal, and liquid fuels derived from biomass. The incentives expired at the end of 2011 for fuels other than liquefied hydrogen.
- *Incentives for cellulosic biofuel.* A $1.01-per-gallon incentive for cellulosic biofuel is provided as an income tax credit. In addition, 50-percent bonus depreciation is allowed for plants that produce cellulosic biofuel in the year they are placed in service. The incentives expire at the end of 2012.
- *Tax credits for alternative fuel refueling property.* A 50-percent income tax credit is provided for alternative fuel (including electricity) refueling property, subject to a $30,000 cap for depreciable property and a $1,000 cap for nonbusiness property. The credit expired at the end of 2011 except for property relating to hydrogen.
- *Tax credits for energy efficient new homes.* A $2,000 dollar income tax credit is allowed for the construction of an energy efficient home ($1,000 in the case of a manufactured home). The credit expired at the end of 2011.
- *Tax credits for energy efficiency improvements to existing homes.* A 10-percent income tax credit is allowed for various energy-efficient home improvements (improvements to the building envelope and the installation of energy-efficient heating and cooling equipment). The aggregate credit is limited to $500. The credit expired at the end of 2011.
- *Tax credits for energy efficient appliances.* A tax credit ranging from $25 to $225 is allowed to manufacturers of energy efficient dishwashers, clothes washers, and

refrigerators. The credit is limited (except in the case of refrigerators) to $25 million per manufacturer and is further limited for a taxable year (including in the case of refrigerators) to 4 percent of average gross receipts for the preceding three years. The credit expired at the end of 2011.

- *Tax credit for plug-in hybrid conversions.* A 10-percent credit (up to $4,000) is allowed for the cost of converting a used vehicle into a plug-in electric drive motor vehicle. The credit expired at the end of 2011.
- *Deferral of gain on sales to implement electric restructuring policy.* Utilities selling transmission facilities to implement federal or state electric restructuring policy are permitted to report the gain over an 8-year period rather than in the year of sale. This treatment expired at the end of 2011.

Implementation of Section 1603 and 48C Programs

Section 1603

The section 1603 program is administered within the Treasury Department by the Office of the Fiscal Assistant Secretary (OFAS). Because the program incorporates many tax concepts, technical assistance is provided by the Office of Tax Policy in the Treasury Department, the Internal Revenue Service Office of Chief Counsel, and other offices as necessary. In addition, the Treasury Department has entered into an inter-agency agreement with the Department of Energy (DOE) so that Treasury may utilize, as necessary, DOE's engineering, scientific, and other expertise when reviewing applications.

Section 1603 is not a discretionary program, and Treasury is required to make payments to all eligible applicants. Application reviews are focused on determining whether the statutorily mandated eligibility criteria have been met and whether the amount claimed has been appropriately calculated. Recipients are required to make annual reports on the use of the property for a period of five years after receipt of the payment. If the property ceases to meet the eligibility criteria during the five-year period, part or all of the payment will be recaptured.

Section 48C

Unlike section 1603, implementation of section 48C is largely complete. Section 48C also differs from section 1603 in that section 48C is a discretionary program that authorized the Treasury Department to allocate $2.3 billion dollars in tax credits among advanced energy projects. In addition, awards were limited to projects that had a reasonable expectation of commercial viability. Within this class of projects, Treasury, in consultation with DOE, allocated the limited supply of credits using specified selection criteria including commercial viability, job creation, pollution and greenhouse gas reduction, technological innovation, lowest cost, and shortest completion time.

Because section 48C is a tax provision, the section 48C program is administered within the Treasury Department by the Internal Revenue Service. As in the case of section 1603, the Internal Revenue Service entered into an inter-agency agreement with DOE that enabled the Internal Revenue Service to draw on the expertise of the Office of Energy Efficiency and

Renewable Energy (EERE). During the review process, EERE considered more than 500 applications and, at the conclusion of the review, ranked the projects in descending order of priority. The tax credits were awarded to taxpayers based on this ranking until the $2.3 billion in available credits was fully allocated.

Based on the experience gained in the 2009 review process, the IRS and EERE are confident that any additional credits authorized by Congress could be quickly and efficiently allocated.

Conclusion

Mr. Chairmen, this concludes my prepared testimony. I will be pleased to answer any questions you or other members of the Committee may have.

APPENDIX: GENERAL EXPLANATIONS OF THE ADMINISTRATION'S FISCAL YEAR 2013 REVENUE PROPOSALS RELATED TO ENERGY[2]

PROVIDE ADDITIONAL TAX CREDITS FOR INVESTMENT IN QUALIFIED PROPERTY USED IN A QUALIFYING ADVANCED ENERGY MANUFACTURING PROJECT

Current Law

A 30-percent tax credit is provided for investments in eligible property used in a qualifying advanced energy project. A qualifying advanced energy project is a project that re-equips, expands, or establishes a manufacturing facility for the production of: (1) property designed to produce energy from renewable resources; (2) fuel cells, microturbines, or an energy storage system for use with electric or hybrid-electric vehicles; (3) electric grids to support the transmission, including storage, of intermittent sources of renewable energy; (4) property designed to capture and sequester carbon dioxide emissions; (5) property designed to refine or blend renewable fuels or to produce energy conservation technologies; (6) electric drive motor vehicles that qualify for tax credits or components designed for use with such vehicles; and (7) other advanced energy property designed to reduce greenhouse gas emissions.

Eligible property is property: (1) that is necessary for the production of the property listed above; (2) that is tangible personal property or other tangible property (not including a building and its structural components) that is used as an integral part of a qualifying facility; and (3) with respect to which depreciation (or amortization in lieu of depreciation) is allowable.

Under the American Recovery and Reinvestment Act of 2009 (ARRA), total credits were limited to $2.3 billion, and the Treasury Department, in consultation with the Department of Energy, was required to establish a program to consider and award certifications for qualified investments eligible for credits within 180 days of the date of enactment of ARRA. Credits may be allocated only to projects where there is a reasonable expectation of commercial viability. In addition, consideration must be given to which projects: (1) will provide the greatest domestic job creation; (2) will have the greatest net impact in avoiding or reducing air pollutants or greenhouse gas emissions; (3) have the greatest potential for technological innovation and commercial deployment; (4) have the lowest levelized cost of generated or stored energy, or of measured reduction in energy consumption or greenhouse gas emission; and (5) have the shortest completion time. Guidance under current law requires taxpayers to apply for the credit with respect to their entire qualified investment in a project.

Applications for certification under the program may be made only during the two-year period beginning on the date the program is established. An applicant that is allocated credits must provide evidence that the requirements of the certification have been met within one year of the

[2] The complete set of the General Explanations of the Administration's Fiscal Year 2013 Revenue Proposals can be found on Treasury's website here: http://www.treasury.gov/resource-center/tax-policy/Documents/General-Explanations-FY2013.pdf. The relevant energy-related proposals are included in this Appendix.

date of acceptance of the application and must place the property in service within three years from the date of the issuance of the certification.

Reasons for Change

The $2.3 billion cap on the credit has resulted in the funding of less than one-third of the technically acceptable applications that have been received. Rather than turning down worthy projects that could be deployed quickly to create jobs and support economic activity, the program – which has proven successful in leveraging private investment in building and equipping factories that manufacture clean energy products in America – should be expanded. An additional $5 billion in credits would support nearly $17 billion in total capital investment, creating tens of thousands of new construction and manufacturing jobs. Because there is already an existing pipeline of worthy projects and substantial interest in this area, the additional credit can be deployed quickly to create jobs and support economic activity.

Proposal

The proposal would authorize an additional $5 billion of credits for investments in eligible property used in a qualifying advanced energy manufacturing project. Taxpayers would be able to apply for a credit with respect to part or all of their qualified investment. If a taxpayer applies for a credit with respect to only part of the qualified investment in the project, the taxpayer's increased cost sharing and the project's reduced revenue cost to the government would be taken into account in determining whether to allocate credits to the project.

Applications for the additional credits would be made during the two-year period beginning on the date on which the additional authorization is enacted. As under current law, applicants that are allocated the additional credits must provide evidence that the requirements of the certification have been met within one year of the date of acceptance of the application and must place the property in service within three years from the date of the issuance of the certification.

The change would be effective on the date of enactment.

EXTEND AND MODIFY CERTAIN ENERGY INCENTIVES

Current Law

The general business tax credit includes a production tax credit for wind facilities placed in service in 2012 and certain other renewable energy facilities placed in service before 2014 (the renewable electricity production tax credit). The general business credit also includes an investment tax credit for energy property. Energy property is (1) property that is part of a facility that, but for the election to claim an investment tax credit, would qualify for the renewable electricity production tax credit and (2) certain other listed property (including solar energy property).

The Secretary of the Treasury is required to make grants to persons that place in service property that, but for the receipt of the grant, would be energy property qualifying for the investment tax

credit. In general, the grant is 30 percent of the basis on which the investment tax credit could be claimed. For qualified microturbine, combined heat and power systems, and geothermal heat pump property, the grant is 10 percent of such basis. If a grant is paid with respect to any property, no renewable electricity production tax credit or investment tax credit is allowed with respect to that property.

The grant was available for property that was originally placed in service in 2009, 2010, and 2011. For property placed in service after 2011, the grant is available only if construction of the property began in 2009, 2010, or 2011, and the property is placed in service before 2013 (in the case of wind facility property), 2014 (in the case of other property that is part of a facility that could, but for the receipt of the grant, qualify for the renewable electricity production tax credit), or 2017 (in the case of any other energy property).

Reasons for Change

Investments in property qualifying for the renewable electricity production tax credit and the investment tax credit for energy property further the Administration's policy of supporting a clean energy economy, reducing our reliance on oil, and cutting carbon pollution. The extension of incentives for these investments is necessary to the continued success of that policy. The administration of the incentives could be improved, however, if they were delivered entirely through the Internal Revenue Code by substituting a refundable tax credit for the Treasury grant program.

Proposal

The proposal would extend the production tax credit for wind facilities and the investment tax credit for wind facility property to facilities and property placed in service in 2013. The proposal would also extend the Treasury grant program to all otherwise qualifying property placed in service in 2012 (including property on which construction begins in 2012). For property that is placed in service after 2012, the proposal would replace the Treasury grant with a refundable tax credit administered by the Internal Revenue Service. The refundable tax credit would be available for property on which construction begins in 2009, 2010, 2011, 2012, or 2013. The credit would be allowed with respect to property placed in service in 2013 (in the case of property, including wind facility property, that is part of a facility eligible for the renewable electricity production tax credit) and for property placed in service in 2013, 2014, 2015, or 2016 (in the case of any other energy property). Qualification requirements for the refundable credit would be the same (except for the effective date provisions) as the qualification requirements currently applicable under the Treasury grant program.

TARGET THE DOMESTIC PRODUCTION DEDUCTION TO DOMESTIC MANUFACTURING ACTIVITIES AND DOUBLE THE DEDUCTION FOR ADVANCED MANUFACTURING ACTIVITIES

Current Law

Current law allows a deduction to taxpayers that generate qualified production activities income. Such income is generally calculated as a taxpayer's domestic production gross receipts (DPGR)

less the cost of goods sold and other expenses, losses, or deductions attributable to such receipts. DPGR are those gross receipts derived from any lease, rental, license, sale, exchange, or other disposition of (1) qualifying production property (tangible personal property, computer software, and sound recordings) manufactured, produced, grown, or extracted by the taxpayer in whole or in significant part within the United States; (2) any qualified film produced by the taxpayer (where not less than 50 percent of the total compensation is for labor services performed in the United States); or (3) electricity, natural gas, or potable water produced by the taxpayer in the United States. DPGR also include gross receipts derived from the construction of real property performed in the United States, including receipts derived from the conduct of related engineering or architectural services.

The domestic production deduction is generally equal to nine percent of the taxpayer's qualified production activities income (or of its taxable income, computed before the deduction, if less) for the taxable year. It is computed at a 6 percent rate for income attributable to the production, refining, processing, transportation, or distribution of oil, gas, or any primary product thereof. The deduction may not exceed 50 percent of wages (including amounts of elective deferrals and deferred compensation) paid by the taxpayer for the taxable year that are attributable to DPGR.

Reasons for Change

The current domestic production deduction applies to a broad range of activities beyond core manufacturing activities. Broadening the income tax base by narrowing the scope of the domestic production deduction would allow an increased deduction rate for the activities remaining subject to the provision, and would allow for an even greater incentive for the manufacture of certain advanced technology property.

Proposal

The proposal would limit the extent to which the domestic production deduction is allowed with respect to nonmanufacturing activities by excluding from the definition of DPGR any gross receipts derived from sources such as the production of oil and gas, the production of coal and other hard mineral fossil fuels, and certain other nonmanufacturing activities. Additional revenue obtained from this retargeting would be used to increase the general deduction percentage and to fund an increase of the deduction rate for activities involving the manufacture of certain advanced technology property to approximately 18 percent. The proposal would be roughly revenue neutral over the ten-year budget window.

The proposal would be effective for taxable years beginning after December 31, 2012.

ENHANCE AND MAKE PERMANENT THE RESEARCH AND EXPERIMENTATION (R&E) TAX CREDIT

Current Law

The R&E tax credit is 20 percent of qualified research expenses above a base amount. The base amount is the product of the taxpayer's "fixed base percentage" and the average of the taxpayer's gross receipts for the four preceding years. The taxpayer's fixed base percentage generally is the ratio of its research expenses to gross receipts for the 1984-88 period. The base amount cannot be less than 50 percent of the taxpayer's qualified research expenses for the taxable year. Taxpayers can elect the alternative simplified research credit (ASC), which is equal to 14 percent of qualified research expenses that exceed 50 percent of the average qualified research expenses for the three preceding taxable years. Under the ASC, the rate is reduced to six percent if a taxpayer has no qualified research expenses in any one of the three preceding taxable years. An election to use the ASC applies to all succeeding taxable years unless revoked with the consent of the Secretary.

The R&E tax credit also provides a credit for 20 percent of: (1) basic research payments above a base amount; and (2) all eligible payments to an energy research consortium for energy research.

The R&E tax credit expired on December 31, 2011.

Reasons for Change

The R&E tax credit encourages technological developments that are an important component of economic growth. However, uncertainty about the future availability of the R&E tax credit diminishes the incentive effect of the credit because it is difficult for taxpayers to factor the credit into decisions to invest in research projects that will not be initiated and completed prior to the credit's expiration. To improve the credit's effectiveness, the R&E tax credit should be made permanent.

Currently, a taxpayer must choose between using an outdated formula for calculating the R&E credit that provides a 20-percent credit rate for research spending over a certain base amount related to the business's historical research intensity and the much simpler ASC that provides a 14-percent credit in excess of a base amount based on its recent research spending. Increasing the rate of the ASC to 17 percent would provide an improved incentive to increase research and would make the ASC a more attractive alternative. Because the ASC base is updated annually, the ASC more accurately reflects the business's recent research experience and simplifies the R&E credit's computation.

Proposal

The proposal would make the R&E credit permanent and increase the rate of the ASC from 14 percent to 17 percent, effective after December 31, 2011.

PROVIDE A TAX CREDIT FOR THE PRODUCTION OF ADVANCED TECHNOLOGY VEHICLES

Current Law

A tax credit is allowed for plug-in electric drive motor vehicles. A plug-in electric drive motor vehicle is a vehicle that has at least four wheels, is manufactured for use on public roads, is

treated as a motor vehicle for purposes of title II of the Clean Air Act (that is, is not a low-speed vehicle), has a gross vehicle weight of less than 14,000 pounds, meets certain emissions standards, draws propulsion energy using a traction battery with at least four kilowatt hours of capacity, is capable of being recharged from an external source, and meets certain other requirements. The credit is $2,500 plus $417 for each kilowatt hour of battery capacity in excess of four kilowatt hours, up to a maximum credit of $7,500. The credit phases out for a manufacturer's vehicles over four calendar quarters beginning with the second calendar quarter following the quarter in which 200,000 of the manufacturer's credit-eligible vehicles have been sold. The credit is generally allowed to the taxpayer that places the vehicle in service (including a person placing the vehicle in service as a lessor). In the case of a vehicle used by a tax-exempt or governmental entity, however, the credit is allowed to the person selling the vehicle to the tax-exempt or governmental entity, but only if the seller clearly discloses the amount of the credit to the purchaser.

Reasons for Change

In 2008, the President set a goal of putting 1 million advanced technology vehicles on the road by 2015 – which would reduce dependence on foreign oil and lead to a reduction in oil consumption of about 750 million barrels through 2030. To help achieve that goal, the President is proposing increased investment in R&D and a competitive program to encourage communities to invest in the advanced vehicle infrastructure, address the regulatory barriers, and provide the local incentives to achieve deployment at critical mass. The President is also proposing a transformation of the existing tax credit for plug-in electric drive motor vehicles into one that is allowed for a wider range of advanced technologies and that is allowed generally to the seller.

Making the credit available to a wider range of technologies, removing the cap placed on the number of vehicles per manufacturer that can receive the credit, and allowing for a scalable credit up to a maximum of $10,000 will help increase production of advanced vehicles that diversify our fuel use and bring down the cost of producing such vehicles. Moving eligibility for the credit from the purchaser to the person that sells or finances the sale of the vehicle to the ultimate owner would enable the seller or person financing the sale to offer a point-of-sale rebate to consumers. Disclosure requirements, similar to those currently applicable in the case of sales to tax-exempt and governmental entities, would help ensure that the benefit of the credit is passed on to consumers. Shifting the process of claiming the credit from a large number of individual consumers to a relatively small number of business entities would also simplify tax preparation for individuals and reduce the potential for taxpayer error.

Proposal

The proposal would replace the credit for plug-in electric drive motor vehicles with a credit for advanced technology vehicles. The credit would be available for a vehicle that meets the following criteria: (1) the vehicle operates primarily on an alternative to petroleum; (2) as of the January 1, 2012, there are few vehicles in operation in the U.S. using the same technology as such vehicle; and (3) the technology used by the vehicle exceeds the footprint based target miles per gallon gasoline equivalent (MPGe) by at least 25 percent. The Secretary of the Treasury, in consultation with the Secretary of Energy, will determine what constitutes the same technology for this purpose. The credit would be limited to vehicles that weigh no more than 14,000 pounds and are treated as motor vehicles for purposes of title II of the Clean Air Act. In general, the

credit would be the product of $5,000 and 100 and the amount by which the vehicle's footprint gallons per mile exceeds its gallons per mile, but would be capped at $10,000 ($7,500 for vehicles with an MSRP above $45,000). The credit for a battery-powered vehicle would be determined under current law rules for the credit for plug-in electric drive motor vehicles if that computation results in a greater credit. The credit would be allowed to the person that sold the vehicle to the person placing the vehicle in service (or, at the election of the seller, to the person financing the sale), but only if the amount of the credit is disclosed to the purchaser.

The credit would be allowed for vehicles placed in service after the date of enactment and before January 1, 2020. The credit would be limited to 75 percent of the otherwise allowable amount for vehicles placed in service in 2017, to 50 percent of such amount for vehicles placed in service in 2018, and to 25 percent of such amount for vehicles placed in service in 2019.

PROVIDE A TAX CREDIT FOR MEDIUM- AND HEAVY-DUTY ALTERNATIVE-FUEL COMMERCIAL VEHICLES

Current Law

A tax credit is allowed for fuel-cell vehicles purchased before 2015. The credit is $20,000 for vehicles weighing more than 14,000 pounds but not more than 26,000 pounds and $40,000 for vehicles weighing more than 26,000 pounds. There is no other tax incentive for vehicles weighing more than 14,000 pounds.

Reasons for Change

Currently, medium- and heavy-duty trucks consume more than two million barrels of oil every day and account for 20 percent of greenhouse gas emissions related to transportation. Most of these vehicles are powered by diesel fuel. Alternative-fuel vehicles have the potential to reduce petroleum consumption and greenhouse gas emissions. A tax credit would encourage the purchase of such vehicles and the development of a commercially viable manufacturing base for alternative-fuel medium and heavy-duty vehicles.

Proposal

The proposal would allow a tax credit for dedicated alternative-fuel vehicles weighing more than 14,000 pounds. The credit would be equal to 50 percent of the incremental cost of such vehicles compared to the cost of a comparable diesel or gasoline vehicle. The credit would be limited to $25,000 for vehicles weighing up to 26,000 pounds and $40,000 for vehicles weighing more than 26,000 pounds. In the case of fuel-cell vehicles, the proposed credit would be reduced by the amount of the credit allowed with respect to the vehicle under current law. The credit would be allowed to the person placing the vehicle in service or, in the case of a vehicle placed in service by a tax-exempt or governmental entity, to the person that sold the vehicle to such entity (or, at the election of the seller, to the person financing the sale), but only if the amount of the credit is disclosed to the purchaser.

The credit would be allowed for vehicles placed in service after December 31, 2012, and before January 1, 2019. For vehicles placed in service in calendar year 2018, the credit would be limited to 50 percent of the otherwise allowable amount.

PROVIDE TAX CREDIT FOR ENERGY-EFFICIENT COMMERCIAL BUILDING PROPERTY EXPENDITURES IN PLACE OF EXISTING TAX DEDUCTION

Current Law

Taxpayers are allowed to deduct expenditures for energy efficient commercial building property. Energy efficient commercial building property is defined as property that (1) is installed on or in any building that is located in the United States and is within the scope of Standard 90.1-2001, (2) is installed as part of (i) the interior lighting systems, (ii) the heating, cooling, ventilation, and hot water systems, or (iii) the building envelope, (3) is certified as being installed as part of a plan designed to reduce the total annual energy and power costs with respect to the interior lighting, heating, cooling, ventilation, and hot water systems of the building by 50 percent or more in comparison to a reference building that meets the minimum requirements of Standard 90.1-2001, and (4) with respect to which depreciation (or amortization in lieu of depreciation) is allowable. Standard 90.1-2001, as referred to here, is Standard 90.1-2001 of the American Society of Heating, Refrigerating, and Air Conditioning Engineers and the Illuminating Engineering Society of North America (ASHRAE/IESNA) as in effect on April 2, 2003 – a nationally accepted building energy code that has been adopted by local and state jurisdictions throughout the United States. The deduction with respect to a building is limited to $1.80 per square foot.

In the case of a building that does not achieve a 50-percent energy savings, a partial deduction is allowed with respect to each separate building system (interior lighting; heating, cooling, ventilation, and hot water; and building envelope) that meets the system-specific energy-savings target prescribed by the Secretary of the Treasury. The applicable system-specific savings targets are those that would result in a total annual energy savings with respect to the whole building of 50 percent, if each of the separate systems met the system-specific target. The maximum allowable deduction for each of the separate systems is $0.60 per square foot.

The deduction is allowed in the year in which the property is placed in service. If the energy efficient commercial building property expenditures are made by a public entity, the deduction may be allocated under regulations to the person primarily responsible for designing the property. The deduction applies to property placed in service on or before December 31, 2013.

Reasons for Change

The President has called for a new Better Buildings Initiative that would over 10 years reduce energy usage in commercial buildings by 20 percent. This initiative would catalyze private sector investment in upgrading the efficiency of commercial buildings. Changing the current tax deduction for energy efficient commercial building property to a tax credit and allowing a partial credit for achieving less stringent efficiency standards would encourage private sector investments in energy efficiency improvements. In addition, allowing a credit based on prescriptive efficiency standards would reduce the complexity of the current standards, which require whole-building auditing, modeling, and simulation.

Proposal

The proposal would replace the existing deduction for energy efficient commercial building property with a tax credit equal to the cost of property that is certified as being installed as part of a plan designed to reduce the total annual energy and power costs with respect to the interior lighting, heating, cooling, ventilation, and hot water systems of the building by 20 percent or more in comparison to a reference building which meets the minimum requirements of ASHRAE/IESNA Standard 90.1-2004, as in effect on the date of enactment.

The credit with respect to a building would be limited to $0.60 per square foot in the case of energy efficient commercial building property designed to reduce the total annual energy and power costs by at least 20 percent but less than 30 percent, to $0.90 per square foot for qualifying property designed to reduce the total annual energy and power costs by at least 30 percent but less than 50 percent, and to $1.80 per square foot for qualifying property designed to reduce the total annual energy and power costs by 50 percent or more.

In addition, the proposal would treat property as meeting the 20-, 30-, and 50-percent energy savings requirement if specified prescriptive standards are satisfied. Prescriptive standards would be based on building types (as specified by Standard 90.1-2004) and climate zones (as specified by Standard 90.1-2004).

Special rules would be provided that would allow the credit to benefit a REIT or its shareholders.

The tax credit would be available for property placed in service during calendar year 2013.

Chairman BROUN. Thank you, Mr. Parcell, and I really appreciate your being here and the Department working with us, and thank you so much for working with us and giving us your expertise.

Dr. Pacheco, you are recognized for five minutes. We are fixing to have some votes. They are scheduled right now. You will have time to finish, but we will not be able to get into questioning. We are going to have to rush off to vote, so what we will do is recess the Committee after Dr. Pacheco, so we will have about a 25- to 30-minute recess. We will resume 10 minutes after the last vote begins, so if everybody would come on back quickly so we can get through the questioning of this panel and get to the second panel.

Dr. Pacheco, you are recognized for five minutes.

STATEMENT OF DR. MICHAEL PACHECO, VICE PRESIDENT, DEPLOYMENT AND MARKET TRANSFORMATION, NATIONAL RENEWABLE ENERGY LABORATORY

Mr. PACHECO. Good morning, Chairman Broun, Chairman Harris, Ranking Members Miller, Tonko, and other Members of the Subcommittees. Thank you for this opportunity to discuss the technical role that the U.S. Department of Energy's National Renewable Energy Laboratory or NREL has played in designing, developing, and implementing and doing some preliminary analysis on the impact of 1603.

Section 1603, the Grant Program, was created under the Recovery Act to support the deployment of renewable energy resources and to help address the financial crisis at a time when the lack of financing, coupled with a steep decline in tax equity investors, was severely limiting the ability of renewable energy developers to move forward with projects.

1603 offered businesses the option of a one-time cash payment in lieu of the Production Tax Credit or the Investment Tax Credit found in Revenue Codes 45 and 48, respectively. To be eligible for the program, projects originally had to meet the requirements by the end of 2010, which was later extended to the end of 2011.

NREL's involvement in 1603 began almost immediately after the President's signing of the Recovery Act in 2009. Treasury and Energy officials came to NREL requesting the lab's support in implementing the newly enacted 1603 provisions.

Congress clearly intended, and economic conditions demanded, that a working 1603 Program be rolled out quickly. Pivoting from the existing tax credits to cash payments required very careful scrutiny and deliberate execution of the prior tax credit rules in the form of new cash payments, and the development of an application, review, and payment procedures. Working very closely, a group from NREL got together the Internal Revenue Service, Treasury, Department of Energy. This group worked for a period of several months early in 2009, to develop and put in place the 1603 Program.

A key early task was developing the guidance document with explicit definitions of which technologies would met the requirements of the IRS Tax Code.

We also had to assemble a team of skilled individuals in order to manage the application process and review the applications. While assembling the project team, we also worked on a daily basis with Treasury to design the most credible, effective, and transparent review program possible. Our work has also included the design, the development, and the maintenance of an effective and secure Web-based system for the applications in the data base for that information. This has become known as the external face of the program.

We instituted a very rigorous review process to ensure careful technical scrutiny of every application, making certain the projects are eligible for the payment that they would receive from Treasury. Reviews of submitted applications are conducted in a systematic way by an interdisciplinary team with experts educated in, and very experienced in, engineering, accounting, legal, and a variety of other technical and business disciplines.

The 1603 team also draws on the deep and broad expertise across all of NREL to provide whatever technical expertise is needed for the project.

We developed a staffing strategy early in 2009 to ensure that the 1603 Project would have all the skills needed, and the capabilities, plus the flexibility to flex the staffing up or down as the applications increased or decreased, recognizing that the review process and the staffing strategy had to meet the statutory requirement to reply to applicants within 60 days.

Some of the applications are more, are much more complex by nature and require a back-and-forth communication with the applicant. All applications are rigorously evaluated against the criteria based on the tax codes. Every application goes through two reviews at NREL and then a third review at Treasury.

On average, NREL completes our reviews in about 35 days. Once our reviews are complete, the applications, along with our recommendations, go to Treasury. Treasury officials conduct their own review and make the final decision on approving or denying the grants and fulfilling any payments that are forthcoming.

To date, some 41,000 applications have been received, and approximately 35,000 have been reviewed. About 3,000 are awaiting completion to be processed and about another 3,000 have been withdrawn or disqualified.

Totally independent from our work for Treasury, the Department of Energy's Energy Efficiency and Renewable Energy Office asked NREL to conduct a study in late 2011, on the economic impact of 1603. The study, entitled "A Preliminary Analysis of the Jobs and Economic Impacts of the Renewable Energy Projects Supported by Section 1603 of the Treasury Grant Program," found that as of November 10, 2011, up to 75,000 direct and indirect jobs, and up to $44 billion in total economic output, were supported by just the PV and the large wind projects that received a cash grant under 1603.

The same NREL study estimates that operation and maintenance of these facilities will support another $5,000—5,000 jobs per year and up to $1.8 billion annually in economic output over the 20- to 30-year lifetime of these projects. If that study were completed again today with the up-to-date figures from 1603, the eco-

nomic estimates and the jobs estimates would be significantly higher.

Mr. Chairman, thank you for the opportunity to testify here today, and I would also like to thank my colleagues at U.S. Treasury and Department of Energy for calling on NREL to support them on the implementation and the analysis of 1603.

I would welcome any questions after the break.

[The prepared statement of Mr. Pacheco follows:]

Invited Testimony for the House Committee on Science, Space & Technology
Investigations & Oversight and Energy & Environment Subcommittees
Prepared Statement of
Dr. Michael Pacheco
Vice President, National Renewable Energy Laboratory
Golden, CO
April 19, 2012

Mr. Chairman and members of the Committees, thank you for this opportunity to discuss the technical role that the U.S. Department of Energy's (DOE) National Renewable Energy Laboratory (NREL) has played in administering the U.S. Department of Treasury's 1603 Program. The Section 1603 Treasury grant program was created under the American Recovery and Reinvestment Act to support the deployment of renewable energy resources to help address the financial crisis – at a time when a lack of available financing, coupled with a steep decline in tax equity investors, severely limited the ability of renewable energy developers to move forward with projects.

As adopted by Congress, the 1603 Program offered businesses that installed energy projects the option of a one-time cash payment, in lieu of the Production Tax or Investment Tax credits found in the Internal Revenue Code Sections 45 and 48, respectively. The Investment Tax Credit – in place since 2005 – provides a tax credit for up to 30 percent of the total costs of many types of renewable energy projects. The Production Tax Credit – in place since 1992 – provides a tax credit for production of energy from renewable energy projects. A 1603 payment is made after the energy property is placed in service; a 1603 payment is not made prior to or during construction of the energy property. Accepting an award under 1603 disqualifies a project for the ITC or PTC, and vice-versa.

The Partnership for Renewable Energy Finance and other industry observers have credited the 1603 Program for substantially lessening the negative impact that the weakened tax-equity market was having on renewable energy deployment. The program, originally approved through the end of 2010, was extended for an additional year and expired on December 31, 2011. A project may still be eligible for a 1603 award if the developer commenced construction by December 31, 2011.

Because the technologies that qualify under the Internal Revenue Code are primarily renewable energy technologies, the Department of Treasury, in consultation with the Department of Energy, selected the National Renewable Energy Laboratory to provide technical assistance to the

program. NREL is the only National Laboratory dedicated solely to research, development, and deployment of renewable energy and energy efficiency systems. Our 35 years of research and credible analyses have contributed to the successful establishment of the growing U.S. industries that manufacture and deploy a broad range of clean energy technologies, including wind power, solar photovoltaics, concentrating solar power, biomass fuels and power, geothermal power and others.

NREL was selected to assist in the technical design and implementation of Treasury's 1603 Program because of its 1) broad and deep technical experience, 2) knowledge of these renewable energy industries, 3) its work on behalf of the Departments of Agriculture and Energy on earlier federal energy grant programs, and 4) its demonstrated history of intricate project management and achievement. This work was crucial because it ensured that 1603 program funds would be made available *only* to those applicants who met the statutory eligibility requirements.

NREL's involvement began almost immediately upon the President's signing of the Recovery Act in February 2009. Energy Department officials came to NREL requesting assistance in advising the Treasury Department on how best to implement the newly enacted 1603 provisions. The Laboratory's previous experience working with the USDA and DOE on grants for rural energy efficiency and renewable energy projects gave us important, parallel insights.

The challenges were understood to be significant. Congress clearly intended – and economic conditions demanded – that a working program be rolled out quickly. Pivoting from the existing tax credits to cash payments required careful scrutiny and deliberative execution of the prior tax credit rules in the form of the new cash payments, and development of application and payment procedures. A working group was formed with NREL, the Internal Revenue Service (IRS), Treasury and DOE representatives. The working group met in Washington, D.C. one week to formulate plans, and then went back the following week to their respective organizations to forge the details and consult on next steps. This method of development was repeated over a period of three months, to reach final consensus.

The group was guided by two fundamental questions: Would this aspect of the plan fulfill what Congress had intended? Would it meet the requirements of businesses which Congress sought to use the provisions of 1603 to continue development of new energy systems?

One early task was to draft an explicit definition of the technologies that met the requirements of the Act, as it now applied to cash payments, and additionally to define what portions of individual projects were eligible for those payments. On these and other aspects of the program, NREL gathered needed information and provided options for Treasury, which made final decisions on program design and implementation. The definitions and requirements had to be aligned with the existing provisions of the IRS tax code.

We attempted to take into account the needs of all pertinent factions in producing a program guidance document, which Treasury used to solicit feedback from industry and others. The final plans included input from a variety of external constituencies.

Our next step was to work with Treasury in standing up an effective program that would fully implement Section 1603 of the Act. While the Act was clear in its intent, the complexity of the issues required technical and business expertise to ensure the interests of both applicants and the nation's taxpayers were well and carefully represented. The tax policies involved little new territory, the underlying tax policies were in fact well known. Early on, we saw the biggest need to be one of strong due diligence – and we designed, staffed, and managed the program to accomplish that.

As an applied science lab, NREL not only conducts needed basic research into promising new technologies, we also place considerable emphasis on each and every subsequent step of the technology development process. Our ever-present goal is to see these new technologies put to good use, to benefit the nation and its economy. As a result we have come to appreciate the value of sound business acumen in technology development. To implement the 1603 applications review program, NREL assembled a qualified team that understood the business cases for these energy systems.

We assessed the skills and experience of existing NREL staff, identified key team members, and then went outside the Lab to recruit individuals with strategic knowledge to fill any gaps. Where necessary, we developed specific criteria for newly created positions, and proactively went outside of our organization to hire the most demonstrably qualified candidates for those positions.

At the same time, we worked on a daily basis with Treasury to design the most credible, effective and transparent review program possible. That included the engineering, development and maintenance of an effective and secure Web-based information, application and database system that would come to be the external "face" of the program. Considerable time and effort has gone into the program's Web capabilities, and this one-stop, on-line resource has contributed greatly to the successful implementation of the program, for both applicants and the government. A link to the Web site is provided here: www.treasury.gov/initiatives/recovery/Pages/1603.aspx

The review process we put in place was infused with an overriding ambition and goal: Give full scrutiny to the projects to make sure they are affirmatively and unquestionably eligible for the payment they would receive. For example, the first step is to ensure the applicant is a qualified business and that the project has in fact been in put in service.

Reviews of submitted applications are conducted in a systematic way by interdisciplinary teams, with experts educated in and experienced with a broad range of engineering, financial, accounting, legal, and other technical and business aspects. Wherever necessary, the 1603 team

reaches beyond their ranks to draw upon the broad and deep expertise across the National Renewable Energy Laboratory to address technical issues that arise.

From the beginning of the project, NREL's management developed a staffing strategy to ensure this critical project would have all the skills and capabilities needed, and the staffing plan was designed to provide sufficient flexibility in resource planning to allow the 1603 staffing level to flex up or down as the flow of applications increased and decreased. The process and staffing strategy also had to ensure that NREL and Treasury would meet the statutory requirement to respond to applicants within 60 days of receiving a fully completed application.

The 1603 project team leader was recruited from outside NREL based strong business experience performing due diligence on behalf of private equity and lending institutions investing in large-scale energy projects, excellent project management skills, and a solid grounding in engineering sciences. Members of the review team collectively possess 450 years of professional experience in accounting, law, engineering, business, economics, physics and finance, with education encompassing 17 advanced degrees, five MBAs, two PhDs, and two juris doctoral degrees.

All review team members at NREL, and several from the Treasury Department, received training in the newly established process. The beginning training session for each reviewer set forth system functions and reviewer expectations. Each member of the team was required to execute a Conflict of Interest agreement and the training emphasized the importance of strict reviewer anonymity and strict non-disclosure of applicant information, both within NREL and outside of the Lab.

We adopted a methodical approach and a set of operating procedures in which the review process works as a system, in step-by-step fashion, to answer a series of questions, including: Is the project eligible under the tax code? Is the technical description consistent with Sections 45 and 48 of the tax code? Has the project been actively placed into service? Are the costs eligible under the tax code? Does the applicant's documentation credibly support their claims? Our goal is to be absolutely consistent on how we review each and every project.

Some of applications are by nature more complex, with considerable back and forth communication resulting from the review process. The guiding principle is: every determining factor is appropriately weighed, and applications are rigorously evaluated against criteria. Thus, every application goes through two reviews at NREL, and a third at the Treasury Department.

The average time (in calendar days) for NREL to complete an application review (in duplicate) is 35 days. Once the review is complete, applications with our recommendations are delivered to the Treasury Department. Treasury officials then conduct their own review and make the final decisions, approving or denying grants, and fulfilling any payment that may be forthcoming.

In addition to the application review process, NREL is also managing the 1603 Program's annual review process for Treasury. Every recipient is required to submit to an annual review, in which they verify that they haven't sold or transferred the project, and state what the actual production of energy of the project has been during that year.

In conclusion, let me summarize our accomplishments on behalf of the 1603 Program. To date, some 41,000 applications have been received, and approximately 35,000 have been reviewed. About 3,000 are awaiting project completion to be processed; another 3,000 have been withdrawn or disqualified. In less than three years, the Treasury Department has issued cash payments for nearly 35,000 renewable energy projects, small to large, across the range of technologies, and in every state. Cash payments under the 1603 Program totaled $11.2 billion, which has helped leverage several times that amount in additional private investment. In total, the 1603 program has assisted in the development of $37 billion in new energy facilities for the nation.

In a separate but related project, DOE's Energy Efficiency and Renewable Energy office requested that NREL conduct a study of the economic impact of the 1603 Program. That work was distinct from our program management work for Treasury, and was conducted by a different organization within the Laboratory. NREL has deep knowledge of renewable technologies and their deployment in the marketplace, and is frequently engaged to perform economic impact analyses. The Laboratory has developed a suite of validated models which are used extensively by the Laboratories, universities and other external organizations and individuals to estimate the economic impacts of individual renewable generation projects, as well as the impacts of broader investment in renewable generation technologies.

The study, entitled, "Preliminary Analysis of the Jobs and Economic Impacts of Renewable Energy Projects Supported by the §1603 Treasury Grant Program," found that up to 75,000 direct and indirect jobs, and up to $44 billion in total economic output were supported by the design, manufacturing, construction and installation of photovoltaic and wind projects funded by the 1603 Treasury. In addition, the study estimates that the operation and maintenance of these facilities will continue to sustain more than 5,000 jobs per year, and up to $1.8 billion annually in economic output over the 20- to 30-year lifetime of the facilities. At the time the study was conducted (data as of Nov 10, 2011), the 23,000 photovoltaic and large wind projects funded by the program added 13.5 gigawatts (GW) of renewable energy to America's electricity generation capacity, representing about half of all the added non-hydropower renewable energy capacity in 2009-2011. The more up-to-date figures on the Treasury 1603 website are over 34,000 projects and 16.5 GW of renewable energy; so the jobs and economic impact figures would be higher if the study were conducted again today.

It is important to note that the NREL study provides estimates of direct and indirect jobs related to facility construction and operation, but does not attempt to estimate the overall economic impact produced by those jobs. No attempt was made to estimate if or how many jobs were lost

or displaced in other sectors by the installation of these RE projects. In addition, the study does not attempt to quantify which projects were completed directly because of the 1603 Program, nor does it address relative effectiveness of these or other tax incentives. It is clear that some portion of the jobs, earnings, and economic output supported by these projects can be directly attributable to the 1603 Program, but no attempt was made to estimate that portion in this analysis.

Thank you for the opportunity to testify. I would welcome any questions you may have.

Chairman BROUN. Dr. Pacheco, thank you so much. You hear all these buzzers going off. That is the indication on our votes. What we will do is, if you all will just stand by, I am going to recess the Committee until 10 minutes after the beginning of the last recorded vote. We will hurry back so we can turn you all loose, and I thank you all for your patience.

[Recess.]

Chairman BROUN. Committee comes back to order. I thank you all for your testimony. I want to remind Members that the Committee rules limit questioning to five minutes per Member, and at this point the Chair will open the first round of questions, and I will recognize myself for five minutes.

Dr. Pacheco, a recent NREL study analyzing the jobs and economic impacts of the 1603 Program estimated that it supported between 50,000 to 75,000 jobs a year. Very quickly, I would like to clear up some confusion as to what this report does as well as what it does not say.

Did NREL attempt to calculate how many jobs were actually created, or did it enter grant application data to calculate how many jobs could have been created?

Dr. PACHECO. Congressman Broun, the NREL approach on that was what we did was took the total number of projects, the types of projects, and the size of those projects, and we used that information on the—at the time the study was done around 23,000 projects as opposed to the current number. And from that we went ahead and calculated how many jobs were supported by those projects.

Chairman BROUN. So formally we don't really know.

Dr. PACHECO. I wouldn't say that we don't really know. It is based on the models that——

Chairman BROUN. It was based on a model and not actual calculation of jobs. Correct?

Dr. PACHECO. It is based on a calculation of jobs.

Chairman BROUN. How many of the projected jobs are direct jobs rather than indirect jobs, Dr. Pacheco?

Dr. PACHECO. I have the detailed numbers, but the split is in favor of the direct jobs, and I would have to look at the numbers to give you the exact numbers, which I have right here.

Chairman BROUN. Could you do that quickly because——

Dr. PACHECO. Yeah.

Chairman BROUN [continued]. My time is limited?

Dr. PACHECO. Yes, I can.

Chairman BROUN. Okay.

Dr. PACHECO. So of those numbers the—well, actually, I don't have the split that you are looking for.

Chairman BROUN. If you would get that for us——

Dr. PACHECO. Sure. I will provide that.

Chairman BROUN. And, again, is this just calculated jobs, or is this actual—this is a calculation also?

Dr. PACHECO. It is calculated. Yes.

Chairman BROUN. Okay. The study also estimated that only between 30 to 70 percent of the components of projects, which is a wide range of turbines, towers, et cetera, were manufactured in the

U.S. but also that these estimates, "should not be construed as full bounding uncertainty."

Could these projects contain less than 30 percent of domestically produced components?

Dr. PACHECO. Yes. It is possible.

Chairman BROUN. So we don't really know what it could be. It could be 10 percent, it could be 70 percent, it could be anything. Right?

Dr. PACHECO. That is correct.

Chairman BROUN. Thank you. How many of these jobs and how much economic support went to China, Europe, and elsewhere as opposed to being here in the U.S.?

Dr. PACHECO. This was a very preliminary report, and we did not have those details from this report.

Chairman BROUN. So, again, it is just an estimation. Is that correct?

Dr. PACHECO. That is correct.

Chairman BROUN. Okay. The NREL study also indicated that job estimates cannot be attributed to the 1603 Program alone and that it does not calculate the net effects of displaced jobs from other industry sources. NREL was very specific characterizing what its report said, going to great lengths to caveat its findings. DOE, on the other hand, has indicated that the NREL study makes clear that projects receiving payments from the 1603 Program has supported tens of thousands of jobs "then."

This is at odds with the findings of the February 24 *Wall Street Journal* report that questions the actual job impact of the 1603 Program. Additionally, last November, CRS Report on the Section 1603 Program that Dr. Sherlock co-authored with Phillip Brown stated, "Any job creation estimate" attributed to the program "be viewed with skepticism."

Can the panel help me understand how many jobs were actually created? Dr. Pacheco.

Dr. PACHECO. Congressman, that is a very difficult number to actually calculate and estimate and really requires some intense study. What we did in our study was to use the models that we have and actually had to tailor those models slightly for this particular application.

Chairman BROUN. So we don't know. Anybody else? My time is about to run off. I apologize for cutting you off. Anybody else? Dr. Sherlock? Anybody?

Okay. To Mr. Parcell, has Treasury assessed the annual reports from 1603 recipients to verify their projects are operating and employing workers?

Mr. PARCELL. Yes. Treasury requires annual reports from each project that has received an award on how much—whether it is generating energy and whether it continues to satisfy the conditions for award.

Chairman BROUN. Have you all audited assessments at all and verified anything? Yes or no, please. My time has run out.

Mr. PARCELL. Yes.

Chairman BROUN. You have audited?

Mr. PARCELL. The Inspector General has audited certain——

Chairman BROUN. Please provide that for us.

My time has expired. Now I will recognize Mr. Tonko for five minutes.

Mr. TONKO. Thank you, Mr. Chair. I am glad we are having this hearing, because I think it is important that we understand the role of subsidies in supporting our energy economy.

I am a supporter of a broad array of tools to help this country transform our energy economy. We need to diversify our energy sources, and we need to reduce our dependence on foreign sources of energy. So we need to reduce our emission of greenhouse gases, also. We also need to change our energy economy to grow industries that will keep American jobs here and provide export opportunities for our products.

I am pleased to learn about how successful, listening to the panelists, that the Section 1603 Program has been, and I would like to see us extend it. For those who think it is foolish to subsidize the renewable industry, I would like to point out that there is no sector of our energy economy that has ever developed without government subsidies and no sector today that doesn't receive a wide array of government support.

I want to show just two charts to help illustrate my point. They are both from a report by a venture capital firm, DDL Investors, entitled, "What would Jefferson do?" The first chart shows the aggregate level of subsidies for our oil, gas, nuclear, biofuel, and renewable industries. The oil and gas industries dwarf, dwarf all others, receiving $447 billion in subsidies between 1918 and 2009. Nuclear ranks second with $185 billion, biofuels ranked third with $32 billion, and our renewables are a distant fourth with just $5.93 billion between '94 and 2009.

Now, we can quibble about what was included in this analyst's count and what was left out, but the scale of the subsidies would not change appreciably, even if we put in the Carter era, solar investments, for example.

So when people say today that the government shouldn't pick winners and losers, I look at this chart and have to respond, it is a little late for that. The government has been supporting the growth of different energy sectors for 100 years, longer if you look at early coal and timber support.

I want to point the Subcommittee's attention to a second chart that shows the level of support for each of these four sectors on an annualized average over the life of their support. Again, oil and gas lead the pack with $4.9 billion in annual support, and renewables take up the rear with just $370 million in average annual support.

Now, in the last few years, at long last, subsidies to the renewable industry have passed those provided to fossil fuels, but the gravy train to the oil and gas industry continues nonetheless with annual tax supports of at least $4 billion a year. These subsidies to the oil and gas industry are going to an energy sector that is immensely profitable and immensely rich. The top oil companies made over $100 billion in profits in 2011, yet the subsidies continue. The subsidies to the industry just keep coming.

Obviously, a permanent feature of the tax credit has meant a great deal to the industry. So if there is a statement from this hearing, I would think permanent relief for some of these industries to get them up and running has made a difference.

Mr. Chair, that makes me question the seriousness of those who say we should not subsidize the renewable energy industry when oil and gas and nuclear sectors continue to benefit from a panoply of subsidies. Where is the outrage that almost a century after government subsidies to the oil and gas industry began, we still are cutting them checks? Where is the sense of fairness, Mr. Chair?

I look forward, Mr. Chair, to the follow-on hearing by this Committee looking at the subsidies and their appropriateness for the oil and gas industries and the nuclear industry as well, the sectors that have received the lion's share of taxpayer dollars over the years. That would be fair, and that would be proper, and I certainly think that all Members would learn a lot from a series of hearings of that kind. Let us truly examine all of the tax subsidies over the years towards the various sectors of our energy supplies.

I hope this is just the first hearing in that series of hearings that will serve us and the Committee well.

With that, Mr. Chair, I yield back.

Chairman BROUN. Thank you, Mr. Tonko. I am not sure I heard a question in all that but anyway—okay.

Well, now, Dr. Harris, you are recognized for five minutes, my fellow Subcommittee chair.

Mr. HARRIS. Thank you very much, Mr. Chairman, and, you know, since this is all about the taxpayer and that is really the charge of this Committee is to see whether government monies are spent adequately, I would think that our taxpayers would want us to invest in companies that actually make a profit and pay taxes, and, you know, if we pay $4 billion in subsidies and get tens and tens of billions of dollars in taxes from oil and gas companies, I think our average taxpayer would say that is a pretty darn good investment, especially since the price of their energy is so low.

Let me ask about some of the claims about jobs, though. Mr. Parcell, the—or actually, let me, Mr. Pacheco, let me ask you a question. The graph from the NREL study or the table says that there are supposed to be 4,500 to 4,900 operational jobs, so permanent jobs at these, but when the *Wall Street Journal* did—and they didn't use models. They actually called up companies and said, how many people do you have employed, which I think is the way we should be doing it, just the way we do, we sample unemployment and employment. The Labor Department doesn't make up their 8.2 percent. They actually call people. They actually survey people.

They say there are only 300 people employed. Doesn't that devastate the model you use? Doesn't it completely invalidate the model you used that predicted there should be 5,000, whereas there are 300? You are aware of the *Wall Street Journal* article?

Dr. PACHECO. I am very aware of the article that you are referring to——

Mr. HARRIS. Okay.

Dr. PACHECO [continuing], Congressman, and my recollection of that article is the author talked about four or five companies out of the 23,000 that were affected by 1603, and I can answer Congressman Broun's question now if you would like.

Mr. HARRIS. Excuse me. Let me just—no. You got to answer my questions, my five minutes.

Dr. PACHECO. Okay. Sorry.

Mr. HARRIS. No. You are wrong. I mean, the article says 40 percent of the funding, 4.3 billion went to 36 wind farms. These are the largest. During the peak of the construction, they employed about 72, they produced 7,200 jobs. But once the construction was done, they only employed 300 jobs. Forty percent of the funding from that program went to 36 wind farms. So I know you can say, look, you know, we—look. I wrote scientific papers. I know what you can do with statistics. Certainly you can say, yes, you know, they only looked at 36 wind farms, you know, we looked at 2,500 or whatever. They looked at the biggest ones. They looked at the ones that are most likely to produce employment, so does that fact that they could only find 300 people working there whereas you would have proposed, I imagine, there should be thousands of people working there, completely invalidate the model you used?

Dr. PACHECO. No, not at all, Congressman. So——

Mr. HARRIS. How do you explain 300 people as opposed to thousands?

Dr. PACHECO. I would be happy to do that if you give me a moment.

Mr. HARRIS. Go for it. You got about 30 seconds, though, if you can—otherwise you will have to respond in writing because I have other questions.

Dr. PACHECO. So—and this builds on the earlier question, and I have found the proper table, and I can make this available to the Committee, but the results of our modeling would have predicted, it did predict that as of the datas of November that we would be employing 770 people in the operation of all the wind facilities, all the large wind facilities that we were built with 1603 dollars.

Mr. HARRIS. This chart that I am looking at, which is the estimate from the NREL report, says 4,500 to 4,900. Now, are there multiple tables?

Dr. PACHECO. The number that you are looking at, sir, is a total of the direct jobs, the indirect jobs, and the induced jobs that would be involved in the operation of the facility. If you go to the top of the table, what it says is that the direct average jobs——

Mr. HARRIS. What was your testimony as to ratio of direct to indirect jobs?

Dr. PACHECO. I didn't have that number. I have it now.

Mr. HARRIS. Your answer to the Chairman. What is the ratio?

Dr. PACHECO. The total ratio, if you take that number that the estimate is 75,000——

Mr. HARRIS. Yes.

Dr. PACHECO [continuing]. Out of that total, and those are construction jobs, not operational jobs——

Mr. HARRIS. Doctor, Doctor. I am talking only about the operational jobs.

Dr. PACHECO. Okay.

Mr. HARRIS. They say there are 300. You say there are 5,000, and then you say, well, we are just going to account for the difference——

Dr. PACHECO. No, I didn't say that.

Mr. HARRIS [continuing]. In indirect jobs.

Dr. PACHECO. I said that the 5,000 was the total of all the jobs involved in all of the facilities' operation. It turns out that for the operational jobs directly at the site——

Mr. HARRIS. Yes.

Dr. PACHECO [continuing]. Which are the ones that the——

Mr. HARRIS. Right.

Dr. PACHECO [continuing]. Article you are referring to——

Mr. HARRIS. Right.

Dr. PACHECO [continuing]. Our number in the table, I will make this available——

Mr. HARRIS. Yes.

Dr. PACHECO [continuing]. Was 770.

Mr. HARRIS. Okay. So they called up the companies and said, it is 300. Okay. That is only off by a factor of over 100 percent.

Dr. PACHECO. Well——

Mr. HARRIS. Let me tell you something. One hundred percent, if I did a model, and it was 100 percent off, I would go find a new model.

Now, let me just ask, Dr. Sherlock, did you review the *Wall Street Journal* article or CRS, someone at CRS? Did they review it to see if this, in fact, is true, if, in fact, the model that NREL used is over, by the Doctor's testimony today, is over, is wrong by over 100 percent, it mispredicts by over 100 percent.

Dr. SHERLOCK. CRS has not done independent analysis of job creation of the 1603 Grant Program.

Mr. HARRIS. I may ask you to do that at some point.

Dr. SHERLOCK. Sure. Absolutely.

Mr. HARRIS. Finally—oh, I am sorry. I am over.

Thank you very much, Mr. Chairman, for—and I yield back.

Chairman BROUN. Thank you, Dr. Harris.

I am going to keep a pretty tight time clock on everybody because we have got a whole other panel, and we are going to have some votes probably in about an hour or so.

Now I recognize Mr. Miller for five minutes.

Mr. MILLER. Thank you, Mr. Chairman, and I don't want to quibble too much about our Committee's jurisdiction. We do disagree about the appropriateness of trying to encourage emerging technologies, and that would be, tax credits for that purpose would be within this committee's jurisdiction, but we are not talking about R & D tax credits here. We are talking about tax credits that were designed to create jobs, which is not within our Committee's jurisdiction, and I think the questions that this panel has gotten so far has made it very clear that this really is about how many jobs were created, not whether we have nurtured emerging technologies or the commercialization of research through the tax credits that we are talking about.

In the second, on the second panel Ms. Thorning, who is one of the Republican witnesses, estimates that this has cost us about $80,000 per job, which I think the Republicans think is scandalously high, shows it is absolutely not worth it. But later today, we will be voting on a proposal from the majority party, from the Republicans, from Mr. Cantor, the Republican leader, to give a tax break for small business, not what you or I might think of as small, which would probably be more like a Mom and Pop operation, but

companies up to 500 employees. Their own estimates are that that would be, that that would cost $46 billion in tax revenues. As the Republicans have already pointed out that that really does, therefore, come out of the pockets of everyone else, and would create 40,000 jobs. That is their own estimate, which may be ambitious. That works out to more than $1 million a job.

So the jobs created by this particular program actually appear to be a bargain by comparison to other proposals.

Dr. Sherlock, you, can you tell us how the oil and gas industry has already benefited in the past from tax credits and other support from the Federal Government, and how emerging alternative, unconventional resources, oil and gas resources, also have tax credits and how they benefited from those, that support over the last century?

Ds. SHERLOCK. Sure. So tax credits have been available to oil and gas since the 1910s, 1920s. Up until about 1978, the oil and gas sector was the primary beneficiary of targeted tax incentives for energy. Beginning in the late 1970s, early 1980s, that is when tax credits that would have benefitted renewables were first put in the Code. There weren't really measureable revenue losses associated with those provisions until recent years. In recent years, primarily due to expansion in the wind industry and the PTC, as well as provisions enacted as part of the Recovery Act, we have seen a shift towards the total cost of energy-targeted tax provisions in that renewables now do receive a substantial share of the targeted tax incentives. But historically, oil and gas have received the bulk of tax incentives that are targeted to energy.

Mr. MILLER. Okay. You quoted President Reagan, well, you didn't quote President Reagan, but you said the purpose or the cited policy goal of the Reagan Administration to be more neutral and less distortionary in the tax policy towards energy. Do you think we have a free market, a perfectly free market, or does government policy and tax policy already distort energy policy, the energy market?

Dr. SHERLOCK. There are distortions that are created through the tax code and even from an economic standpoint when you look at the market for energy, the market for energy may have certain market failures that may be a rationale for government intervention in the energy market.

Mr. MILLER. And how does that affect the entry into the market of alternative energy sources, the fact that there are already distortions based on government policy in the energy market?

Dr. SHERLOCK. Since there are distortions based on government policy, it can put renewables at a disadvantage.

Mr. MILLER. All right. My time is not quite expired, but it is almost expired.

Chairman BROUN. Thank you, Mr. Miller. I appreciate and thank all of you all—oh, Mr. McNerney. I didn't see you. Okay. Mr. McNerney, you are recognized for five minutes.

Mr. MCNERNEY. Thank you, Mr. Chairman. Thanks to the panel for coming and testifying this morning. Although I don't believe that this hearing is going to lead to any meaningful legislation, it is more of a political sounding board for the majority party, but I do have some questions.

Dr. Sherlock, what—I believe from your testimony that you indicated that the most effective way for the tax credits to be effective is to have a large number of people take advantage of the incentives.

Do you have any suggestions for policymakers based on past experience to get the most number of people to participate in these programs?

Dr. SHERLOCK. The incentives will be most efficient not necessarily based on participation, but when you have claims of tax credits of people that would not have engaged in the activity otherwise. So, you are actually causing people to invest in solar panels, or causing people to build wind farms, rather than rewarding those that would have built the wind farm or invested in solar panels anyway.

One challenge with current policy is that with policy uncertainty and expiring provisions, many of the projects that take place are taking place in the face of that uncertainty and may have gone forward anyways without the tax incentives.

So when the tax incentives are enacted temporarily, at the last minute, they may end up rewarding projects that would have gone forward anyways, diminishing the economic efficiency of the incentive.

Mr. MCNERNEY. So how can we best include the class of people of that—or class of businesses wouldn't participate without the incentives?

Dr. SHERLOCK. One step would be to have additional certainty with the incentives and to either have long-term incentives or some sort of credible expiration or to, on the flip side, not have incentives and let the markets make decisions there.

Mr. MCNERNEY. Well, that is aligned with my experience in the industry in which even the—a one-year tax extension doesn't really help because it takes years to get projects approved and get investors lined up. So this uncertainty in the programs is most damaging. So I agree fully with that, Dr. Sherlock.

Dr. Pacheco, just out of curiosity, how do the payments, how are payments made for the production tax credits? Are they adders to energy generation earnings, or are they something that comes along with an investment-type situation, or how are those payments made?

Dr. PACHECO. If it is okay, Congressman, I would like to defer that question to my colleague on the right.

Mr. MCNERNEY. Okay.

Mr. PARCELL. Yes. The production tax credit is a credit under Section 45 of the Code. It is claimed on the income tax return of the person producing the electricity at the rate of 2.2 cents per kilowatt hour.

Mr. MCNERNEY. Well, actually, I was referring to the 1603 Program. How are the 1603 Program payments made? Are they based on energy production or some other means?

Mr. PARCELL. No. The 1603 payments are based on investment in the—it is based on the cost of the facility.

Mr. MCNERNEY. Okay.

Mr. PARCELL. It is really a substitute for the investment tax credit under the Internal Revenue Code.

Mr. MCNERNEY. Dr. Pacheco, can you provide an estimate of how many jobs in both the solar and the broader renewable energy sector have been impacted by the expiration of the 1603 Program, and what impacts we can expect over the next few years if the program is not renewed?

Dr. PACHECO. I can certainly speak to our estimate of how many jobs had been supported during the course of the program, and that as of the November date when we did our study, the jobs estimate at that time was up to the 75,000 total in construction and up to the numbers I discussed earlier on the operational phase.

I can also come back if you are willing to allow me to clarify the earlier comment. I have the *New York Times* article in front of me, and I would very much like to respond to the earlier question, if that is okay.

Mr. MCNERNEY. You got about 45 seconds.

Dr. PACHECO. I can do it in much less than that.

As I read the article that was referred to earlier, the author cites that 40 percent of the funding went to 36 wind farms and that those wind farms that were surveyed can account for 300 employed people today. So if you were to extrapolate, sir, that 40 percent up to our earlier estimate of the 770, I think you would conclude that our models that are actually quite accurate.

Mr. MCNERNEY. Thank you for that comment——

Dr. PACHECO. You are welcome.

Mr. MCNERNEY [continuing]. Dr. Pacheco. I yield back.

Chairman BROUN. Thank you, Mr. McNerney.

I would like to state that this is the Oversight Committee, so we do have a responsibility to have oversight as to the rules of the Committee demand.

I thank you for your all's testimony. It has been valuable time spent, and I appreciate all you all, in particular, Mr. Parcell. I know, again, I want to thank you.

The Members of the Subcommittee may have additional questions for all of you all, and we will ask for you to respond to those in writing, and if you would do that expeditiously, we would greatly appreciate it.

The first panel of witnesses is excused, and we will now turn to the second panel. So thank you all very much for coming.

And if the second panel will take their seats quickly because we have got votes in about an hour, and we have got a big panel and a lot of questions. So we appreciate it.

Okay. At this time I would like to introduce our second panel of witnesses, and I appreciate you all's patience through the interruption.

Mr. Rhone Resch, the President and CEO of Solar Energy Industries Association; Mr. Terry Royer, the CEO, Winergy Drive Systems Corporation; Mr. Steven Erby, the Vice President of Monolith Solar Associates; Dr. Benjamin Zycher, a Visiting Scholar of the American Enterprise Institute; Dr. Margo Thorning, the Senior Vice President and Chief Economist of the American Council for Capital Formation; and Ms. Lisa Linowes, Executive Director of Industrial Wind. I thank you all for being here.

As I noted before, it is the practice of this Subcommittee to receive testimony under oath, and we will use that practice with you as well.

Do any of you have any objection to taking an oath?

Let the record reflect that all witnesses are willing to take an oath.

And you also may be represented by counsel. Do any of you have counsel here today?

Let the record reflect that none of the witnesses has counsel.

Now, if you would please stand and raise your right hand.

[Witnesses sworn.]

Chairman BROUN. Let the record reflect—you may be seated. Let the record reflect that all the witnesses have taken the oath.

And I recognize our first witness from the second panel, Mr. Rhone Resch, Solar Energy Industries Association. Mr. Resch, before you start, we are going to have votes in about an hour, so if you all would please try to limit your testimony. I don't want to cut you short. I want to hear what each of you have to say, but we also have questions, and we would like to try to get through the line of questions before we have our next vote.

So Mr. Resch, you have five minutes.

STATEMENT OF MR. RHONE RESCH,
PRESIDENT AND CEO,
SOLAR ENERGY INDUSTRIES ASSOCIATION

Mr. RESCH. Thank you very much, Chairman Broun. Good morning, Chairman Harris, Ranking Member Tonko, Ranking Member Miller, and Members of the Subcommittee. I appreciate having the opportunity to testify this morning.

My name is Rhone Resch, and I am President and CEO of the Solar Energy Industries Association. There are more than 5,600 companies, the vast majority of which are small businesses that make up America's solar industry today. SEIA is proud to represent all of these domestic companies in the entire solar value chain, from small installers to manufacturers to project developers.

Access to a diverse, abundant, reliable, and affordable supply of energy is in the national interest. Accordingly, federal policy has for decades provided a framework that has helped every major source of energy utilized in the United States today reach commercial scale. The recognition that smart policy is vital to developing our domestic energy resources has contributed significantly to America's long-term economic prosperity.

History has also shown that well-crafted federal tax incentives can effectively leverage private sector investment in new energy resources. This is clearly the case with federal incentives such as the Solar Investment Tax Credit and the 1603 Treasury Program that are designed to promote and expand deployment and use for solar energy.

Congress first enacted the 30 percent Investment Tax Credit as part of the Energy Policy Act of 2005, and subsequently extended the incentive through 2016. Here is what has happened as a result.

There has been a sevenfold increase in solar generating capacity and a 17-fold increase in photovoltaic or PV capacity in the United

States. Last year alone, PV installations increased by 109 percent and were one of the fastest-growing industries in the United States.

The solar industry now employs more than 100,000 Americans, more than double the amount from just two years ago. The U.S. PV panel manufacturing increased from 134 megawatts in 2005 to 865 megawatts in 2011, and today there are over 600 manufacturing facilities in the domestic value chain in the United States.

Technological advances and innovative financing options have driven down the cost for consumers. In 2011 alone, the price of solar panels dropped by 50 percent. Businesses and homeowners across the country are choosing solar because it makes economic sense.

For example, Chairman Broun, there are more than 1,700 solar jobs in Georgia, six solar companies in your district, and the largest ground-mounted solar project in the State is in the Blairsville area, and that project came to fruition with the help of the 1603 Program.

And Chairman Harris, in your district there are 12 solar companies and more than 500 solar PV installations. This represents $25 million in solar investment in your district alone. In fact, there are more than five solar companies in every district of the Members represented on these two Subcommittees.

By any objective measure, the Solar Investment Tax Credit is doing exactly what it was meant to do. Since the incentive went into effect in 2006, the industry has made significant strides towards grid parity. If current trends continue, and costs continue to come down on account of economies of scale, improved technologies, and enhanced efficiencies, need for federal policy support for solar will be relatively brief when compared to other conventional and renewable energy sources.

Let me also touch on the 1603 Treasury Program. Renewable Project developers typically partner with investors who have federal tax liability as a way to monetize energy tax incentives.

Access to this tax equity provides a portion of the capital needed to finance renewable energy projects. The 2008 economic crisis and the ensuing recession have severely restricted access to tax equity. The 1603 Program addresses this problem by allowing companies to receive a grant in lieu of the existing tax credit that they were eligible to claim. This creates flexibility in how you finance these solar projects.

And I want to address three common misperceptions about the 1603 Program. First, under the 1603 Program, the government does not pick winners or losers. It is the market that chooses which projects go forward.

Second, the grant is not an upfront payment. Rather, it can only be claimed when the project is completed, and it must go through a thorough Treasury audit and an NREL audit, as we heard earlier.

And third, I would urge you not to judge this program by the legislation on which it was introduced but on the merits of the results. The program has supported 22,000 solar projects with an average size of $150,000. These are not huge projects. These are projects developed by small businesses that are going on schools and

churches and community buildings in communities around the entire country.

The 1603 Program lapsed at the end of 2011, and although there has been a modest recovery in tax equity markets, there remains a temporary need for the program. Absent the 1603 Program, financing available for domestic renewable projects will be reduced by more than 50 percent. A reduction of this magnitude will disproportionately impact small businesses, like Steve's company, that lack the resources and scale to enter into complicated tax equity transactions under these market conditions.

Today, the solar industry is one of the most entrepreneurial segments of our economy, and ultimately, it is these entrepreneurs from the scientists developing more efficient and cost-effective solar technologies to the small business leaders making solar more affordable for consumers that are responsible for the rapid growth and reduced costs that are the hallmark of America's solar industry today. Stable, reliable, and well-structured tax policy provides the framework that allows for this market-driven innovation.

Chairman BROUN. Mr. Resch, if you can go ahead and finish up your testimony. You are over the time already, sir.

Mr. RESCH. Thank you. If policymakers have the foresight to retain these highly effective tax policies, the short-term investment will yield significant long-term results.

Thank you for having me here today. I am happy to answer any questions that you have.

[The prepared statement of Mr. Resch follows:]

TESTIMONY OF

RHONE RESCH, PRESIDENT & CEO
SOLAR ENERGY INDUSTRIES ASSOCIATION

SUBMITTED TO THE

U.S. HOUSE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
SUBCOMMITTEE ON INVESTIGATION AND OVERSIGHT &
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT

JOINT HEARING ON

IMPACT OF TAX POLICIES ON COMMERCIAL APPLICATION OF RENEWABLE ENERGY TECHNOLOGY

APRIL 19, 2012

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Chairman Broun, Chairman Harris, Ranking Member Tonko, Ranking Member Miller and members of the subcommittees:

The Solar Energy Industries Association (SEIA) is the national trade association for the U.S. solar energy industry. On behalf of our 1,100 member companies and the more than 100,000 American taxpayers employed by the solar industry, I appreciate having the opportunity to testify this morning about the important and constructive role that federal tax incentives have played in helping expand the deployment and use of renewable energy.

Introduction

Access to a diverse, abundant, reliable and affordable supply of energy is in the national interest. Accordingly, federal policy has for decades provided a legislative and regulatory framework that has helped every major source of energy utilized in the U.S. today reach commercial scale. The recognition that smart policy can play a vital role in developing new domestic energy resources has contributed significantly to America's long-term economic prosperity and growth.

Similarly, history has shown that well-crafted and efficient federal tax incentives can be powerful policy mechanisms to promote the nation's energy objectives and leverage private sector investment for the deployment and utilization of new energy resources. This is clearly the case with federal tax incentives designed to promote the expanded deployment and use of solar energy technologies.

Since the enactment of the 30 percent commercial and residential solar Investment Tax Credit ("ITC") in 2005 and the 1603 Treasury Program ("1603") in 2009, domestic deployment of solar has increased seven-fold; the cost to consumers has significantly dropped; and we have developed a domestic industry value chain that today employs over 100,000 Americans. By any objective measure, these important incentives are doing exactly what they were meant to do – allow our nation to reap the significant energy, economic and environmental benefits associated with utilizing our abundant solar resources.

When compared to other sources of energy – both conventional and renewable – the duration of federal support for solar has been brief. The solar ITC is the primary federal policy that encourages the deployment of solar technology. Since the ITC took effect in 2006, the industry has made significant and concrete strides towards grid parity. If current trends continue and costs continue to drop on account of economies of scale, improved technology and enhanced efficiencies, the solar industry's need for federal policy support will be shorter than virtually any other domestic energy source.

Ultimately, it is the entrepreneurs in America's solar industry – from the scientists that are developing more efficient and cost-effective solar technologies to the market innovators that are providing new financing options that make solar more affordable for consumers – that are

responsible for the rapid growth and reduced costs that are the hallmarks of America's solar industry. Stable, reliable and well-structured tax policy provides the framework that allows for this market-driven innovation. If policymakers have the foresight to retain these highly effective tax policies, this short-term investment will yield significant long-term benefits.

Background on Solar Energy Technologies

A variety of commercial solar technologies are in use in the domestic marketplace today. Solar is being deployed in a variety of market applications to respond to diverse consumer needs. Utility-scale power plants are constructed to provide traditional wholesale electricity to utilities, but projects can also be developed on a distributed basis to optimize geographic proximity to areas of high demand and avoid the costs of building new transmission lines. Moreover, many companies focus exclusively on developing solar systems on rooftops of commercial buildings and homes to allow end-use customers to reduce their monthly electricity bills. The solar industry is experiencing record growth in large part due to the flexibility and diversity of these technologies and market innovations.

Photovoltaic ("PV") Solar Technology

PV technologies directly convert energy from sunlight into electricity. Sunlight strikes semiconductor material in a panel and releases electrons from their atomic bonds, producing an electric current. PV panels contain no moving parts and generally last twenty years or more with minimal maintenance. PV panels are utilized in residential, commercial and utility-scale applications.

Traditionally, PV cells are made using various forms of silicon ("Si"), but companies are now manufacturing cells using a wide variety of semiconductor materials, each of which lend themselves to different applications. Two of these qualities are particularly important: the *absorption coefficient* – which refers to how easily light is absorbed by the material, and the *band-gap* – which determines how efficiently light energy from different parts of the solar spectrum release the electrons from their atomic bonds.

Crystalline Silicon ("c-Si") cells were first commercialized by Bell Labs in the 1950s, and are traditionally manufactured by slicing high-grade (>99.99 percent pure) silicon into thin wafers, roughly as thick as several human hairs. Mono-crystalline silicon solar cells offer higher efficiencies but are more difficult to manufacture. Poly-crystalline silicon cells have generally lower efficiencies but are cheaper and easier to manufacture.

Thin-film solar cells are manufactured by applying very thin layers of semiconductor material to inexpensive materials such as glass, plastic or metal. Thin-film cells require less semiconductor material but tend to be less efficient at energy conversion. They also tend to be less costly to manufacture. Examples include cadmium telluride ("CdTe"), amorphous silicon (a-Si) and copper-indium-gallium-diselenide ("CIGS").

Multi-junction cells, which are also referred to as cascade or tandem cells, are the highest-efficiency solar cells currently available. These cells work by combining two or more types of semiconductor material with staggered band-gaps, allowing each to capture a different range of the solar spectrum. The result is a cell with much higher efficiency than any single-material PV cell. These types of cells are expensive to manufacture, and are used when weight and efficiency are at a premium, such as satellites, high-performance solar-powered vehicles, in military applications, and for Concentrating PV ("CPV").

CPV technology utilizes a specialized type of solar panel which uses mirrors or lenses to focus high concentrations of direct sunlight onto high-efficiency solar cells. Since concentrating panels cannot absorb diffuse light, they are typically only used in areas with high levels of direct sunlight such as the U.S. Southwest. In order to maintain focus, CPV employs tracking systems allowing them to follow the sun's path as it moves across the sky. Tracking systems can also be used in projects utilizing standard non-concentrating PV panels to increase energy harvest by more than 20 percent.

Concentrating Solar Power ("CSP") Technology

CSP plants use mirrors or lenses to concentrate the thermal energy from the sun, creating temperatures high enough to drive traditional steam turbines or engines that create electricity. This technology is optimal for utility-scale applications and is ideal for areas of high direct normal solar radiation, such as the U.S. Southwest.

There are a variety of CSP technologies utilized in the marketplace. Parabolic trough systems use curved mirrors to focus the sun's energy onto a receiver tube that runs down the center of a curved-mirror trough. In the receiver tube, a high-temperature heat transfer fluid (e.g., synthetic oil) absorbs the sun's energy, reaching temperatures of around 700° F, and passes through a heat exchanger to heat water and produce steam. The steam drives a conventional steam turbine power system to generate electricity. A typical solar collector field contains hundreds of parallel rows of troughs connected as a series of loops, which are placed on a north-south axis so the troughs can track the sun from east to west. Individual collector modules are typically 15-20 feet tall and 300-450 feet long.

Power tower projects utilize a central receiver system. Seeking higher operating temperatures for greater efficiencies, computer-controlled flat mirrors (heliostats) track the sun along two axes and focus solar energy on a receiver at the top of a high tower. The focused energy is used to heat transfer fluid (800° F to 1,000° F) to produce steam and run a central power generator.

Another CSP technology utilizes compact linear Fresnel reflectors (CLFR). To reduce some of the up-front capital costs of plant construction, CLFR developers rely on the principles of curved-mirror trough systems, but use long parallel rows of lower-cost flat mirrors. These modular reflectors focus the sun's energy onto elevated receivers, which consist of a system of tubes through which water flows. The concentrated sunlight boils the water, generating high-pressure steam for direct use in power generation and industrial steam applications.

The technical process of capturing thermal energy for CSP power plants has led some companies to develop energy storage capabilities to smooth facility output throughout the day and even generate electricity after the sun is no longer shining.

The method of thermal storage in CSP plants involves capturing the heat of solar radiation in a heat transfer medium very similar to a thermos that can keep coffee hot for hours. Some plants currently under construction include a storage process utilizing molten salt, a combination of sodium nitrate and potassium nitrate that is often found in food preservatives and fertilizers. The mixture can be heated to a lava-like consistency and pumped into a holding tank. In this state, it will lose only about 1 percent of its heat during the day. The molten salt can be removed from the tank at any time, even during evening hours, to be run through a heat exchanger to create steam, run a turbine, and generate electricity for the power grid. The used salt is returned to a second tank at a lower temperature to be passed through the cycle again in a continuous loop.

Solar Heating and Cooling Technology

Solar heating and cooling technologies collect the thermal energy from the sun and use this heat to provide hot water, space heating, cooling and pool heating for residential, commercial and industrial applications.

Solar water heating systems can be installed on any home and are composed of three main elements: the solar collector, insulated piping, and a hot water storage tank. The solar collector gathers the heat from solar radiation and transfers the heat to potable water. This heated water flows out of the collector to a hot water tank, and is used as necessary. Auxiliary heating can remain connected to the hot water tank for back-up if necessary.

There are two kinds of solar cooling systems: desiccant systems and absorption chiller systems. Absorption chiller systems, the most common solar cooling systems, use solar water heating collectors and a thermal-chemical absorption process to produce air-conditioning, without using electricity. The process is nearly identical to that of a refrigerator, only no compressor is used. Instead, the absorption cycle is driven by a heated fluid from the solar collector. In a desiccant system, air passes over a common desiccant or "drying material" such as silica gel to draw moisture from the air and make the air more comfortable. The desiccant is regenerated by using solar heat to dry it out.

Solar space heating systems are similar to solar water heating systems, but generally involve more solar collectors, larger storage units, and a more sophisticated design. These heating systems can use a non-toxic liquid, water, or air as the heat-transfer medium from the solar collector. The heated liquid or air is then circulated throughout the building or home to provide space heating. Another solar space heating technology uses transpired solar collectors along a building's exterior south-facing wall. The perforations in these collectors allow air to pass

through and be heated. This solar-heated air is then channeled into the building's ventilation system.

Solar energy is also used to heat both commercial and residential swimming pools. The existing pool filtration system can frequently be used to transfer heat from the solar collectors to the pool water. Solar pool heating systems use different collectors, depending on the climate and on whether the pool is located outdoors or indoors.

Background on the Solar Investment Tax Credit

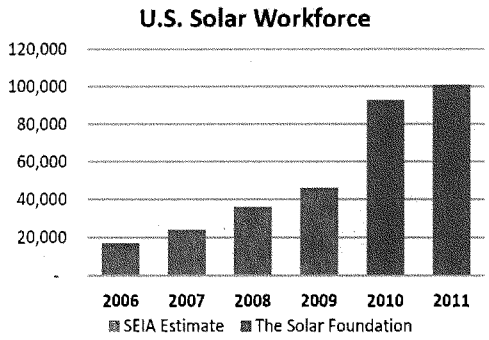
The *Energy Policy Act of 2005* (P.L. 109-58) created tax incentives for solar energy – a 30 percent ITC for commercial and residential solar energy systems that applied from January 1, 2006, through December 31, 2007. These credits were extended for one additional year in December 2006 by the *Tax Relief and Health Care Act of 2006* (P.L. 109-432). In 2007, global investment in clean energy topped $100 billion, with solar energy as the leading clean energy technology for venture capital and private equity investment. The solar ITC helped to create unprecedented growth in the U.S. solar industry from 2006-2007. The amount of solar electric capacity installed in 2007 was double that installed in 2006.

The *Emergency Economic Stabilization Act of 2008* (P.L. 110-343) included an eight-year extension of the commercial and residential solar ITC, eliminated the monetary cap for residential solar electric installations, and permitted utilities and alternative minimum tax (AMT) filers to utilize the credits. Under current law, the solar ITC is set to expire on December 31, 2016.

Solar Investment Tax Credit a Resounding Policy Success

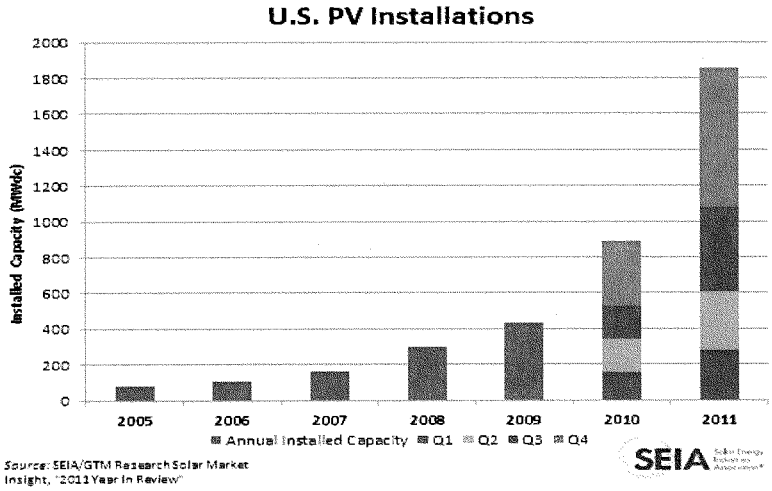
An Engine for U.S. Job Creation

Due in large part to the availability of the multi-year ITC, the solar industry grew by 109% in 2011 compared to the previous year, making it one of the fastest growing industry sectors in the U.S. economy. Today, the solar industry employs more than 100,000 Americans, more than double the number in 2009. They work at more than 5,600 companies, the vast majority being small businesses, in all 50 states. Additional job growth is expected as the industry continues to grow in the future.



Increasing U.S. Solar Installations

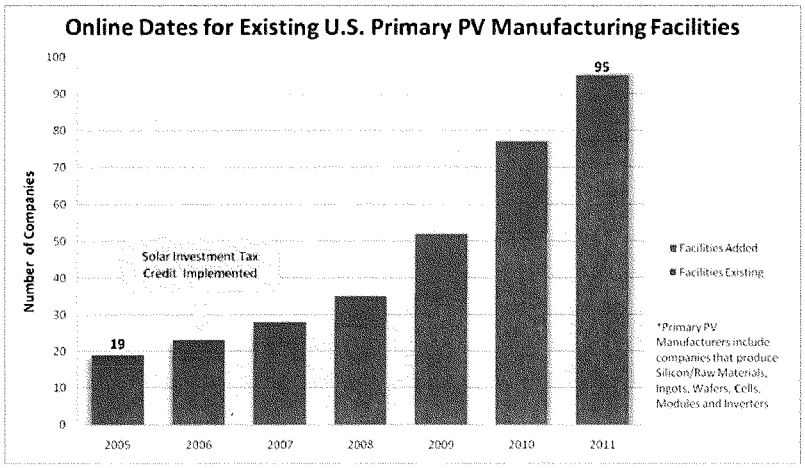
The market certainty provided by a multiple-year extension of the solar ITC has accelerated the deployment of solar in the U.S. Since the solar ITC was implemented in 2006, the total amount of solar generating capacity deployed has grown more than seven-fold. During this same time period, PV capacity has grown by nearly seventeen-fold. Cumulative solar capacity in the U.S. now exceeds 4,460 megawatts ("MW"), enough to power more than 700,000 homes. In 2011, the U.S. installed 1,855 MW of PV capacity, up from 887 MW in 2010.



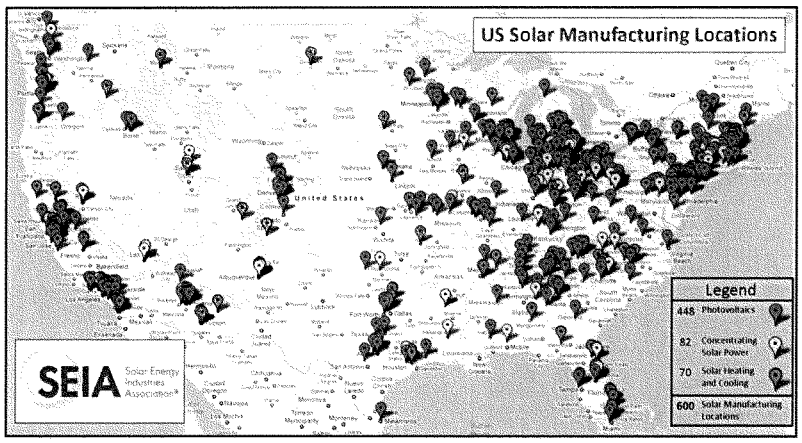
Growing U.S. Solar Manufacturing Capacity

The sharp growth in project installations after passage of the ITC occurred in tandem with expanding U.S. solar manufacturing. As annual installed generating capacity grew each year, U.S. PV panel production increased from 134 MW in 2005 to 865 MW in 2011.

Today, there are at least 95 domestic facilities in 26 states currently manufacturing PV primary components, including solar-grade polysilicon, ingots, wafers, cells, solar modules, and inverters. But only 19 of those facilities were operating in 2005 – a five-fold increase in the United States in the last six years.



Glass and steel manufacturers are also important members of the solar value chain, providing essential components for utility-scale solar power plants, including CSP projects currently under construction in the U.S. Southwest. Overall, there are 600 domestic manufacturing facilities in the solar value chain.



Without question, solar energy is a competitive, global industry. U.S. manufacturers exported to Europe and other foreign markets in the past and increasingly serve U.S. developers in response to the ITC jump-starting project construction here at home.

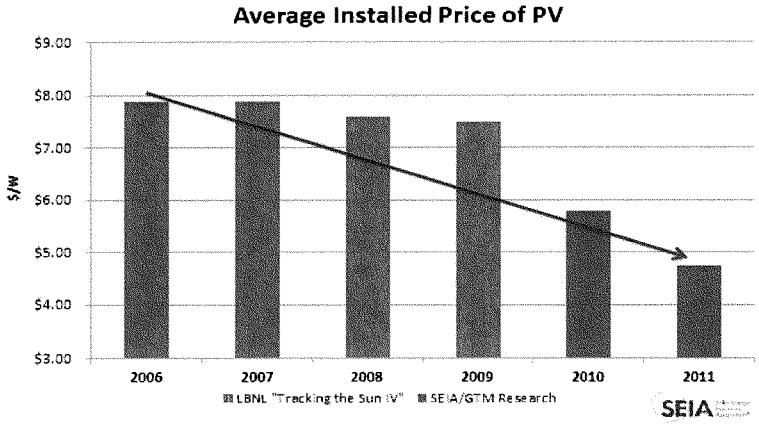
The ITC thus has a positive ripple effect that reaches beyond project development to enable growth and maturation of the broader solar supply chain. New solar manufacturing facilities opened in 2011 in Arizona, Illinois, Kentucky, Michigan, Mississippi, North Carolina, Nevada, New York, Ohio, Pennsylvania, Texas, Vermont, Washington and Wisconsin. Solar manufacturing expansion will continue in 2012 and 2013, as major new facilities come online in Arizona, Colorado, Indiana, Massachusetts, Mississippi, North Carolina, Nevada, New York, Ohio, Oregon, Pennsylvania, South Carolina and Tennessee.

As U.S. manufacturers compete with companies around the globe, the ITC is a critical policy mechanism to ensure robust demand for solar energy components in the U.S. market.

The Falling Cost of Solar for Consumers

The existence of the ITC through 2016 provides market certainty for companies to develop long-term investments in manufacturing capacity that drives competition, technological innovation, and ultimately lowers costs for consumers.

In 2011 alone, the price of solar panels dropped by 50%, and costs continue to fall, making solar even more affordable for residential and business consumers. In addition, innovative financing options for consumers, such as third-party leases and power purchase agreements ("PPAs"), have removed financial barriers and made it easier for consumers to choose solar. This is part of an ongoing trend that has shown consistent declines in solar pricing in the marketplace.

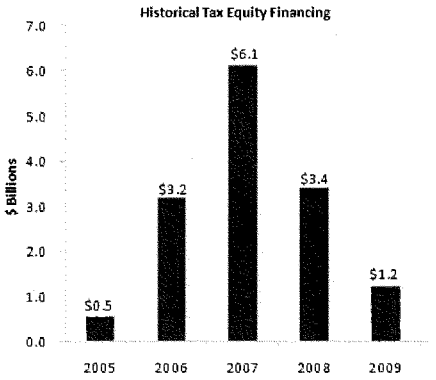


Importance of Tax Equity Financing and Credit Liquidity

The 2008 economic crisis rendered solar and other renewable energy tax incentives of little immediate value. Prior to the financial crisis, many utility-scale renewable energy projects relied upon third-party tax equity investors to monetize the value of federal renewable energy incentives. The economic downturn drastically reduced the availability of tax equity, severely limiting the financing available for renewable energy projects.

Tax equity is the term used to describe the passive financing of an asset or project by large tax-paying entities that can utilize tax incentives to offset their tax liabilities. Tax equity investors in renewable energy projects receive a return on investment based not only on the income from the asset or project, but also on federal income tax preferences (through the utilization of tax credits). Renewable energy developers themselves typically do not have sufficient taxable income to benefit directly from these tax credits and must partner with tax equity investors in order to finance projects. For example, they participate in a partnership structure in which ownership of the project is transferred from the tax equity investor to the developer-owner once the tax benefits are realized. Leasing structures akin to those commonly found in many sectors of the economy are also utilized.

The pool of tax equity investors is typically limited to the largest and most sophisticated financial firms and utilities, and the 2008 economic crisis significantly reduced the market demand among these entities for tax equity. A report released by the Bipartisan Policy Center on March 22, 2011, noted that the number of tax equity investors in renewable energy projects declined from approximately 20 in 2007 to 13 in 2008 and only 11 in 2009. The associated decline in overall tax equity financing provided to renewable energy projects was equally dramatic, falling from $6.1 billion in 2007 to $3.4 billion in 2008 and $1.2 billion in 2009.



Sources: U.S. Department of The Treasury, US Partnership for Renewable Energy Finance, and Leading Tax Equity Market Participants

Section 1603 Treasury Program

The Section 1603 Treasury Program ("1603") was enacted in 2009 and extended in 2010 to address the lack of tax equity available to finance renewable energy projects. The program lapsed at the end of 2011, though solar projects that commenced construction before the end of last year and are placed in service before the expiration of the solar ITC in 2016 are eligible under the program.

It is important to note that under the 1603 program, the government does not pick winners and losers – it simply allows taxpayers to receive a federal grant in lieu of taking an existing energy tax credit they are otherwise entitled to claim. This merely constitutes a change to the timing of when an existing energy tax incentive can be utilized. This change in timing, however, provides the liquidity needed for the further development of domestic energy projects.

Section 1603 Treasury Program Has Been a Proven Success

1603 is structured in a technology neutral manner that encourages the development of a wide variety of domestic energy technologies including: biomass; combined heat and power; fuel cells; geothermal; hydropower; landfill gas; marine hydrokinetic; microturbine; municipal solid waste; wind and solar.

Since its enactment, the National Renewable Energy Laboratory's ("NREL") preliminary analysis conservatively estimates that 1603 has supported an average of 52,000 to 75,000 jobs over the period analyzed. The program has leveraged $25.8 billion in private sector investment to support over 24,000 domestic projects utilizing a wide range of energy technologies in all 50 states. As of March 2012, awards to more than 22,000 domestic solar projects leveraged over $4.87 billion in private sector investment for projects in 47 states.

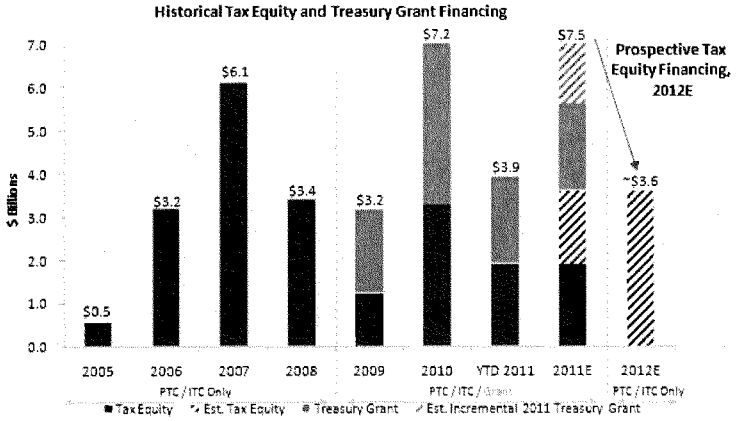
It is important to note that 1603 is particularly helpful for small businesses that are the nation's engine of economic growth and job creation. These businesses typically do not have the resources or scale to enter into complicated tax equity financing transactions. By virtue of its structure, 1603 allows small solar businesses and project developers to monetize the underlying solar ITC to finance the development of worthwhile distributed generation projects. The fact that the average 1603 award for a solar project is less than $150,000 demonstrates that small businesses are effectively utilizing the program.

Congress Should Extend the Section 1603 Program

Though the tax equity market has modestly improved, there remains a need for 1603. Access to tax equity financing has still not recovered to the levels available prior to the recession, and the rates of return that are being demanded in today's marketplace by investors remain prohibitively high. In December 2011, tax equity investors in solar projects required returns from 7.5% to as high as 17% compared to pre-recession levels of 6% to the low teens.

Due to global economic conditions, a large gap persists between the total amount of financing that renewable energy developers need to fully realize the benefits of continued expansion of domestic solar projects. Expiration of 1603 is projected to reduce the availability of tax equity financing from an estimated $7.5 billion in 2011 to approximately $3.6 billion in 2012 – a reduction of more than 50%. This will stifle job creation and severely restrict the market's

ability to leverage private sector capital to finance new domestic energy projects. Therefore, to continue this successful, job-creating program, SEIA encourages Congress to extend 1603.



Sources: U.S. Department of The Treasury, US Partnership for Renewable Energy Finance, Leading Tax Equity Market Participants

Conclusion

As the brief duration of federal solar tax incentives demonstrates, effective federal tax policy can yield significant energy and economic policy benefits. SEIA and the U.S. solar industry look forward to working constructively with policymakers to craft effective tax policy that is consistent with the nation's energy and economic policy objectives.

Again, Chairman Broun, Chairman Harris, Ranking Member Tonko, Ranking Member Miller and members of the subcommittees, I sincerely appreciate having the opportunity to testify today, and would be happy to answer any questions you might have.

Chairman BROUN. Thank you, Mr. Resch.

Mr. Royer, you are recognized for five minutes.

STATEMENT OF MR. TERRY ROYER, CEO, WINERGY DRIVE SYSTEMS CORPORATION

Mr. ROYER. Yes, thank you. Thank you, Chairman Broun, Chairman Harris, and Ranking Members and Subcommittee Members. I appreciate the opportunity to speak to—with you today about the impact that tax policies have on the commercialization of renewable energy, in particular, wind energy. I want to focus my testimony today on one particular tax policy—the Production Tax Credit.

While the wind industry has utilized other tax incentives to gain a foothold in the U.S. energy marketplace, the underlying PTC has, by far, been the most effective at generating the private capital and investment certainty that any industry needs to grow and prosper. Let me back up for a moment to give you a little background on Winergy and where it fits in this conversation.

Winergy Drive Systems Corporation, located in Elgin, Illinois, was incorporated in 2001. Winergy is the world leader of gearboxes for wind turbines. The gearbox is the key component inside the wind turbine. We operate two factories in Elgin, Illinois, just outside Chicago, and supply gearboxes to the top wind turbine manufacturers and producers, who are all located here in the United States.

Winergy started here in the United States assembling and testing of these components in 2001 with 11 employees. In the past six years, when the PTC has not been allowed to expire, the demand it created has contributed to the expansion of our company and has helped us weather the recent economic downturn. In 2009, we were afforded the opportunity because of this growth to build a new facility in Elgin. Today, we have 380 employees supporting our customers with the building of our products. Revenue from the wind industry accounts for 100 percent of my company's total income.

As one of the nearly 500 companies that manufacture components for the wind industry in the United States, we are just one example of the critical role the PTC has played in the growth of this sector. The access to financing, the overall market certainty, and the PTC has provided to investors has led to the accelerated growth of wind farms projects in the United States. In fact, in just the last six years, 38,000 megawatts of wind have been constructed under a PTC—under a consistent PTC policy. This is over 80 percent of the total megawatt installed in the United States, which started back prior to 1980.

These projects demand huge pieces of equipment, complicated engineering, and a skilled workforce to construct. Due to the economics of logistics and transportation costs, the wind industry has quickly realized that making these parts in the United States actually leads to lower cost and more efficiency. So the growing demand for the construction of wind projects, brought on by the investor response to the PTC, has led to a rapid growth of U.S. wind manufacturing. Indeed, in 2005 only 25 percent of the products and components were produced in the United States. Today, nearly—over 60

percent of the components are now made on domestic soil. This trend must continue. Over 75,000 jobs exist in the industry and depend on it, not to mention tens of thousands of potential jobs if we can contain this growth.

In addition to this growing domestic supply chain, technology innovations have also continued to push wind energy further down the cost curve. The cost of wind energy has come down 90 percent since 1980 and capital costs have dropped 33 percent since 2008. Companies like my own contributed to these technological innovations and increased efficiencies and driven down cost. Innovations in gearbox technologies that Winergy has led are a key part to the cost reductions we have seen in the overall last four years. Wind energy technology continues to improve as the industry scales up.

The PTC has not just the—has not just benefited the manufacturers and developers but the American electricity consumers and the U.S. economy as a whole. Wind energy provides nearly three percent of America's electricity today, with that number surpassing 20 percent in the States of Iowa and South Dakota. Overall, wind energy has accounted for 35 percent of all new electric generating capacity that has been put online in the last five years. Increasing the diversity and energy security of our country, the wind industry has generated investment upward of $20 billion annually, which is greater than the economic impact on U.S. GDP from Colombia, Panama, and South Korea free trade agreements combined.

It is imperative that the PTC in place for the near future, so that private investment continue to grow this market and so that U.S. manufacturing jobs continue to be created. The PTC is not a handout. It is a business tax credit with funding based solely on project performance, not evaluation by any governmental official. Without a mechanism with which to fund wind projects past 2012, manufacturers like Winergy are already losing business.

Chairman BROUN. Mr. Royer, if you could go ahead and wrap up your testimony. You passed the five minutes already.

Mr. ROYER. I expect Winergy orders for 2013 to fall by at least 60 percent, which will lead to substantial job losses. Industrywide, 37,000 jobs will be lost if the PTC is not extended.

Again, thank you for hearing my testimony.

[The prepared statement of Mr. Royer follows:]

Testimony of Terry Royer, Winergy Drive Systems Corporation

House Committee on Science Space and Technology
Subcommittee on Energy and Environment
Subcommittee on Investigations and Oversight

Hearing on Impact of Tax Policies on the Commercial Application of Renewable Energy Technology

April 19, 2012

Good Morning. Thank you, Chairmen Harris and Broun, Ranking Members Miller and Tonko, and Subcommittee Members. My name is Terry Royer, and I am the CEO of Winergy Drive Systems Corporation. I appreciate the opportunity to speak with you today about the impact that tax policies have had on the commercialization of renewable energy, in particular, wind energy. I want to focus my testimony today on one particular tax policy – the Production Tax Credit (or PTC). While the wind industry has utilized other tax incentives to gain a foothold in the U.S. energy marketplace, the underlying PTC has, by far, been the most effective at generating the private capital and investment certainty that any industry needs to grow and prosper.

Let me back up for a moment to give you a little background on Winergy and how we fit into this conversation. Winergy Drive Systems Corporation is a division of Winergy Ag, an operating unit of Siemens Ag. Winergy Drive Systems Corporation is the US operating arm, which was incorporated in 2001. We are headquartered in Elgin, IL, a western suburb of Chicago. Winergy is the world leader in gearboxes for wind turbines. The gearbox is the key component inside a wind turbine. We operate two factories in Elgin and supply gearboxes to the top wind turbine manufacturers in the United States.

Winergy started here in the United States assembling and testing gearboxes with 11 employees in 2001. In the past six years when the PTC has not been allowed to expire, the demand it created has contributed to the expansion of our company, and has helped us weather the recent economic downturn. In 2009 we opened a new facility. Today we have 380 employees supporting our customers with the building of our products. Revenue from the wind industry accounts for 100% of my company's total income.

As one of the nearly 500 wind manufacturing facilities in the U.S., we are just one example of the critical role the PTC has played in the growth of our sector. The access to financing and the overall market certainty that the PTC has provided to investors, has led to the accelerated growth of wind farms projects in the U.S. In just the last six years, 38,094MW of wind have been constructed under a consistent PTC - this is over 80% of the total wind megawatts in the U.S. These projects demand huge pieces of equipment, intricate engineering, and a skilled construction force. Due to the economics of logistics and transportation costs, the wind industry has quickly realized that making these parts in the U.S. actually leads to lower costs and more efficiency. So, the growing demand for the construction of wind projects, brought on by the investor response to the PTC, has led to a

rapid growth of U.S. wind manufacturing. Indeed, in 2005 only 25% of the component parts of a wind project were built in the U.S. Now, we are making more than 60% of component parts in the U.S. This is a trend that must continue. Over 75,000 existing jobs in the industry depend on it, not to mention tens of thousands of potential jobs.

In addition to this growing domestic supply chain, technology innovations have also continued to push wind energy further down the cost curve. The cost of wind energy has come down 90% since 1980 and capital costs have dropped 33% since 2008 (Bloomberg New Energy Finance). Companies like my own contributed to these technological innovations that increased efficiency and drove down costs. Innovations in gearbox technologies that Winergy has led are a key input to the cost reductions we have seen over the last four years. Wind energy technology continues to improve as the industry scales up.

The PTC has benefited not just the manufacturers and developers, but the American electricity consumer and the U.S. economy as a whole. Wind energy now provides nearly 3% of America's electricity, with that number surpassing 20% in the states of Iowa and South Dakota. Overall, wind energy has accounted for 35% of all new electric generating capacity in the last five years, increasing the diversity and energy security of our country. The wind industry has generated investment upward of $20 billion annually, which is greater than the economic impact on U.S. GDP from the Colombia, Panama, and South Korea free trade agreements combined (Senate Finance Committee Statement, 10/11/11).

It is imperative that the PTC remain in place for the near-future so that private investment continues to grow this market and so that U.S. manufacturing jobs continue to be created. The PTC is not a handout. It is a business tax credit, with funding based solely on project performance, not evaluation by government officials. Without a mechanism with which to fund wind projects past 2012, manufacturers like Winergy are already losing business. I expect Winergy orders for 2012 and 2013 to fall by nearly 60%, which will lead to subsequent job losses. Industry-wide, 37,000 jobs will be lost if the PTC is not extended. (2011 Navigant Study).

Again, thank you for the opportunity to speak with you today about the importance of federal tax incentives – particularly the PTC – for driving economic growth, energy diversity and U.S. manufacturing. I look forward to answering any questions you might have.

Chairman BROUN. Mr. Erby, you are recognized for five minutes.

STATEMENT OF MR. STEVEN ERBY,
VICE PRESIDENT,
MONOLITH SOLAR ASSOCIATES, LLC

Mr. ERBY. Thank you, sir.

My name is Steve Erby, Vice President, Monolith Solar Associates, and I would like to thank Chairman Broun and Mr. Harris and Congressman Tonko for having us here today.

We are a veteran-owned company based out of Rensselaer, New York. We install and lease small commercial solar systems ranging in size from 25,000 watts to 150,000 watts. We install in schools, churches, community centers, fire stations, and small businesses. My business partner, Mark Fobare, and I started this adventure in my den in 2009. We quickly grew to the kitchen; we gained a secretary and were promptly thrown out of the house by my wife. We expanded into the garage. Today, we just recently moved into a completely refurbished 9,000-square-foot warehouse with over 21 employees. We have installed 37 systems since August of 2010 and have contracted pipeline of 127 systems, roughly nine megawatts of product. We are proof that the 1603 Program works.

Without the 1603 Program, none of this would have happened and would have not been able to continue. Monolith applies for the 1603 grant for each system. As a startup business, we do not qualify for the ITC. We do not have the passive income to offset the investment of the tax credit. Most of our potential prospective customers do not qualify either. Some of the benefits derived from the program: our small business has grown from two employees to 21 employees in a very short time, 18 months, and we stand to double that size with the current number of contracts that are signed. We established our business in a designated economic development zone in the city of Rensselaer. We have created additional jobs employing contractors, subcontractors, electricians, engineers, accountants, and professionals. And most importantly, I think we are driving down the cost of doing business for the small business.

One of our recent installations was a sale to a small TV appliance store, Towne TV in Schenectady. Despite being a 56-year-old business, due to the current economy, they were unable to take advantage of the ITC. The 1603 Program allowed them to install solar, lowering their operating cost, generating cash flow for other uses, and generally spinning up the economic machine for them and the solar industry.

We have generated quite a buzz attending many community functions, educating students, businesses, customers about solar and the energy economy. Municipal leaders have embraced solar as a way of reducing taxpayer burden and providing leadership to their communities. Mechanicville, East Greenbush, Sand Lake, Niskayuna, Schenectady, and Rensselaer are just a few of the communities that have put solar on top of every one of their municipal structures.

The industry needs the 1603 Program, and preferably the reintroduction of the 1603 rebate, to create jobs, foster a strong value chain, and grow our business. There are too many small businesses

and organizations who are unavailable to take advantage of the ITC as a credit.

We are not an isolated success. As Mr. Rush has explained, there are hundreds of companies across the United States that are benefitting from the 1603 Program. The engine of growth in this economy is small business supporting a strong middle class.

As we work to create these opportunities in our local community, we met John, the father of eight children. He was obligated to leave his job to temporarily care for a premature baby. His wife kept the better-paying job. The baby improved, but the family income suffered. John looked for work for a year but could not find gainful employment in the difficult economy until he joined Monolith. He is now one of our best employees, and we are very fortunate to have him.

We believe that solar can be the engine for the middle class and small community growth and economic security. Growth must be nurtured by incentives such as the 1603 Program that allows the industry and the market to mature.

On behalf of all the employees at Monolith Solar, I want to thank you for having us here. Thank you.

[The prepared statement of Mr. Erby follows:]

Impact of Tax Policies on the Commercial Application of Renewable Energy Technology

Steven A. Erby
Vice President
Monolith Solar Associates, LLC

Statement before the Subcommittee on Investigations and Oversight
and Subcommittee on Energy and Environment

April 19, 2012

My name is Steve Erby. I am the Vice President of Monolith Solar Associates.

I would like to thank Representative Harris and Representative Broun for inviting us to speak to you on the impact of the US Treasury 1603 Program as it applies to our solar business.

Based in Rensselaer, NY, Monolith installs and leases small commercial solar systems ranging in size from 25,000 to 150,000 watts. We install in schools, churches, community centers, fire stations and small businesses.

Mark Fobare and I started this adventure in my den in 2009, expanding to the kitchen and then to the garage before purchasing and refurbishing a previously-abandoned building near the Rensselaer Train Station. Because of the conservative climate of banking, we were forced to bootstrap, working morning, noon and night, maxing out our personal credit cards to start this business. We now have 21 full time employees and a variety of subcontractors. All in, we have installed 37 systems since August 2010 and have a contracted pipeline of 127 systems, nearly 9 MWs of product. We are proof that the 1603 Program works and we are all proud of what we have done.

Without the 1603 Program, none of this would have happened and we will not be able to continue.

Monolith applies for the 1603 Program for each system. As a start-up business, we do not qualify for the ITC; we do not have the passive income to offset the Investment Tax Credit. Most of our potential prospective customers do not qualify either.

The benefits derived from the Program:

1. Our small business has grown from 2 to 21 employees in eighteen months and will double in size at the current pace.
2. We established our business in a designated economic development zone in the City of Rensselaer.
3. We have created additional jobs employing contractors, sub-contractors, engineers, accountants and other professionals.

monolith

4. We are driving down the cost of doing business, for the small business.

One of our recent installations was a sale to a small, TV/Appliance business: Towne TV in Schenectady. Despite being a 56-year old business, due to the current economy they were unable to take advantage of an ITC. The 1603 rebate allowed us to install solar for them, lowering their operating costs, generating cash flow for other uses and generally spinning up the economic machine for them and the solar industry.

We have generated quite a buzz, attending many community functions, educating students, businesses and customers about solar and the energy economy. Municipal leaders have embraced solar as a way of reducing taxpayer burden and providing leadership to an improved renewable energy infrastructure. Mechanicville, East Greenbush, Sand Lake, Niskayuna, Schenectady and Rensselaer have contracted for installation on all of their municipal buildings.

This industry needs the 1603 Program and preferably the reintroduction of the 1603 rebate to create jobs, foster a strong value chain and grow our business. There are too many small businesses and organizations who are unable to take advantage of the ITC, as a credit.

We are not an isolated success; there are hundreds of other companies that in various degrees have benefited from the 1603 Program.

The engine of growth in this economy is small business, supporting a strong middle class.

As we worked to create these opportunities in our local community, we met John, the father of eight children, who was obligated to leave his job to temporarily care for a premature baby. His wife kept the better paying job. The baby improved, but the family income suffered. John looked for work for a year, but could not find gainful employment in a difficult economy, until he joined Monolith. He's now one of our best employees and we are fortunate to have him.

We believe that solar can be the engine for middle class and small community growth and economic security. Growth must be nurtured by incentives, such as the 1603 Program, that allows this industry and market to mature.

On behalf of all the employees of Monolith Solar, and small companies like ours across the country, I urge you to reinstate, and expand the 1603 Rebate Program.

Thank you for your attention.

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Chairman BROUN. Thank you, Mr. Erby.

Dr. Zycher, you are recognized for five minutes.

STATEMENT OF DR. BENJAMIN ZYCHER,
VISITING SCHOLAR,
AMERICAN ENTERPRISE INSTITUTE

Dr. ZYCHER. Thank you very much, Mr. Chairman. I am very pleased to have this opportunity to offer my views today on why renewable energy subsidies should be abandoned. At the end, I will be more than happy to address any questions that may arise.

Despite very substantial policy support in the form of direct and indirect subsidies at the federal and state levels, renewable electricity has only a small share of the market with poor prospects for growth. This is due to three inherent problems that public policies can overcome only at very substantial cost: first, the unconcentrated energy content of wind flows and sunlight; second, siting constraints and the higher transmission costs that result; and third, the intermittency unreliability problem which yields very large additional cost for backup generation.

Each of these problems is discussed in detail in the testimony that I have submitted for the record, but the central effect could be stated quite simply. We have achieved the perfect green trifecta—higher costs, less reliability, and more pollution. The five central rationales that usually are offered in defense of policy support for renewable are deeply problematic.

First, the "infant industry" rationale is inconsistent with the existence of the international capital market and with the cost evidence published by the Energy Information Administration.

Second, the "level playing field" rationale simply is incorrect. The subsidies enjoyed by renewable power are far greater than those received by conventional electricity both on average and on the margin.

Third, the pollution or "externality" rationale ignores the large effects of our environmental policies and ignores also the cost of backup generation imposed by renewable power upon the electricity market, an adverse effect far greater than even the highest estimates of the environmental costs of conventional generation reported in the peer-reviewed literature.

Fourth, the resource depletion or "sustainability" rationale is incorrect simply as a matter of basic economics and is inconsistent with the historical evidence in any event.

And then, finally, the "green jobs" rationale borders on the preposterous. It confuses benefits for particular interest groups with costs imposed upon the economy as a whole. It ignores the adverse employment effects in the industries that lose when government attempts to pick winners. It ignores the adverse employment effects of increases in electricity costs and the adverse employment effects of the taxes needed to finance current and future subsidies. And it ignores the starkly adverse experience in Europe, which also is mesmerized by the "green jobs" mirage.

Under the green jobs analytic framework, we could create a lot of employment if we outlaw the use of heavy equipment for digging ditches and mandated instead the use of shovels. That sounds pret-

ty ridiculous, doesn't it? Well, there is no analytic difference between inefficient ditch-digging and inefficient power generation as tools with which to pursue increased employment—none.

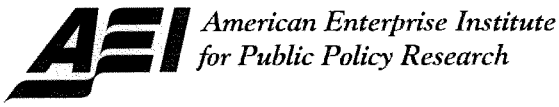
Ongoing perspective developments in the market for natural gas will worsen the already poor competitive position of renewable electricity because of the dramatic increase in natural gas supply is attendant upon the application of hydraulic fracturing technology. The EIA projection of gas prices over the next 20 years has declined about 20 percent and the EIA projection of non-hydroelectric renewable generating capacity also has declined by about 20 percent specifically because of reduced competitiveness.

There was a headline in the *Wall Street Journal* dated August 22, 1978, that read "Solar Power Seen Meeting 20 Percent of Needs by 2000; Carter May Seek Outlay Boost." That forecast has a lot of company. In 1971, the National Academy of Sciences argued that it will take only another 50 years to use up the great bulk of the world's supply of recoverable petroleum liquids and natural gas. In 1977, the Executive Office of the President argued that supplies of oil are diminishing, and world oil will become very scarce and very expensive in the 1980s. In 1978, the Executive Director of the International Energy Agency argued that all available evidence points to a serious energy crisis in the middle or late 1980s. In 1979, the Central Intelligence Agency argued that the world can no longer count on increases in oil production to meet its energy needs. In 1980, the Secretary of Energy argued that oil supplies will be running out in a couple of decades. In 1979, the Chairman of Exxon argued that we are going to be facing shortages and higher prices for years.

There is a dual theme common to all such predictions. First, the substitution—the musings of experts, policymakers, and commentators in place of market forces; and second, a batting average of zero. As we look back—I am not going to go through the list today; there is no time—there is a long list of legislation similar to the ones that we are talking about today in pursuit of energy independence and all the rest. None of them have worked. The eternal truth is that government subsidies for renewable energy are swimming against the strong tide of market forces and are doomed to the same failures that we have experienced time and again. Moreover, such policies have the more subtle effect of inducing evermore interest groups to seek favors from government, not a salutary outcome.

Thank you again and I will be pleased to answer any questions.

[The prepared statement of Dr. Zycher follows:]



Statement before the Committee on Science, Space, and Technology
Subcommittee on Energy and Environment
Subcommittee on Investigations and Oversight
U.S. House of Representatives

Hearing on
Tax Policy Impacts on the Commercial Application of
Renewable Energy Technology

Tax and Other Subsidies for Renewable Energy Should Be Abandoned

Dr. Benjamin Zycher
Visiting Scholar
American Enterprise Institute

April 19, 2012

The views expressed in this testimony are those of the author alone and do not necessarily represent those of the American Enterprise Institute.

Thank you, Mr. Chairman and distinguished members of this committee, for this opportunity to offer my perspective on the commercial impact and policy analytics of tax and other policies---subsidies---for renewable energy. For the most part my comments will be oriented toward the issues raised by subsidies for renewable electricity, wind and solar power in particular, but are broadly applicable to the analysis of biofuels as well.

I begin with a summary of my testimony for the record. Section I discusses the inherent limitations of renewable electricity that public policies can overcome only at very substantial cost to the taxpayers and to the economy as a whole. Section II discusses the five central rationales that commonly are offered in support of subsidies for renewable power; these rationales uniformly are deeply flawed. Section III discusses recent and prospective developments in the market for natural gas---a direct competitor to renewable power technologies---and the attendant implications for the future competitiveness of renewable electricity. Section IV offers concluding observations on the economics and policy analytics of subsidies for renewable energy.

I will be very pleased to address any questions and observations that the Chairman and other members of this committee may have.

Summary

This testimony is based upon my recent book *Renewable Electricity Generation: Economic Analysis and Outlook,* published late last year by the AEI Press. I address here the outlook for renewable sources of energy in electricity generation as a substitute for such conventional fuels as coal and natural gas. The emphasis is on wind power, which in terms of projected generation capacity is by far the most important of the non-hydroelectric forms of renewable power. Some analysis of solar energy is presented also, and the broad analytic themes are applicable to biofuels as well. The discussion examines also the central rationales usually offered in support of policies subsidizing the expanded use of renewables, and the implications of prospective supply and price developments in the market for natural gas.

Public policy support for renewable electricity has been substantial. This support has taken the form of direct and indirect subsidies, and requirements in a majority of the states that specific percentages of the market for electric power be reserved for electricity produced from renewable sources. Nonetheless, renewable power provides only a small proportion---about 3.6 percent---of electric power in the U.S., and official projections are for slow growth at most. This small market share has persisted despite very substantial tax and other policy support, an outcome that can be explained by the problems intrinsic to renewable power---that is, the inherent limitations on its competitiveness---that public policies can circumvent or neutralize only at very substantial expense. These problems uniformly yield high costs and low reliability for renewable power, and can be summarized as follows.

- The unconcentrated energy content of renewable energy sources.

- Location (or siting) limitations.
- Relatively low availability ("capacity factors") over time combined with the intermittent nature of wind flows and sunlight.

The low energy content of sunlight and wind flows relative to that of fossil or nuclear fuels forces renewable technology to compensate by relying upon massive substitute investment in land and/or materials. Second, unlike conventional generation technologies, renewable generation is sharply constrained by siting problems because favorable sunlight and wind conditions are limited geographically, yielding large additional costs for transmission. Finally, capacity factors---essentially, the proportion of the year during which renewable facilities actually can generate power---are substantially lower for wind and solar facilities than is the case for most conventional generation, and the intermittent nature of sunlight and wind flows exacerbates this problem. These conditions result in a need for conventional backup generation capacity so as to preserve the stability of the electric grid and to prevent power shortages; this need increases associated costs sharply. Moreover, in particular for wind power, actual power generation tends to be concentrated in off-peak periods---winds tend to blow at night and in the winter---so that the electricity produced from wind facilities tends to be less valuable than that produced from conventional sources.

The Energy Information Administration estimates wind (onshore) and solar costs in 2016 at about $149 and $257-396 per megawatt-hour, respectively; if we add a reasonable estimate for backup costs based upon EIA data, the total is about $517 for wind and $625-$764 for solar generation. The EIA estimates for gas- or coal-fired generation are about $80-$110 per megawatt-hour. Accordingly, the projected cost of renewable power in 2016 including the cost of backup capacity is at least five times higher than that for conventional electricity. This does not include the additional costs for transmission imposed by renewable generation.

The five central rationales commonly offered in support of subsidies and mandates for renewables can be summarized as follows.

- The "infant industry" rationale: Renewables cannot compete with conventional electric generation technologies on an equal basis because scale and learning efficiencies can be achieved only with an expanded market share.
- The "level playing field" rationale: Subsidies enjoyed by conventional technologies introduce an artificial competitive disadvantage for renewable technologies.
- A second "level playing field" rationale: The adverse environmental effects (e.g., air pollution)---"externalities"---of conventional electricity generation create an additional artificial cost advantage for those technologies.
- The resource depletion (or "sustainability") rationale: Policy support for renewables is justified as a tool with which to slow the depletion of such conventional resources as natural gas and to hasten the development of technologies providing alternatives for future generations.

- The "green employment" rationale: Policy support for renewables will yield expanded employment (and economic competitiveness).

These rationales are deeply problematic. The infant industry argument is inconsistent with the presence of an international capital market and with the cost evidence for renewables. The subsidies per kilowatt-hour enjoyed by renewables outweigh by far those bestowed upon conventional generation technologies---even if we ignore the issue of whether the latter can be defined properly as "subsidies"---so that the first level playing field argument is unsupported by the evidence. With respect to the adverse environmental effects of conventional generation, the cost of conventional backup capacity made necessary by the unreliability of wind and solar generation is substantially greater than any artificial cost advantage enjoyed by conventional technologies as a result of negative external effects assumed not to have been corrected ("internalized") by current policies. The depletion or sustainability criticism of conventional technologies is incorrect simply as a matter of basic economics, and is inconsistent with the historical evidence in any event. Finally, the premise that expansion of renewable power will yield an increase in "green employment" confuses benefits for a particular group with costs imposed upon the economy as a whole, and fails to distinguish between employment growth in the aggregate and employment shifts among economic sectors. Moreover, the actual employment effect of expanded renewables subsidies is likely to be negative because of the inverse aggregate relationship between electricity costs and employment, because of the adverse employment effects of the taxes needed to finance the subsidies, and because of the adverse employment effects of an economy smaller than otherwise would be the case. In short: The purported economic and social benefits of policy support for renewables are illusory.

The market difficulties faced by renewables are likely to be exacerbated by ongoing supply and price developments in the market for natural gas, which will weaken further the competitive position of renewable power generation. At the same time, subsidies and mandates for renewables impose nontrivial costs upon the taxpayers and upon consumers in electricity markets. The upshot is the imposition of substantial net burdens upon the U.S. economy as a whole even as the policies bestow important benefits upon particular groups and industries, thus yielding enhanced incentives for innumerable interests to seek favors from government. As is the case in most contexts, the resource uses emerging from market competition, even as constrained and distorted by tax and regulatory policies, are the best guides for the achievement of resource allocation that is most productive. As federal policymakers address the ongoing issues and problems afflicting renewable electricity generation, the realities of this recent history provide a useful guide for policy reform. One such reform should be the abandonment of tax subsidies and other policy support for renewable energy.

I. Inherent Limitations of Renewable Electricity

This testimony is based upon my recent book *Renewable Electricity Generation: Economic Analysis and Outlook,* published late last year by the AEI Press. Renewable

electricity---wind and solar power in particular---receives very large subsidies and policy support, both direct and indirect, from the federal and state governments. As discussed in section II, this policy support is far larger per kilowatt-hour, both on average and on the margin, than that enjoyed by such conventional electric generation technologies as coal, natural gas, nuclear fuels, or hydroelectric facilities, putting aside the issue of whether the "subsidies" given conventional fuels properly should be defined as subsidies at all. Moreover, a majority of states has mandated some form of guaranteed market shares for renewable electricity. This political support for renewable power is substantial, broad-based, bipartisan, and longstanding.

Nonetheless: Renewable electricity generally, and wind and solar power in particular, is very costly in terms of real resource consumption and is likely to remain so for the foreseeable future because of three central factors discussed below. As a result, they have achieved only small market shares. Renewable electricity generation from all non-hydroelectric sources was only 3.6 percent of total U.S. generation in 2010. The Energy Information Administration estimated in 2007 that the proportion in 2030 would be that very same 3.6 percent. The EIA more recently has increased that projection to 11 percent.

But it is not clear what changes in important parameters have yielded over the course of only a few years that increase in the projected market share for 2030. No sound rationale, whether economic or technological, can explain this change in the official wisdom. Quite to the contrary: Both economic and technological factors suggest strongly that wind and solar power will remain uncompetitive, heavily dependent upon subsidies both direct and indirect, and small relative to the electricity market as a whole.

The implementation of energy policies in the U.S. for decades has pursued energy sources defined in various ways as alternative, unconventional, independent, renewable, and clean, in an effort to replace such conventional fuels as oil, coal, and natural gas. These longstanding efforts without exception have yielded poor outcomes, in a nutshell because they must swim against the tide of market forces. That is why the only reliable outcome has been one disappointment after another, and there are powerful reasons to predict that the same will continue to prove true with respect to the current enthusiasm for renewable electricity.

Policy preferences for renewable electricity at both the federal and state levels are substantial, in the form of both direct and indirect financial subsidies, and other forms of support as well.[1] The relative magnitudes of the federal subsidies given various forms of electricity, as estimated by the EIA, are instructive.[2] For 2010, nonhydroelectric renewable power generation, again, was 3.6 percent of all generation; but it received 53.5 percent of all federal financial support for the electric power sector. Wind power, providing 2.3 percent of generation, received 42 percent of such support. This

[1] For a detailed list of such policies, see the database at http://www.dsireusa.org/.
[2] U.S. Energy Information Administration, *Direct Federal Financial Interventions and Subsidies In Energy In Fiscal Year 2010*, July 2011, at http://www.eia.gov/analysis/requests/subsidy/pdf/subsidy.pdf, Tables ES4 and ES5.

combination of substantial policy support and meager market competitiveness suggests the presence of important impediments to the growth of renewable power. The technical literature reveals three central problems that have not received widespread attention in the popular discussion; they can be denoted as:

- The unconcentrated energy content of renewable energy sources.
- Location (or siting)---that is, geographic---limitations and resulting transmission costs.
- Relatively low availability ("capacity factors") over time combined with the intermittent nature of wind flows and sunlight.[3]

Unconcentrated Energy Content.[4] The energy content of wind flows and sunlight, which varies depending upon air speed and sunlight intensity, is far less concentrated than that of the energy contained in fossil or nuclear fuels. In order to compensate for this physical characteristic, large capital investments in land and/or materials must be made to make renewable generation even technically practical in terms of generating nontrivial amounts of electricity. A wind farm would require 500 wind turbines of 2 MW each to provide a theoretical generation capacity of 1000 MW. Since the wind turbines must be spaced apart to avoid wake effects (wind interference among the turbines), a 1000 MW wind farm even in principle would require on the order of 48,000-64,000 acres (or 75-100 square miles) of land. With an assumed capacity factor for a typical wind farm of, say, 35 percent[5], reliable wind capacity of 1000 MW would require an amount of land (perhaps at different locations) on the order of two to three times that rough estimate. In contrast, a 1000 MW gas-fired plant requires about 10-15 acres; conventional coal, natural gas, and nuclear plants have capacity factors of 85-90 percent.

The same general problem afflicts solar power. The energy content of sunlight, crudely, is about 150-400 watts per square meter, depending on location, of which about 20-30 percent is convertible to electricity, depending on the particular technology. Accordingly, even in theory a square meter of solar energy receiving capacity is enough to power roughly one 100-watt light bulb, putting aside such issues of sunlight intensity and the like. This problem of land requirements for solar thermal facilities is of sufficient importance that most analyses assume a maximum plant capacity of 50-100 MW, which, conservatively, would require approximately 1250 acres, or 2 square miles.

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[3] The capacity factor for a generation facility (or technology) is its actual production over a given time period divided by its theoretical maximum production over that time period, controlling for planned maintenance and the like.

[4] The energy content of different fuels varies greatly. Per unit of fuel---tons of coal, millions of cubic feet of natural gas, wind speeds in miles per hour, an hour of sunlight---this variation can be thought of usefully as the degree of concentration of the energy content of a particular energy source.

[5] For standard assumptions on capacity factors for the various generation technologies, see Energy Information Administration, "2016 Levelized Cost of New Generation Resources from the *Annual Energy Outlook 2010*", at http://www.eia.doe.gov/oiaf/aeo/pdf/2016levelized_costs_aeo2010.pdf. The assumed capacity factor for onshore wind generation in that analysis is 34.4 percent.

In short: Transformation of the unconcentrated energy content of wind and sunlight into a form useable for modern applications requires massive capital investment in the form of both land and wind turbines and solar receiving equipment. This means that the energy that can be extracted from renewable sources, relative to that from conventional forms, by its very nature is limited and expensive.

Siting Limitations and Transmission Costs. Conventional power generation plants can be sited, in principle, almost anywhere, and such fuels as coal and natural gas can be transported to the generation facilities. This means that investment planning decisions can optimize transmission investment costs along with the other numerous factors that constrain and shape generation investment choices, among them land costs, environmental factors, reliability issues, transmission line losses, and the like. Wind and solar sites, on the other hand, must be placed where the wind blows and the sun shines with sufficient intensity and duration. (Photovoltaic installations, suitable for small applications, face the transmission problem either not at all or to a far smaller degree than solar thermal plants, but still are constrained by the intensity of sunlight.) Because appropriate sites are limited, with the most useful (i.e., lowest cost) ones exploited first, the successive (or marginal) cost of exploiting such sites must rise, so that even if wind and solar technologies exhibit important scale economies in terms of capacity and/or generation costs, scale economies may not characterize a broader cost calculation including the cost of finding and using particular sites.

In other words, scale economies are unlikely to be available at the industry level even if they are present at the project (or the turbine or parabolic dish) level. This reality is consistent with a time series of capacity factors for 1998-2009 published recently by the EIA. The capacity factors for non-hydroelectric renewables declined almost monotonically from 57.0 percent to 33.8 percent over that period, suggesting that as renewables capacity has expanded it has been forced onto increasingly unfavorable sites.

Because conventional generation investments can optimize transmission costs and other reliability factors more easily than is the case for wind and solar capacity, it would be surprising if such costs were not higher for the latter. This general condition is exacerbated by the physical realities that wind conditions are strongest in open plains regions, while solar generation in general requires regions with strong sunlight and, for thermal solar plants, sizeable open areas. For the U.S., the best wind capacity sites are in a region stretching from the northern plains down through Texas, and the best thermal solar sites are in the southwest. The U.S. simply lacks significant east-west high-voltage interconnection transmission capacity to transport such power to the coasts. One national study of this problem notes that "wind development will require substantial additions to the nation's transmission infrastructure... due to the locational dependence of wind resources [and] the relatively low capacity factor of wind plants..."[6]

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[6] Andrew Mills, Ryan Wiser, and Kevin Porter, "The Cost of Transmission for Wind Energy: A Review of Transmission Planning Studies," Lawrence Berkeley National Laboratory, LBNL-1471E, February 2009, p. vii, at http://eetd.lbl.gov/EA/EMP/reports/lbnl-1471e.pdf.

Some analyses of these transmission costs are available. One survey of 40 transmission studies for wind projects conducted during 2001-2008 finds a median transmission cost of $15 per megawatt-hour. The survey was limited to studies of transmission requirements for multiple new wind plants with a combined capacity greater than 300 MW. An analysis by the California Public Utilities Commission concludes that implementation of a 20 percent renewable electricity standard (or requirement) for the state by 2020 would impose a need for four new major transmission lines at a cost of about $4 billion, while a 33 percent standard would require seven new lines at a cost of $12 billion. For that 33 percent requirement, the assumptions in the CPUC study suggest transmission costs of about $6.39 per megawatt-hour, a figure that is implausibly low. A study done for the National Renewable Energy Laboratory examined the transmission requirements and attendant costs for four alternative wind capacity scenarios for the Eastern Interconnection (the continental U.S. east of the Rocky mountains, minus Texas, plus parts of southeastern Canada). This study reports a cost of wind "integration" of about $5 per megawatt-hour; but other data in the study suggest transmission costs of about $17 per megawatt-hour, a figure roughly comparable to the $15 median reported in the survey noted above.

A comprehensive comparison of various cost categories across generation types has been published by the EIA. The data show that conventional generation---coal and natural gas combined cycle---has transmission costs of about $3.60 per megawatt-hour, less than half those of wind generation ($8.40) and about a third those of thermal solar generation ($10.40). These projections for transmission costs are consistent with the hypothesis that wind and solar power are highly constrained in terms of capacity factors and sites, and so impose higher transmission costs than is the case for conventional generation.

Low Availability and Intermittency. Electric energy in large amounts cannot be stored at low cost in batteries due to technological limitations; only indirect storage in the form of water in dams is economic. This reality means that the production and consumption of electricity in a given power network must be balanced constantly in order to prevent blackouts, and more generally to preserve system reliability. Because unexpected surges in demand and/or outages of generating equipment can occur, backup generation capacity must be maintained; such backup capacity is termed the "operating reserve" for the given network. This operating reserve is of two types; the first is the "spinning reserve," that is, generators already connected to the network, the output of which can be increased by raising the torque applied to the generating turbines. The typical system requirement is that spinning reserves be 50 percent or more of total operating reserves. The second component of operating reserves is the supplemental reserve, which comprises generation capacity that can be brought on line within five to ten minutes and/or electric power that can be obtained quickly from other networks or by withholding power being distributed to other networks. Additional reserve capacity often is provided by generators that require up to an hour to come on line; this backup capacity is not included in measures of the operating reserve for a system because of the length of time required for availability.

Electric supply systems respond to growing demands ("load") over the course of a day (or year) by increasing output from the lowest-cost generating units first, and then calling upon successively more-expensive units as electric loads grow toward the daily (or seasonal) peak. Because of the uncertainties caused by the unreliability of wind and sunlight, most electric generation capacity fueled by renewable energy sources cannot be assumed to be available upon demand; that is, system planning and optimization cannot assume that such power will be available when it is expected to be most economic. Accordingly, it cannot be scheduled (or "dispatched"). Instead, it requires backup generation capacity to preserve system reliability.

And so the cost of that needed backup capacity becomes a crucial parameter usually not mentioned in public discussions of wind and solar power. One study, using figures from the California Independent System Operator, projects that an increase in California renewable generation capacity between 2009 and 2020 would be about 17.7 gigawatts (GW) for a 20 percent renewable requirement, and about 22.4 GW for the 33 percent requirement.[7] The projected needs for backup capacity (of varying types) are, respectively, 0.8 GW (or 4.5 percent) and 4.8 GW (or 21 percent).

What would that backup power cost? U.S. wind and solar generation capacity in 2009 was about 34,000 MW. If we assume, conservatively, that this renewable capacity has required investment in backup capacity of about 3 percent (rather than 4.5 percent), that requirement would be about 1000 MW. Cost estimates published by the EIA suggest that this backup capacity has imposed fixed capital and operations and maintenance costs of about $1.7 billion, variable operating costs of approximately $2.00-$4.50 per megawatt-hour, and total costs per megawatt-hour of about $368.[8]

That rough estimate is likely to be biased downward. Because state renewables requirements require system operators to take renewable power when it is available, conventional backup generation must be cycled up and down in coordination with the availability of the renewable generation. In particular for coal-fired generation, but also for gas combined-cycle backup generation, this means that the conventional assets cannot be operated as efficiently as would be the case were they not cycled up and down in response to wind or solar generation conditions. A recent study of the attendant emissions effects for Colorado and Texas found that requirements for the use of wind power impose significant operating and capital costs because of cycling needs for backup generation---particularly coal plants---and actually exacerbate air pollution problems.[9]

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[7] See KEMA, Inc., "Research Evaluation of Wind Generation, Solar Generation, and Storage Impact on the California Grid," June 2010, p. 1, at http://www.ovcr.ucla.edu/uploads/file/CA%20Energy%20Commission_PIER%20Final%20Project%20Report_June%202010.pdf.

[8] EIA, *Electricity Market Module*, release date April 2010, p. 91 (Table 8.2), at http://www.eia.gov/oiaf/aeo/assumption/pdf/electricity.pdf#page=3.

[9] See Bentek Energy, *How Less Became More: Wind, Power and Unintended Consequences In the Colorado Energy Market*, April 16, 2010, pp. 25-33, at http://www.wind-watch.org/documents/wp-content/uploads/BENTEK-How-Less-Became-More.pdf.

The EIA estimates wind (onshore) and solar costs in 2016 at about $149 and $257-396 per megawatt-hour, respectively; if we add a reasonable estimate for backup costs based upon EIA data, the total is about $517 for wind and $625-$764 for solar generation. The EIA estimates for gas- or coal-fired generation are about $80-$110 per megawatt-hour.[10] Accordingly, the projected cost of renewable power in 2016 including the cost of backup capacity is at least five times higher than that for conventional electricity. This does not include the additional costs for transmission imposed by renewable generation.

At the same time, outages of wind capacity due to weak wind conditions are much more likely to be correlated geographically than outages of conventional plants, for the obvious reason that weak winds in part of a given region are likely to be observed in tandem with weak winds in other parts of that region. Because appropriate regions for thermal solar sites and photovoltaic systems are concentrated geographically, the same correlation problem is likely to affect solar electric generation as well.

The higher cost of electricity generated with renewable energy sources is only one side of the competitiveness question; the other is the value of that generation, as not all electricity is created equal. In particular, power produced at periods of peak demand is more valuable than off-peak generation, whether during a given daily cycle or across annual seasons. In this context, wind generation in particular is problematic because in general there is an inverse relationship between the daily hours of peak demand and wind velocities, and between peak summertime demands and peak wintertime wind velocities: Winds tend to blow at night and in the winter.

II. The Central Rationales for Renewables Subsidies: A Critique

The central rationales in support of subsidies and other policy support for renewable power are numerous and varied, but generally fall into the following categories:

- The "infant industry" rationale: Renewables cannot compete with conventional electric generation technologies on an equal basis because scale and learning efficiencies can be achieved only with an expanded market share.
- The "level playing field" rationale: Subsidies enjoyed by conventional technologies introduce an artificial competitive disadvantage for renewable technologies.
- A second "level playing field" rationale: The adverse environmental effects (e.g., air pollution)---"externalities"---of conventional electricity generation create an additional artificial cost advantage for those technologies.
- The resource depletion (or "sustainability") rationale: Policy support for renewables is justified as a tool with which to slow the depletion of such

[10] See EIA, *op. cit.*, fn. 5.

conventional resources as natural gas and to hasten the development of technologies providing alternatives for future generations.

The Infant Industry Rationale. This argument begins with the assumption that new technologies often cannot compete with established ones because the available market at the beginning is too small for important scale economies to be exploited, and because the downward shifts in costs that might result from a learning process cannot be achieved without a substantial expansion in market share. Accordingly, policy support for expansion of the newcomers' share of the market is justified as a tool with which to allow the achievement of both scale and learning efficiencies.

One obvious problem with this rationale is that the market for electric power already has several competing technologies, each of which began with a small market share virtually by definition. More generally, many industries employing competing technologies are characterized by the presence of scale economies and/or learning efficiencies; but market forces operating through domestic and international capital markets provide investment capital in anticipation of future cost savings and higher economic returns. Accordingly, the infant industry argument is a *non sequitur*: The market can foresee the potential for scale and learning efficiencies, and invest accordingly. There is no efficiency rationale for subsidies or other policy support.

In any event, the narrower issue is whether important cost reductions attendant upon learning and/or scale efficiencies remain available to be exploited for wind or solar generation. The pattern of average costs over time, controlling for the size of projects, should yield inferences about the remaining importance of learning efficiencies; if the infant industry argument is correct, we should observe in the data over the last decade or two declining costs for renewable electricity. For wind generation, the Department of Energy reports data on average project cost per MW over time, beginning in the early 1980s.[11]

These data show a rough pattern of declining average costs from the 1980s through about 2001, and then rising average costs through 2009: from about $4800 per MW in 1984 to about $1300 per MW in 2001, and rising to about $2100 in 2009, all in constant year 2009 dollars. Since these data are weighted by capacity, the rising average costs per wind MW after 2000-2001 suggest that further learning efficiencies no longer are available to be exploited, unless, perhaps, future technological advances are made.[12]

Other DoE data are available on average costs by project size for wind projects installed in the 2007-2009 period.[13] The short time period reduces the likely impact of learning efficiencies, yielding important information about the availability of scale

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[11] See Department of Energy, "2009 Wind Technologies Market Report," August 2010, at Figure 27, at http://www1.eere.energy.gov/windandhydro/pdfs/2009_wind_technologies_market_report.pdf.

[12] Note that an assumption of future technological advances does not imply enhanced future competitiveness, in that technological advances are likely affect conventional and renewable technologies alike.

[13] *Ibid.*

economies. The data show that scale economies are important only for small wind projects (about $2700 per MW for projects smaller than 5 MW), and that average costs either constant or slightly increasing (about $1800-$2000 per MW) characterize projects larger than about 20 MW or thereabouts.

Reliable time-series data on costs for photovoltaic and thermal solar systems are more difficult to find in the literature; perhaps the only consistent series is provided by the EIA for 2000-2009.[14] These data show a decline in costs per MW for both photovoltaic and thermal systems early in the decade, suggesting the exploitation of learning efficiencies, and, perhaps, the use of more suitable sites. The data show also an increase in costs per MW after 2002; this suggests that no further learning efficiencies are available to be exploited and/or that the problem of rising site costs is significant.[15] On the other hand, a different data analysis for photovoltaics only, published by the DoE, shows a decline in the capacity-weighted average installed cost between 1998 and 2008, from $10.80 per watt (2008 dollars) to $7.50 per watt.[16] In short: The data are mixed in the case of solar generation systems. The "infant industry" assumption of significant learning and/or scale economies as a barrier to adoption of renewable technologies at best is far from obviously correct; the bulk of the available data suggest that it is incorrect.

Leveling the Playing Field. The second central rationale offered in favor of policy support for renewables is essentially a level-playing-field premise: Because conventional generation benefits from important tax preferences and other policy support, renewables cannot compete without similar treatment. A recent EIA analysis presents data from which federal subsidies and support per kilowatt-hour produced by different technologies can be compared.[17] These data are presented in Table 1.[18]

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[14] Energy Information Administration, *Electricity Market Module* discussions within the "Assumptions" chapters, various years, at http://www.eia.gov/oiaf/archive.html.

[15] For photovoltaic systems, capacity costs fell from $5386 per MW in 2000 to $4744 in 2002, and then increased steadily to $6239 in 2009. For thermal systems the figures were $3679 in 2000, $3194 in 2002, and $5237 in 2009.

[16] Department of Energy, "Solar Technologies Market Report," January 2010, at Figure 3.9, at http://www1.eere.energy.gov/solar/pdfs/46025.pdf.

[17] See the EIA data at http://docs.wind-watch.org/US-subsidy-2010.pdf.

[18] Other things held constant, subsidies that affect the marginal (or incremental) cost of generation or the per-unit prices received by particular technologies are likely to affect market prices, even under standard rate-of-return regulation, and so might create a competitive disadvantage for other technologies not receiving equivalent treatment. An example is the per-unit production tax credit for renewable power. Other credits might improve profitability without affecting marginal costs or prices directly; investment tax credits for renewables are a good example. The latter would attract additional investment into the industry over time, thus perhaps affecting market prices, but that price effect would be felt by all producers regardless of which actually received the subsidy. At the same time, even such subsidies as the latter would serve to reduce or eliminate whatever competitive disadvantages confront renewables as a result of policies in support of conventional generation.

Table 1
FY2010 Electricity Production Subsidies and Support per Megawatt-Hour
(year 2010 dollars)

Fuel/Technology	Dollars per megawatt-hour
Natural Gas, Petroleum Liquids	0.63
Coal (pulverized)	0.64
Hydroelectric	0.84
Biomass	2.00
Nuclear	3.10
Geothermal	12.50
Wind	52.48
Solar	968.00

Source: EIA, *op. cit.*, fn. 17.

These data show that federal solar and wind subsidies in fiscal year 2010 were far higher---by two or three orders of magnitude---than those enjoyed by fossil fuels, nuclear, or hydroelectric generation. Accordingly, it is clear that solar and wind technologies are not at a competitive disadvantage because of average subsidies enjoyed by conventional generation; quite the reverse is true.

A more direct calculation of marginal subsidies and support has been reported by Metcalf, yielding estimates of effective marginal tax rates on investments in alternative electric generation technologies.[19] Computation of such effective marginal tax rates incorporates the many subsidies and preferences that affect choices among those alternatives, and so offers a direct test of the degree to which federal policies favor given technologies over others. Table 2 summarizes his findings, which are for 2007.

Table 2
Metcalf Findings on Effective Marginal Tax Rates for Electric Generation Investment
(percent)

Technology	Current Law	No Tax Credits	Economic Depreciation
Coal (pulverized)	38.9	38.9	39.3
Gas	34.4	34.4	39.3
Nuclear	-99.5	32.4	-49.4
Solar Thermal	-244.7	12.8	-26.5
Wind	-163.8	12.8	-13.7

[19] See Gilbert E. Metcalf, "Investment in Energy Infrastructure and the Tax Code," in Jeffrey R. Brown, ed., *Tax Policy and the Economy, Volume 24*, Chicago: University of Chicago Press Journals, 2010, pp. 1-33. See also Gilbert E. Metcalf, "Federal Tax Policy Towards Energy," NBER Working Paper No. 12568, October 2006, at http://www.nber.org/papers/w12568.pdf; and Gilbert E. Metcalf, "Taxing Energy In the United States: Which Fuels Does the Tax Code Favor?", Manhattan Institute Center for Energy Policy and the Environment, Report No. 4, January 2009, at http://www.manhattan-institute.org/html/eper_04.htm.

Source: Metcalf (2010), *op. cit.*, fn. 19.
Note: Current law is as of 2007.

The three columns present the Metcalf calculations of effective marginal tax rates under current law (as of 2007), under a regime without production and investment tax credits, and with economic depreciation assumed in place of accelerated depreciation, respectively.[20] Under current law, solar thermal and wind generation investments receive large net percentage marginal subsidies (negative effective marginal tax rates) far larger than those enjoyed by nuclear investments; and coal and gas investments face effective tax rates greater than zero. If the tax credits are assumed away, solar thermal and wind investments face effective tax rates roughly one-third those of the other technologies. If economic depreciation replaces accelerated depreciation, nuclear investment enjoys a negative effective marginal tax rate (tax subsidy) larger (in absolute value) than those for solar and wind investments; but coal and gas investments face effective marginal tax rates of over 39 percent.

The Metcalf calculations of effective marginal tax rates under current law suggest strongly that the "offsetting subsidy" rationale for public support for solar and wind investments is weak: Coal and gas investments face positive effective marginal tax rates, and new nuclear investment no longer is a serious competitive threat.[21] Moreover, the effective subsidies enjoyed by solar and wind generation are far greater than those needed to level the playing field with respect to nuclear generation.[22]

Adverse External Effects of Conventional Generation. A negative "externality" is an adverse effect of economic activity the full costs of which are not borne by the parties engaging directly in the activity yielding the adverse effect. A simple example is the

[20] Metcalf uses an exponential depreciation rate rather than straight-line depreciation as an approximation of economic depreciation over the lives of given investments.

[21] The last nuclear generation reactor to begin operation is the Watts Bar-1 plant in Tennessee, which began commercial operation on May 27, 1996. See EIA at http://www.eia.gov/cneaf/nuclear/page/operation/statoperation.html. However, the Tennessee Valley Authority has announced plans to complete Watts Bar-2.

[22] The playing field is biased in favor of renewables for two additional reasons, the first of which is the implicit subsidy for backup generation capacity and transmission costs: Such costs are a direct effect of investment in renewable capacity, but are spread across electricity consumption from all sources. The Federal Energy Regulatory Commission, in a recent case involving the Midwest Independent Transmission Operator, ruled that the transmission costs attributable to wind generation may be allocated to consumers regardless of the amount of wind power actually consumed by any given ratepayer. This ruling essentially spreads such costs across the entire grid; accordingly, the transmission costs associated with wind generation are not reduced but instead are hidden somewhat from calculations of the marginal cost of wind power. See the FERC Conditional Order, Docket No. ER10-1791-000, December 16, 2010, at http://www.ferc.gov/whats-new/comm-meet/2010/121610/E-1.pdf. Second, public subsidies for renewable power, whether in the form of direct outlays or indirect tax preferences, impose costs upon the private sector larger than the subsidies themselves, because of the excess burden (or "deadweight losses") imposed by the tax system. Essentially, the private sector becomes smaller by more than a dollar when it is forced to send a dollar to the federal government. For a nontechnical discussion, see Martin A. Feldstein, "The Effect of Taxes on Efficiency and Growth," *Tax Notes*, May 8, 2006, pp. 679-684.

emission of effluents into the air as a byproduct of such industrial processes as power generation. There is no dispute that power generation with fossil fuels imposes adverse environmental effects in the form of sulfur dioxide, nitrogen oxides, mercury, particulates, and other effluents. Accordingly, the EPA and the states have established detailed programs for defining emission standards and for implementing attendant investment and enforcement programs.

If the negative externalities yielded by conventional generation are not internalized fully by current environmental policies---that is, if buyers and producers are not confronted with the full costs of the environmental effects that they impose on others---then the costs of conventional generation as perceived by the market would be (artificially) lower than the true social costs. At the same time, the unreliable nature of wind and solar generation imposes a requirement for costly backup capacity, as discussed above.[23] And so the question to be addressed is as follows: Given the magnitude of those externalities as estimated in the technical literature, are the additional (or marginal) costs of backup capacity imposed by renewable generation sufficient to offset any artificial cost advantage enjoyed by conventional generation?

A number of analyses of the externality costs of U.S. electricity generation were conducted during the 1980s and 1990s. These studies differ somewhat in terms of methodology and focus, but offer a range of estimates useful in terms of the question addressed here. In summary: The estimated externality costs for coal range from 0.1 cents per kilowatt-hour to 26.5 cents per kilowatt-hour. For gas generation, the range is 0.1-10.2 cents per kilowatt-hour. For oil, nuclear, and hydro generation, the respective ranges are 0.4-16.5 cents per kilowatt-hour, 0-4.9 cents per kilowatt-hour, and 0-2.1 cents per kilowatt-hour.

The highest estimated figure is for coal generation, at 26.5 cents per kilowatt-hour, or $265 per megawatt-hour. From the discussion above, a conservative estimate of the cost of backup capacity for existing wind and solar generation is about $368 per megawatt-hour, or roughly 37 cents per kilowatt-hour. Accordingly, if all conventional generation were coal-fired, existing wind and solar capacity imposes a backup cost "externality" about 39 percent higher than the environmental externality costs of conventional generation under the implausible assumption that none of the conventional externalities have been internalized under current environmental policy. In addition, these figures do not include the higher transmission costs imposed upon the system by renewable power.

But in fact coal generation is a bit less than 45 percent of total U.S. generation; gas generation is about 23 percent, nuclear generation is about 20 percent, hydroelectric generation is about 7 percent, and renewables and other miscellaneous technologies make up the rest. If we use those figures and the highest estimates by fuel type noted above to compute a weighted-average externality cost for nonrenewable generation, the externality cost per conventional kilowatt-hour is about 15.5 cents, or $155 per megawatt-hour. If we use instead the midpoints of the externality ranges listed above, the weighted average

[23] See the discussion *supra.*, pp. 8-10.

externality cost is 7.8 cents per kilowatt-hour, or $78 per megawatt-hour. Relative to the backup cost "externality" ($368 per megawatt-hour) imposed by wind and solar investments alone, those figures are sufficiently low to cast substantial doubt upon the externality argument for renewables subsidies: Current environmental regulation must internalize some substantial part of conventional externalities, and federal and state subsidies, both explicit and implicit, and requirements for minimum market shares for renewables also have the effect of offsetting any artificial cost advantage enjoyed by conventional generation as a result of uninternalized externalities.

Note that in terms of economic efficiency, subsidies for renewables intended to offset the (assumed) uninternalized external costs of conventional generation are a "second-best" policy at best. Such subsidies would reduce the (inefficient) competitive advantage of conventional generation yielded by the presence of some social costs unreflected in prices; but they would not improve the efficiency of costs or prices for conventional generation. And by biasing the perceived costs and prices of renewable generation downward, the subsidies would result in a total electricity market that would be too large. Moreover, renewable power generation imposes its own set of adverse environmental effects, among them flicker problems, noise, wildlife destruction, toxic minerals pollution, unsightly land use, and others; this is a topic outside the scope of this testimony. In short: The externality argument in favor of policy support for renewable electricity generation is exceedingly weak, far more so than commonly assumed.

The Resource Depletion or "Sustainability" Rationale. "Renewable" energy has no uniform definition; but the (assumed) finite physical quantity of conventional energy sources is the essential characteristic differentiating the two in most discussions. In a word, conventional energy sources are depletable. In contrast, sunlight and wind flows replenish themselves, a central component of "sustainability," perhaps a broader concept, which has been defined by the Environmental Protection Agency as "the satisfaction of basic economic, social, and security needs now and in the future without undermining the natural resource base and environmental quality on which life depends."[24]

As an aside, the energy content of sunlight and wind is finite, regardless of self replenishment. They contain only so much convertible energy, and they are not always available. Moreover, the same is true for the other resources---materials, land, etc.---upon which the conversion of such renewable energy into electricity depends. Accordingly, the depletable nature of conventional energy resources is far less relevant analytically than commonly assumed; in economic terms, all energy resources are "scarce." In any event, the basic "sustainability" concept seems to be that without policy intervention, the operation of market forces will result in the depletion (or exhaustion) of a finite resource. Accordingly, subsidies and other support for renewable power generation are justified as tools with which to slow such depletion and to hasten the development of technologies that would provide alternatives for future generations.

That argument is deeply problematic. Putting aside the issue of whether government as an institution has incentives to adopt a time horizon longer than that

[24] See the EPA discussion (February 2011) at http://epa.gov/sustainability/basicinfo.htm.

relevant for the private sector, the profit motive provides incentives for the market to consider the long-run effects of current decisions. The market rate of interest is a price that links the interests of generations present and future. If a resource is being depleted, then its expected future price will rise, other things held constant. If that rate of price increase is greater than the market interest rate, then owners of the resource have incentives to reduce production today---by doing so they can sell the resource in the future and in effect earn a rate of return higher than the market rate of interest---thus raising prices today and reducing expected future prices. In equilibrium---again, other factors held constant---expected prices should rise at the market rate of interest.[25] Under market institutions, it is the market rate of interest that ties the interests of the current and future generations, by making it profitable currently to conserve some substantial volume of depletable resources for future consumption.[26] Because of the market rate of interest, market forces will never allow the depletion of a given resource.

Accordingly, the market has powerful incentives to conserve, that is, to shift the consumption of some considerable volume of resources into future periods. That is why, for example, not all crude oil was used up decades ago even though the market price of crude oil always was greater than zero, which is to say that using it would have yielded value. In short, the "sustainability" argument for policy support for renewable electricity depends crucially upon an assumption that the market conserves too little and that government has incentives to improve the allocation of exhaustible resources over time. That is a dual premise for which the underlying rationale is weak and with respect to which little persuasive evidence has been presented.

"Green Jobs": Renewable Power As A Source of Expanded Employment. A common rationale offered in support of expanded renewable power posits that policies in support of that goal will yield important benefits in the form of complementary employment growth in renewables sectors, and stronger demand in the labor market in the aggregate. Both of those premises are almost certainly incorrect.

The employment in renewables sectors created by renewables policies actually would be an economic cost rather than a benefit for the economy as a whole. Suppose that policy support for renewables (or for any other sector) had the effect of increasing the demand for high-quality steel. That clearly would be a benefit for steel producers, or more broadly, for owners of inputs in steel production, including steel workers. But for the economy as a whole, the need for additional high-quality steel in an expanding renewable power sector would be an economic cost, as that steel (or the resources used to produce it) would not be available for use in other sectors. Similarly, the creation of "green jobs" as a side effect of renewables policies is a benefit for the workers hired (or for those whose wages rise with increased market competition for their services). But for

[25] In reality the long run prices of most exhaustible natural resources have declined (after adjusting for inflation), in large part because of technological advances in discovery, production, and use.

[26] Strictly, speaking, it is not the price of the resource that should rise at the market rate of interest; instead the total economic return to holding the resource for future use should equal the market rate of interest. That economic return includes expected price changes and capital gains, expected cost savings, and the like.

the economy as whole, that use of scarce labor is a cost because those workers no longer would be available for productive activity elsewhere.[27]

There is the further matter that an expansion of the renewable electricity sector must mean a decline in some other sector(s), with an attendant reduction in resource use there; after all resources in the aggregate are finite. If there exists substantial unemployment, and if labor demand in renewables is not highly specialized, a short-run increase in total employment might result, abstracting from the effects of the fiscal or monetary tools with which government finances such efforts. But in the long run---not necessarily a long period of time---such industrial policies cannot "create" employment; they can only shift it among economic sectors. In short, an expanding renewables sector must be accompanied by a decline in other sectors, whether relative or absolute, and creation of "green jobs" must be accompanied by a destruction of jobs elsewhere. Even if an expanding renewables sector is more labor-intensive (per unit of output) than the sectors that would decline as a result, it remains the case that the employment expansion would be a cost for the economy as a whole, and the aggregate result would be an economy smaller than otherwise would be the case.[28] There is no particular reason to believe that the employment gained as a result of the (hypothetically) greater labor intensiveness of renewables systematically would be greater than the employment lost because of the decline of other sectors combined with the adverse employment effect of the smaller economy in the aggregate and the adverse employment effect of increases in electricity costs. There is in addition the adverse employment effect of the explicit or implicit taxes that must be imposed to finance the expansion of renewable power.

Because renewable electricity generation is more costly than conventional generation, policies driving a shift toward heavier reliance upon the former would increase aggregate electricity costs, and thus reduce electricity use below levels that would prevail otherwise. The 2007 EIA projection of total U.S. electricity consumption in 2030 was about 5.17 million gWh.[29] The latest EIA projection for 2030 is about 4.31 million gWh, a decline of about 16.6 percent.[30] The change presumably reflects some combination of assumptions about structural economic shifts, increased conservation, substitution of renewables for some conventional generation, and a price increase from about 8.8 cents per kilowatt-hour to 9.0 cents (in 2009 dollars).

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[27] Considerable employment would be created if policies encouraged ditch-digging with shovels (or, in Milton Friedman's famous example, spoons) rather than heavy equipment. Such employment obviously would be laughable, that is, an obvious economic burden. There is no analytic difference between this example and the "green jobs" rationale for renewables subsidies.

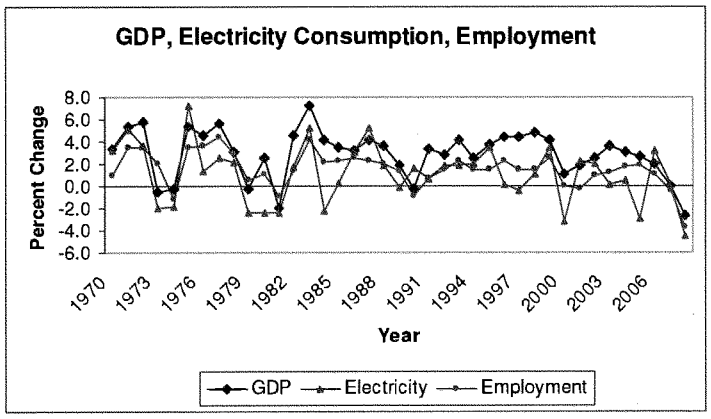
[28] Many advocates of renewables subsidies assert that solar and wind power is more labor intensive than conventional generation. The assumption of greater labor intensity for renewable power production is dubious: The operation of solar or wind facilities does not employ large amounts of labor, and it is far from clear that construction of solar or wind facilities is more labor intensive than construction of conventional generation facilities.

[29] See EIA at http://www.eia.doe.gov/oiaf/archive/aeo07/aeoref_tab.html, at Table 2.

[30] See EIA at http://www.eia.gov/forecasts/aeo/tables_ref.cfm, at Table 8.

It would be surprising if that reduction in total U.S. electricity consumption failed to have some employment effect. Figure 1 displays data on percent changes in real GDP, electricity consumption, and employment for the period 1970 through 2009.[31]

Figure 1



It is obvious from the aggregate trends that electricity use and labor employment are complements rather than substitutes; the simple correlation between the percent changes for the two is 0.61, meaning, crudely, that a percent change in one tends to be observed with a 0.61 percent change in the other, in the same direction. The simple GDP/electricity and GDP/employment correlations are 0.67 and 0.85, respectively.

The correlations by themselves are not evidence of causation, the determination (or refutation) of which requires application (and statistical testing) of a conceptual model. But the data displayed in Figure 1 make it reasonable to hypothesize that the higher costs and reduced electricity consumption attendant upon expansion of renewable generation would reduce employment in the aggregate; and they certainly provide grounds to question the common assertion that policies in support of expanded renewable electricity generation would yield increases in aggregate employment as a side effect, putting aside whether such increases would be a net economic benefit for the economy as a whole.

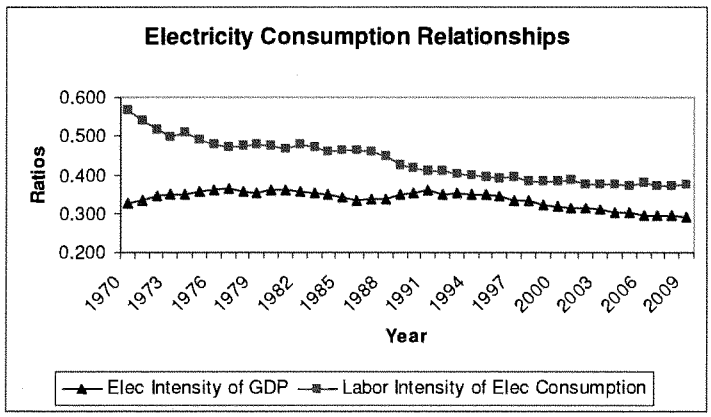
It certainly is possible that the historical relationship between employment and electricity consumption will change. Technological advances are certain to occur; but the

[31] Sources: For real GDP, see Bureau of Economic Analysis at http://www.bea.gov/national/nipaweb/SelectTable.asp?Popular=Y, and author computations; for civilian employment, see Bureau of Labor Statistics at http://www.bls.gov/cps/cpsaat1.pdf; and for electricity consumption, see EIA at http://www.eia.doe.gov/emeu/aer/pdf/pages/sec8_5.pdf.

prospective nature and effects of those shifts are difficult to predict.[32] The U.S. economy may evolve over time in ways yielding important changes in the relative sizes of industries and sectors; but, again, the direction of the attendant shifts in employment and electricity use is ambiguous.

But there exists no evidence with which to predict that a reduction in electricity consumption would yield an increase in employment. Like all geographic entities, the U.S. has certain long-term characteristics---climate, available resources, geographic location, trading partners, *ad infinitum*---that determine in substantial part the long-run comparative advantages of the economy in terms of economic activities and specialization. Figure 2 presents the historical paths of the electricity intensity of U.S. GDP (kilowatt-hour per dollar of output) and of the labor intensity of U.S. electricity consumption (employment per kilowatt-hour).[33]

Figure 2



During 1970-2009, the electricity intensity of GDP has increased and declined over various years, but for the whole period has declined slightly at a compound annual rate of about 0.3 percent. The labor intensity of U.S. electricity consumption---in a sense, the employment "supported" by each increment of electricity consumption---has declined more-or-less monotonically over the entire period, at an annual compound rate of about

[32] Note that greater energy "efficiency" in any given activity can yield an increase in actual energy consumption, if the elasticity of energy demand with respect to the marginal cost of energy use is greater than one. If, for example, air conditioning were to become sufficiently "efficient" in terms of energy consumption per degree of cooling, it is possible that air conditioners would be run so much that total energy consumption in space cooling would increase. A tax, on the other hand, whether explicit or implicit, increases the price of energy use, and so unambiguously reduces energy consumption.

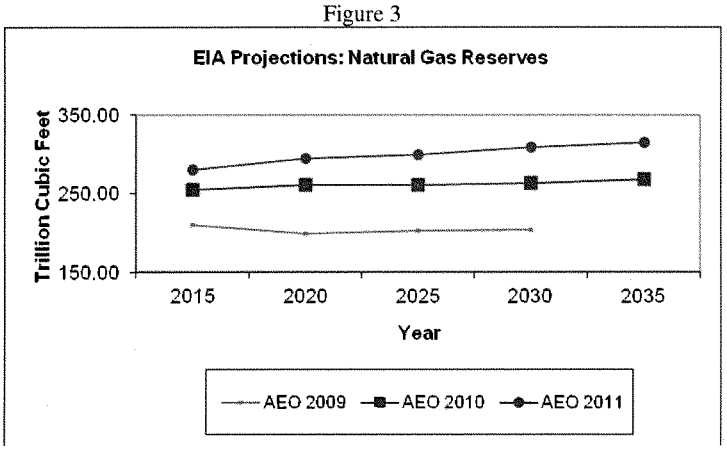
[33] Sources: See fn. 31.

1.05 percent.[34] This may be the result largely of changes in the composition of GDP (toward services), and perhaps the substantial increase in U.S. labor productivity in manufacturing. But these data do not suggest that a reduction in electricity consumption would yield an increase in aggregate employment; instead, they suggest the reverse. In short, while the employment/electricity relationship may have declined over time, there is no evidence that it is unimportant in an absolute sense, and it is far from inverse.

III. Implications of Recent Developments in the Market for Natural Gas

Recent technological advances in the production of natural gas from shale formations and from coal beds have increased estimated natural gas reserves sharply.[35] Figure 3 illustrates the resulting sharp increase over the last two years in projected gas reserves. Between the 2010 and 2011 EIA estimates, projected natural gas reserves through 2025 have increased about 15 percent. The 2011 projection is about 17 percent higher for 2030 and for 2035.[36]

Figure 3



As a result, the EIA has reduced its projections of future prices for natural gas delivered for electric generation. Between the two sets of projections (2010 and 2011), prices fall by about 15-23 percent over the period 2015-2035.[37]

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[34] These data in Figure 2 were scaled upward by a factor of 10 for ease in presentation.
[35] For a brief discussion, see EIA, "What Is Shale Gas and Why Is It Important?," at http://www.eia.gov/energy_in_brief/about_shale_gas.cfm.
[36] See EIA at http://www.eia.gov/oiaf/archive/aeo/aeoref_tab.html, at Tables 13 and 14; and EIA at http://www/eia.gov/forecasts/aeo/tables_ref.cfm, at Tables 13 and 14.
[37] *Ibid.*

Drawing the obvious conclusion, the 2011 EIA projection of combined cycle gas capacity for 2035 is about 6 percent higher than that made a year earlier. *But the projections of non-hydroelectric renewable capacity in 2030-2035 fall by about 16-21 percent over the course of only one year.*[38] These EIA projections of capacity investment in substantial part reflect the fact that gas and renewable generation technologies are substitutes, and the projected decline in delivered gas prices exacerbates the inherent competitive disadvantages borne by renewable technologies.

IV. Concluding Observations

As a crude generalization, the experience in Europe in the context of renewable electricity can be summarized as high costs combined with low reliability.[39] That is the U.S. experience as well, an outcome unavoidable given the basic economic realities afflicting wind and solar power electric generating technologies. Accordingly, renewable power generation has achieved only a small market share in the U.S., and official projections are for slow growth at best, notwithstanding large subsidies and other policy support.

This market resistance to investment in renewable generation capacity can be explained by the problems intrinsic to renewable power---that is, the inherent limitations on its competitiveness---that public policies can circumvent or neutralize only at very substantial cost. Those problems can be summarized as:

- unconcentrated energy content;
- siting constraints and resulting high costs for transmission; and
- the costs created by low capacity factors, the intermittent nature of wind flows and sunlight, and the resulting need for backup capacity.

Moreover, the five central analytic rationales that dominate the political/policy support for renewables are highly problematic: The "infant industry argument is a *non sequitur* and is inconsistent with the cost evidence on renewables. The subsidies enjoyed by renewables outweigh by far those bestowed upon conventional generation technologies. The costs of backup capacity made necessary by renewable power---an "externality" that renewable power imposes upon the electric system writ large---are greater than any negative externalities created by conventional generation and assumed

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[38] For the capacity projections in the 2010 *Annual Energy Outlook*, see http://www.eia.gov/oiaf/archive/aeo10/aeoref_tab.html, at Table 9. For the capacity projections in the 2011 *Annual Energy Outlook* (early edition), see http://www.eia.gov/forecasts/aeo/tables_ref.cfm, at Table 9.

[39] See Kenneth P. Green, "The Myth of Green Energy Jobs: The European Experience," American Enterprise Institute, Energy and Environment Outlook No. 1, February 2011, at http://www.aei.org/docLib/EEO-2011-02-No-2-g.pdf. See also Kenneth P. Green, "On Green Energy: A Dutch (Re)Treat," *The American*, April 10, 2011, at http://www.american.com/archive/2011/april/on-green-energy-a-dutch-re-treat. For an analysis of capacity factors for UK wind generation even lower than expected, see *Analysis of UK Wind Power Generation: November 2008 to December 2010*, John Muir Trust, March 2011, at http://www.jmt.org/assets/pdf/wind-report.pdf.

not to have been corrected by current policies. And the "sustainability" and "green employment" rationales are exceedingly weak.

These realities suggest that the purported social benefits of policy support for renewables are illusory. Moreover, ongoing supply and price developments in the market for natural gas are likely to weaken further the competitive position of renewable power generation. At the same time, the subsidies and mandates that have been implemented in support of renewable electricity impose nontrivial costs upon the taxpayers and upon consumers in electricity markets. The upshot is the imposition of substantial net costs upon the U.S. economy as a whole even as the policies bestow important benefits upon particular groups and industries, thus yielding enhanced incentives for innumerable interests to seek favors from government. As has proven to be the case in most contexts, the outcomes of market competition, even as constrained and distorted by tax and regulatory policies, are the best guides for the achievement of resource allocation that is most productive. As federal policymakers address the ongoing issues and problems afflicting renewable electricity generation, the realities of this recent history provide a useful guide for policy reform.

Chairman BROUN. Thanks, Doctor. Thank you.

Dr. Thorning, you are recognized for five minutes.

STATEMENT OF DR. MARGO THORNING, SENIOR VICE PRESIDENT AND CHIEF ECONOMIST, AMERICAN COUNCIL FOR CAPITAL FORMATION

Dr. THORNING. Thank you, Chairman Broun, Chairman Harris, Ranking Member Tonko. I appreciate the chance to appear before you. The American Council for Capital Formation represents a cross-section of U.S. industry, and we are happy to say that our Board of Advisors contains prior Democrat and Republican administration officials. I would like to just make a few points to summarize my testimony.

First, renewable energy industry simply don't meet the test for subsidy, as Dr. Zycher mentioned. Just to add a little flavor to that, we have had windmills for—since about 7 A.D. The Persians used them to grind grain. We have had solar power since the Romans used it 2,000 years ago to heat rooms. So the renewable sector just doesn't meet the criteria of an infant industry. And there is—according to the Commerce Department, it is not expected to be a major factor in job creation in the future and there is virtually no impact on the growth of global greenhouse gas emissions from a slight increase in the use of renewable energy or even a large increase in renewable energy here in the United States.

Second, renewable energy costs are quite high. Each one percent of GDP in the United States is accompanied by a .2 percent increase in energy use. So to the extent we substitute more expensive renewable energy for a less expensive conventional energy, we will retard economic growth.

Second, data from EIA show that the cost of renewable energy generation equipment is substantially more expensive than that of conventional energy and the Treasury Department data on the American Recovery and Reinvestment Act show that the cost of new generation created by the 1603 Program is 14 times higher than an advanced natural gas generation per megawatt hour.

Additionally, if you look at States that have renewable portfolio standards, the average—on average, households by 28 percent—excuse me, allergy—on average, households pay 28 percent more for electricity and industry pays 23 percent more than States that don't have RPS.

Third, green jobs are few and costly, as has been discussed already. Anecdotal estimates suggest that the creation of—the government's projections are likely to be significantly overstated, and furthermore, the cost per job is quite high. The NERL report shows that the jobs—the temporary jobs cost between 63,000 to 91,000 and the 5,000 permanent jobs expected to be created cost $81,000 to $88,000 as opposed to the average wage in the United States, which last year was $43,000.

Another point is that the federal tax code should be neutral. Accelerated depreciation, Section 199, Farm Tax Credit, and LIFO are provisions in the code available to every industry. Taking a look at the incentives, loans and tax credits available to the renewable sector, CRS reports shows—sorry, Metcalf report shows that

the tax rate is a negative 244 percent for solar thermal, for example.

Fifth, fossil fuel expansion is likely to be a much greater source of job growth and economic and energy security according to a host of recent reports. Furthermore, they don't have to be provided—they don't have to be generated with taxpayer dollars.

Finally, just to quickly—to wrap it up, yesterday, the Ford Chief Executive noted that the cost of each battery for the Ford Focus is $12,000 to $15,000. Now, of course, the cars sell for $35,000 to $40,000, so the fact that we have had years and years of work and a lot of government money going into increase the likelihood that electric vehicles would be commercially viable, you know, we have had plug-in electric vehicles since 1832. That is 180 years. How much longer is it going to take before batteries have the range and the quick-charging facilities to make them commercially viable? So that is just an example of where government has tried, through the *American Recovery and Reinvestment Act*, to deploy new technologies which simply are not ready for primetime.

So, in conclusion, high levels of support for renewable energy are probably not a good use of taxpayer dollars. Instead, those taxpayer dollars might be directed toward R&D for new technologies and for energy efficiency. Thank you.

[The prepared statement of Dr. Thorning follows:]

Impact of Tax Policies on the Commercial Application of Renewable Energy Technology and on U.S. Economic Recovery

Margo Thorning, Ph.D.
Senior Vice President and Chief Economist
American Council for Capital Formation
Before the
Subcommittees on Energy and Environment and Investigations and Oversight,
Committee on Science, Space and Technology
U.S. House of Representatives
April 19, 2012

Executive Summary

Government Subsidies and Tax Incentives for Clean Energy: The wind, solar power, biofuel and ethanol industries do not meet the standard criteria used to justify taxpayer-funded subsidies for their deployment across the U.S. economy. They are not "infant industries," are not essential for U.S. economic and job growth and they are unlikely to provide benefits commensurate with their costs. All taxpayer funded programs have opportunity costs since their existence means less money is available for other programs or for the taxpayers themselves to spend. Addressing the huge U.S. federal budget deficit requires cutbacks in programs whose costs exceed their benefits.

Renewable Energy Costs are High: Energy use is a key component in U.S. economic recovery, in recent years each 1% increase in GDP in the U.S. has been accompanied by a 0.2% increase in energy use. Data from DOE's EIA show that new electric generating capacity using wind and solar power tends to be considerably more expensive than conventional, available and secure natural gas and coal resources. Data on the American Recovery and Reinvestment Act of 2009's 1603 grant program shows that the programs' cost electric generation cost per mega watt hour is almost three times more expensive than is solar thermal (the most costly source of electric generations shown in EIA's tabulation).

Green Jobs are Few and Costly: Anecdotal estimates of job creation in renewable energy suggest that the government's projections of expected new jobs may be significantly overstated and that the cost of each green job is high. The cost to taxpayers to create each short term job under the Recovery Act's 1603 program ranges from about $63,000 to over $91,000. The cost of permanent renewable energy jobs (a total of about 5,000 per year for the next 20 or so years) ranges from over $81,000 to over $88,000. In contrast to the cost of creating jobs under the 1603 program, the average U.S. median wage of all occupations was $45,230 in 2011.

Renewable Energy Receives Largest Share of Tax Code Subsidies: In 2010, an estimated 76% of the $19.1 billion in federal tax incentives went to renewables, for energy efficiency, conservation and for alternative technology vehicles while only 13% went to fossil fuels according to the Congressional Research Service (CRS). Some renewable electricity enjoys negative tax rates: solar thermal's effective tax rate is -245 % and wind power's is -164%. Countries like Germany, the UK, Spain, Italy and Australia are cutting subsidies for renewable energy.

Tax Code Should be Neutral: Accelerated depreciation, Section 199, the foreign tax credit deduction and LIFO are examples of tax code provisions that are available to any industry and are not considered "subsidies."

Fossil Fuels Expansion: Several recent economic analyses suggest that increased access to domestic onshore and offshore oil and gas reserves, including shale gas, could strongly boost U.S. economic recovery, manufacturing and job growth as well as increasing energy security.

Conclusions: Continued high levels of federal support for the deployment of clean energy and alternative fuel vehicles in the U.S. is unlikely to have a significant impact on reducing GHG concentrations in the atmosphere since the real growth in emissions is coming from developing countries. Instead, government funded basic R&D for renewables and conservation may be a better use of taxpayer dollars than the current suite of tax incentives and direct spending programs whose renewal by policymakers is highly uncertain, especially given the critical situation of the U.S. federal budget.

Impact of Tax Policies on the Commercial Application of Renewable Energy Technology and on U.S. Economic Recovery

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Introduction

Chairman Harris, Chairman Broun, Ranking Members Miller and Tonko, and members of the Subcommittees, my name is Margo Thorning, senior vice president and chief economist, American Council for Capital Formation (ACCF),* Washington, D.C. I am pleased to present this testimony on the impact of incentives for renewable energy on U.S. economic and job growth and on the federal budget.

The American Council for Capital Formation represents a broad cross-section of the American business community, including the manufacturing and financial sectors, Fortune 500 companies and smaller firms, investors, and associations from all sectors of the economy. Our distinguished board of directors includes cabinet members of prior Democratic and Republican administrations, former members of Congress, prominent business leaders, and public finance and environmental policy experts. The ACCF is celebrating over 30 years of leadership in advocating tax, regulatory, energy, environmental, and trade policies to increase U.S. economic growth and environmental quality.

The Subcommittee Chairmen and Committee members are to be commended for their focus on how the tax incentives, grants and subsidies provided to clean, renewable energy technologies have impacted their deployment as well as the U.S. economic and job growth.

Background

The U.S. federal government has provided funding, tax incentives and subsidies for the development and commercialization of renewable energy for many decades. In 2009, as White House Advisor Joseph Aldy noted, the American Recovery and Reinvestment Act's $90 billion

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* *The mission of the American Council for Capital Formation is to promote economic growth through sound tax, regulatory, energy, environmental, and trade policies. For more information about the Council or for copies of this testimony, please contact the ACCF, 1750 K Street, N.W., Suite 400, Washington, D.C. 20006-2302; telephone: 202.293.5811; fax: 202.785.8165; e-mail: info@accf.org; website: www.accf.org*

in support "represented an unprecedented investment in clean energy".[1] Key areas include support for renewable power generation, transportation including high-speed rail and mass transit, advanced vehicles and battery technology, grid modernization, carbon capture and storage and clean energy manufacturing.

The Recovery Act extended the Production Tax Credit (which has been in existence since 1992) for wind, geothermal and other renewable energy for an additional 3 years and created two new programs to promote renewable power investment: the 1603 grant program and the 1705 loan guarantee program. The 1603 program is a subsidy for investment in new renewable generation capacity, a developer can choose between a PTC, a 30 % investment tax credit (ITC) or a 1603 cash grant equal to 30% of the investment's cost (solar developers can only choose between the ITC and a cash grant).

As noted in Joseph Aldy's 2012 report, the Recovery Act's 1705 loan guarantee program represented a modification of the existing section 1703 energy loan guarantee program created in 2005. "The new program supported conventional renewable power, transmission, and biofuel projects, as well as innovative technologies eligible for loan guarantees under the 1703 program. The Recovery Act appropriated $6 billion to the 1705 program so that the Federal government would pay for the credit subsidy associated with loan guarantees. By providing loan guarantees, this program could make debt capital available and lower the costs of debt for commercial renewable project developers."[2]

The U.S. economic recovery remains weak, unemployment remains stubbornly high, investment remains below the pre-recession level and the federal budget deficit is projected to be 7.2% of GDP in 2012. These economic factors suggest that a careful examination of whether the incentives in the tax code, direct federal expenditures and subsidies (including those added in the Recovery Act) for renewable energy are the best and highest use of U.S. taxpayer's dollars is warranted.

Rationale for Subsidies for Industry

Subsidies are government financial transfers to an industry, through payments to workers or to firms. Probably nobody would deny that the government is subsidizing the industry if it is paying part of the wages of workers in the industry or it is granting firms in the industry funds to make capital purchases. This is the narrowest definition of a subsidy. However there is little difference from the standpoint of the industry between a government transferring funds to it, on one hand, and waiving transfer payments, i.e. taxes, that the firm would normally make to the government. The tax code provisions and direct federal grants made available to clean energy industries meet the conventional definition of subsidies. The key question is: are the benefits of the taxpayer funded incentives worth the cost? Spending money on renewable energy projects creates an opportunity cost by diverting the funds from alternative uses; thus the issue is whether alternative uses of taxpayer dollars would yield a higher return is worth pursuing. Similarly, worth asking is

[1] http://www.rff.org/Publications/Pages/PublicationDetails.aspx?PublicationID=21725
[2] Ibid. p. 13.

whether society would be better off if the public (and private) funds spent on renewable energy were left in taxpayer's pockets.

When economists justify subsidies, they usually do so in one of three ways. First, there is the "infant industry" argument. An industry, for instance, may be dominated by foreign (non-domestic) companies (e.g. textile manufacture by England during the early days of the United States) and for reasons of social policy, the government may want to develop an indigenous industry. Insufficient private capital may be available to permit the private sector, on its own, to accumulate sufficient capital to make the indigenous industry commercially competitive. The government then could subsidize the industry through grants, loans, equity infusions, tariff protection or tax incentives. When the industry has been built up to the point where it is self-sufficient, the subsidies would be removed.

The second argument in favor of subsidization is that a large, critical industry may run into serious temporary difficulties and be in danger of ceasing operations. The government, in such a situation, would have at least three options: it can play no role and let the full market effects be felt; or it can directly subsidize the endangered firms with cash or equity infusions, loans or loan guarantees; or it can let the firms go bankrupt but intervene through the monetary system to prevent the bankruptcy of the firms from affecting other, healthy, part of the economy. A third argument in favor of subsidization is tied to current interests in environmental protection. Subsidies can be used to encourage firms and industries to behave in environmentally friendly ways.[3]

Are Continued Subsidies for Clean Energy Deployment Justified?

- **Infant industries rationale**

Are clean, renewable energies truly "infant industries" and deserving of continued taxpayer support through provisions in the tax code or direct federal expenditures? A look back at history will help put the question in perspective. Regarding solar power, an EIA report notes that solar technology is not new, it dates from the 7th century BC when magnifying glass was used to concentrate the sun's ray to make fire and passive solar to heat rooms was used in Roman bathhouses in the 1st century AD. Almost 3000 years after the use of solar power began; it has many applications but is still not cost-competitive with conventional energy sources in many cases.[4] Similarly, wind power has a long history; the Persians constructed the earliest known windmills in the 6th century AD to grind grain.[5] By 1300 AD windmills were in wide use in Europe for a variety of industrial uses. Though some 1400 years have passed since windmill began to be used for industrial purposes, they are still only an intermittent source of power generation. Finally, batteries have been in use since the early 1800's and the first electric car was invented in Scotland in 1832 by Robert Anderson.[6] Though the plug-in electric vehicle was fairly popular in New York City in the early 1900's, it was quickly supplanted by gasoline

[3] See ACCF testimony at http://accf.org/wp-content/uploads/2011/12/ACCF-Testimony-Final-12-14-11-FINAL.pdf for more details on subsidies for renewable energy.

[4] http://www1.eere.energy.gov/solar/pdfs/solar_timeline.pdf

[5] http://www.utexas.edu/gtc/assets/pdfs/windmills_world.pdf

[6] http://www.npr.org/2011/11/21/142365346/timeline-the-100-year-history-of-the-electric-car

powered vehicles with their greater driving range, quick refueling and lower cost. Thus, looking back at the length of time that renewable energy and alternative fuel vehicles have been in use, it seems questionable that these industries (which receive most federal support) meet the criteria of being "infant industries."

In recent decades, legislation has been enacted at the federal, state and local level to promote the development and deployment of renewable energy, greater fuel economy for transportation vehicles, alternative vehicles and high speed rail.[7] For example, the Energy Policy Act of 1992 initiated the renewable energy production tax credit (PTC), an inflation-adjusted tax credit for electricity produced from qualifying renewable energy sources or technologies. As mentioned above, the Recovery Act extended and amended the PTC and provided additional options including energy investment tax credits and grants. Most states and some localities have also have also enacted renewable portfolio standards or goals and have provided subsidies including grants, rebates and tax credits for the installation of renewable energy. In the mid 1975's, in response to the Arab oil embargo, Congress enacted Corporate Average Fuel Economy Standards to improve the average fuel economy of light cars and trucks. In 2011, new CAFE standards for cars and trucks were set to further improve fuel economy.[8] There has also been substantial government support for alternative fuel vehicles, including hydrogen and electric powered vehicles as well as for biofuel in recent years.[9]

During the recession in the 2008-2009 period, the effort by the federal government to promote the use of renewable energy and alternative vehicles and biofuels accelerated. As provisions of the Recovery Act were being debated, some analysts argued that more grants and loans for renewable energy should be part of the legislation because private sector interest in the sector had declined sharply. For example, Aldy states that during "the financial crisis, the number of tax equity suppliers and the amount of tax equity{for renewable energy}fell by more than half."[10] In fact, it is quite possible that the sudden, dramatic expansion of U.S. natural gas production during that period and the sharp decline in natural gas prices were responsible for a decrease in the private sector's interest in renewable energy investments. As U.S. natural gas production increased, the well-head price dropped from $10.70 tcf in July, 2008 to $3.45tcf in July, 2009. As a result of the decline in natural gas prices, gas became the "fuel of choice" for new electric generation plants.

- **Employment impact of Subsidies for Renewable Energy**

Another key question is whether the phase out of tax incentives for clean energy deployment (including those in the Recovery Act) will have an adverse impact on U.S. economic recovery and job growth. As noted in a 2010 report by Department of Commerce, "Measuring the Green Economy," green products and services comprised only 1 to 2 percent of the total private business economy in 2007. The number of green jobs ranged from 1.8 to as many as 2.4 million when products and services that some might argue were not "green' were included in the total.

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[7] http://www.eia.gov/energyexplained/index.cfm?page=renewable_home#tab3
[8] http://en.wikipedia.org/wiki/Corporate_Average_Fuel_Economy#History
[9] http://www.eia.gov/cneaf/alternate/issues_trends/altfuelmarkets.html
[10] http://www.rff.org/Publications/Pages/PublicationDetails.aspx?PublicationID=21725 , p. 12.

These jobs constituted between 1.5 and 2.0 percent of total employment in 2007.[11] The Commerce Department report concludes that the relatively small size of the green economy suggests that the majority of jobs created during the economic recovery are likely to come from the production of products and services outside the green economy. Thus, phasing out of incentives in the tax code for clean energy is not likely to have a material impact on U.S. economic growth and such savings could help reduce the federal budget deficit, especially if declining government subsidies leads to increased efficiency in the subsidized firms rather than their demise.

An examination of reports on U.S. job growth due to renewable energy outlays in the Recovery Act should be viewed cautiously. For example, Joseph Aldy's recent paper quotes a 2010 estimate by the President's Council of Economic Advisors that the Recovery Act "would support about 720,000 job years through the end of 2012"[12] (a job year is one fulltime job for one year, thus about 180,000 jobs would be created per year according to the CEA estimate). As the CEA noted in its Third Quarterly report on the Recovery Act "Of course, these figures are only estimates. The margin of error for estimates for specific programs from the CEA model is relatively large, and the number of clean energy jobs – either in 2010:Q1 or over the life of the Act – could be somewhat smaller or larger than is indicated here."[13]

The methodology apparently used by the CEA[14] to estimate clean energy job growth appears to be the same as was used by Christine Roemer[15] (former Chairman of the President's Council of Economic Advisors) when she predicted in 2009 that the U.S. unemployment rate would not rise about 8.2% if the Recovery Act were enacted. Unfortunately, the actual U.S. unemployment rate rose to 10% in October of 2009.

Anecdotal estimates of job creation in renewable energy suggest that the government's projections of expected new jobs may be significantly overstated. For example, a recent Wall Street Journal report on the 1603 program concludes "on federal applications, companies said they created more than 100,000 direct jobs at 1603-funded projects. But a Wall Street journal investigation found evidence of far fewer. Some plants laid off workers. Others closed."[16] Another recent report on "green jobs" highlights the opportunity cost of government funding for renewable energy jobs: a Reuters report found that "the green-jobs push has crowded out less fashionable efforts that would have put people back to work quickly. 'From my perspective it makes more sense for us to arm our clients with the basic skills, rather than saying, 'By golly, you will do something in the green economy or you won't work,'' said Janet Blumen, the head of the Foundation for an Independent Tomorrow, a Las Vegas job-training organization that has

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[11] http://www.esa.doc.gov/sites/default/files/reports/documents/greeneconomyreport_0.pdf

[12] http://www.rff.org/Publications/Pages/PublicationDetails.aspx?PublicationID=21725, p. 10.

[13] http://www.whitehouse.gov/administration/eop/cea/factsheets-reports/economic-impact-arra-3rd-quarterly-report/supplement_greenjobs

[14] "The methodology used to estimate the job impact of the ARRA was described in detail in Romer and Bernstein (Obama Transition Document, January 11, 2009). In this section we briefly summarize the methodology and discuss the results." (p. 2) http://www.whitehouse.gov/sites/default/files/microsites/Estimate-of-Job-Creation.pdf

[15] http://www.ampo.org/assets/library/184_obama.pdf

[16] http://online.wsj.com/article/SB10001424052970203710704577705041249471317 8.html

seen positions in trucking and accounting go unfilled because training money had been earmarked for green efforts."[17]

Also, an article on California's green jobs initiative notes that "Job training programs intended for the clean economy have also failed to generate big numbers. The Economic Development Department in California reports that $59 million in state, federal and private money dedicated to green jobs training and apprenticeship has led to only 719 job placements — the equivalent of an $82,000 subsidy for each one."[18]

- **Environmental Impact of U.S. support for Renewable Energy**

Continued high levels of federal support for the deployment of clean energy and alternative fuel vehicles in the U.S. is unlikely to have a significant impact on reducing GHG concentrations in the atmosphere since the real growth in emissions is coming from developing countries (see Figure 1). In addition, renewable energy is not without its own negative environmental and social impacts.

Cost of Job Creation Under the 1603 Program

The cost of job creation in the renewable energy sector through government funded programs such as 1603 is another factor in evaluating the program's effectiveness. For example, a recent report by the National Renewal Energy Laboratory states that between 52,000 and 75,000 temporary jobs were created in 2011 by 1603 grants to solar PV and wind energy projects. Anecdotal estimates of job creation in renewable energy suggest that the government's projections of expected new jobs may be significantly overstated. As shown in Table 1, the cost to taxpayers to create each short term job (expected to last over the 2009-2011 period) ranges from about $63,000 to over $91,000. The cost of permanent renewable energy jobs (a total of about 5,000 per year for the next 20 or so years) ranges from over $81,000 to over $88,000. In contrast to the cost of creating jobs under the 1603 program, the average U.S. median wage of all occupations was $45,230 in 2011.

In addition, renewable energy industries are now globally deployed. As a result, it will be very difficult if not impossible to ensure that the benefits of U.S taxpayer funded subsidies will result in the creation of new investment, jobs, new patents, etc. here in the U.S. On the other hand, it is also true that the U.S. has benefited indirectly from the vast spending on renewables in Europe and lately in China, which have brought down costs for everyone. In this respect it might be argued that the fact that others are subsidizing such technologies is an argument for the U.S. doing less, not more.

[17] http://www.reuters.com/article/2012/04/13/us-usa-campaign-green-idUSBRE83C08D20120413
[18] http://www.nytimes.com/2011/08/19/us/19bcgreen.html?_r=3

Cost of Renewable Energy

Energy use is a key component in U.S. economic recovery, in recent years each 1% increase in GDP in the U.S. has been accompanied by a 0.2% increase in energy use. Higher energy prices tend to slow economic growth and reduce the competitiveness of the U.S. manufacturing sector. As policymakers confront the slow U.S. economic recovery and slow job growth, they need to consider the impact of tax, budget and regulatory decisions that promote the use of renewable energy compared to the expansion of conventional fossil fuels or nuclear power electricity generation and for transportation.

Federal policies such as the Recovery Act's subsidies for renewables and alternative vehicles and biofuels promote the use of more expensive renewable energy to replace cheaper and already environmentally sound and compliant conventional energy sources. These programs have the effect of increasing federal spending, reducing tax receipts and raising the price of energy. According to recent EIA data, new electric generating capacity using wind and solar power tends to be considerably more expensive than conventional natural gas and coal. As shown in Table 2 the total cost of offshore wind, at $244 dollars per mega watt hour (MWH) is almost 300% higher than for advanced combined cycle natural gas–fired plants which cost only $62 per MWH. The cost of solar thermal, at $312 MWH, is over 400% higher than natural gas-fired electricity production. Similarly, advanced nuclear costs an estimated $114 per MWH and advanced coal costs only $110 MWH.[19]

The cost of the electricity generation resources in facilities supported by 1603 grants seems to be much larger than the conventional and renewable new generation cost data provided by EIA (Table 2). As shown in Table 3, the cost of new renewable generation under 1603 is $880.95 MWH, or almost 3 times greater than the most expensive renewable generation (solar thermal) cited in the EIA data.

As shown in the data in Tables 2 and 3, new renewable electricity generation facilities are often substantially more costly (per megawatt hour) that conventional generation from fossil fuel or nuclear plants and can impose higher cost on electricity producers and consumers. Another perspective is provided by examining current data on electricity prices in states with renewable portfolio standards (RPS). States with an RPS mandate tend to experience higher costs for electricity those without an RPS mandate. In 2011, the 29 states with an RPS mandate faced residential electricity prices that were 27% higher than those without a mandate and industrial electricity prices were 23% higher (see Figure 2).

The Federal Tax Code and Incentives for Renewable Energy

Renewable energy has received federal support through direct subsidies and tax credits for many years. Another way of measuring the degree of federal subsidies for alternative energy sources to measure the effective tax rate. A negative tax rate indicates that the tax code is subsidizing the investment since the investor is willing to accept a before-tax rate of return that is less than the after- tax rate of return. According to a study by Gilbert Metcalf, the tax code in 2007 created

[19] http://www.eia.gov/forecasts/aeo/electricity_generation.cfm

strong incentives for renewable energy investments.[20] For example, a 30% investment tax credit combined with 5 year accelerated depreciation gave solar thermal investments an effective tax rate of -244.7% (see Table 4).Wind power had a -168.8 % rate. Since the rates Metcalf computed were created before the new renewable energy incentives provided by the Recovery Act, the size of the negative tax rates has doubtless increased. It is worth noting that as of 2007, the overall effective tax rates for renewables and nuclear are substantially lower than the effective rates on gas, integrated oil drilling, refining and coal.

What Lessons Can We Learn From Federal Programs Supporting Renewable Energy?

As the new Aldy paper notes, renewables have received very strong support from government policies and he suggests that "government policies per ton of CO2 abated can inform assessments of the economic efficiency of the sum of renewable policies. The share of a project financed by taxpayers or ratepayers (through higher electricity rates under a state renewable electricity standard) would likely exceed 60 percent for renewable projects receiving tax benefits, grants, loan guarantees, and above-market rates due to state renewable mandates. This raises questions about the efficiency and the bang-for-the-buck of renewable-related promotion policies that further research should explore."[21]

Aldy further notes that the government estimates that the cost per ton of avoided CO2 emissions is about four times the social cost of carbon used by the U.S. government in its Memorandum to the President 2010, Interagency working Group on the Social Cost of Carbon (2010).[22] Finally, he states that the "1705 loan guarantee program has not had a meaningful impact on the U.S. power sector."[23]

In addition, a recent CRS report on the 1603 grant program in the Recovery Act states that the Section 1603 grant program has been popular with the renewable energy sector. Proponents of the program suggest that the added incentive is necessary to continue to promote renewable energy. The Section 1603 grant program, however, results in revenue losses that are greater than the revenue losses associated with the previously available tax incentives. Given the country's large budget deficits, there may be questions of whether further extensions of this program are worth the budgetary cost.[24]

U.S. Trading Partners are Reducing Support for Renewable Energy

Several European countries, including Germany, the UK, Spain and Italy as well as Australia, have recently announced reductions or elimination of subsidies for wind, solar and biomass energy programs.[25] Government budget constraints are driving the decisions in many cases as

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[20] See http://www.nationalaglawcenter.org/assets/crs/R41953.pdf

[21] http://www.rff.org/Publications/Pages/PublicationDetails.aspx?PublicationID=21725, p.15.

[22] http://www1.eere.energy.gov/buildings/appliance_standards/commercial/pdfs/sem_finalrule_appendix15a.pdf

[23] http://www.rff.org/Publications/Pages/PublicationDetails.aspx?PublicationID=21725 , p. 15.

[24] CRS "ARRA Section 1603 Grants in Lieu of Tax Credits for Renewable Energy: Overview, Analysis and Policy Options," Phillip Brown and Molly E. Sherlock, November 9, 2011. , R41635.

[25] http://www.euractiv.com/energy/germany-announces-30-cuts-solar-subsidies-news-511104, http://www.guardian.co.uk/environment/2011/oct/20/renewable-energy-subsidies-slashed

well as the growing realization that many programs are imposing higher energy costs on already hard-pressed households and industry.[26]

What Role Can Energy Play in U.S. Economic Recovery and Job Growth?

While the renewable energy industry has a role to play as the U.S. tries to reduce emissions of all types and become less dependent on imported oil, policymakers should evaluate the cost-effectiveness of federal tax and budget outlays subsidizing these industries.

In contrast to the disappointing results from many expensive green energy initiatives funded by the U.S. taxpayer, several recent economic analyses suggest that increased access to domestic onshore and offshore oil and gas reserves (including shale gas) could strongly boost U.S. economic recovery, manufacturing and job growth. Fossil fuels, which provide 78% of U.S. primary energy production, can have a positive impact in restoring strong economic growth. A new Global Insight/CERA analysis, "Restarting the Engine-Securing American Jobs, Investment and Energy Security" finds that allowing exploration and development in the Gulf of Mexico in 2012 could create more 230,000 jobs, a $44 billion increase in GDP and $12 billion in additional tax receipts to federal and state treasuries.[27]

Another new report by Wood Mackenzie, "U.S. Supply Forecast and Potential Jobs and Economic Impacts (2012-2030)" finds that policies that encourage the development of new and existing resources could by 2015 increase production by over 1 million barrels of oil equivalent per day (mboed), create almost 670,000 jobs and provide an additional $10 billion in federal and state tax receipts compared to the base case.[28] By 2030, production would rise by over 10 mboed, employment would be over 1.4 million higher and tax receipts would be $99 billion higher.

In fact, domestic access to shale gas and development of that abundant resource has the ability to reduce operating and feedstock costs for manufacturing and chemicals industries, respectively, in ways that can be transformative for those industries and job growth. In another recent analysis, "The Economic and Employment Contributions of Shale Gas in the United States" the consulting firm Global Insight documents the significant contributions that shale gas is making to the U.S. economy.[29] The report finds that in 2010, the industry supported 600,000 jobs and contributed more than $76 billion to GDP. Capital expenditures were $33 billion in 2010 and will grow to $48 billion in 2015. The current low and stable gas prices will contribute to a 10% reduction in electricity prices in the near term and to a 1.1% increase in the level of GDP by 2013. All sectors of manufacturing benefit, especially those that use natural gas as a feedstock or energy source. In the long run, there will be improvements in the competitiveness of domestic

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[26] http://www.upi.com/Business_News/Energy-Resources/2012/04/02/Italy-to-cut-renewable-energy-subsidies/UPI-52381333362600/;http://www.bloomberg.com/news/2012-01-27/spain-suspends-subsidies-for-new-renewable-energy-plants.html;http://www.theaustralian.com.au/national-affairs/climate/subsidies-under-fire-as-solar-rebate-axed/story-e6frg6xf-1226285622435

[27] http://www.gulfeconomicsurvival.org/phx-content/assets/files/GoM_Restarting_the_Engine.pdf

[28] http://www.api.org/policy/americatowork/upload/API-US_Supply_Economic_Forecast.pdf

[29] http://www.ihs.com/images/Shale-Gas-Economic-Impact-Dec-2011.pdf

manufacturers due to lower natural gas and electricity costs. As a result, industrial production will be 4.7% higher in 2035, the Global Insight report concludes.

How Should the Tax Code Treat Energy and other Investments?

Many public finance experts suggest that the tax code should provide the same provisions for all types of industries and activities so as to avoid advantaging one industry over another. For example, accelerated depreciation, in which the write-off period may be shorter than the actual economic life of an asset, is generally provided to all taxpayers regardless of their industry or type of investment in plant or equipment. Section 199 was established to help support U.S. manufacturing of all types. The foreign tax credit deduction is designed to prevent the double taxation of income earned abroad by U.S. multinationals. Similarly, LIFO is an accounting method in use for more than 70 years to protect companies from inflation or rising prices over the course of their operations. All of the above mentioned tax code provisions are available to any industry and are not considered "subsidies."

As Gary Hufbauer, a member of the ACCF's Center for Policy Research Board of Scholars, noted in a recent article, it is important not to confuse "subsidies" with legitimate tax deductions available to all industries.[30] Dr. Hufbauer states, "The semantically accurate way to describe legislation that would eliminate the manufacturing deduction or curtail the foreign tax credit for oil and gas companies is straightforward: the imposition of tax discrimination, not the removal of federal subsidies. Because most Americans agree that tax discrimination is bad policy - Uncle Sam shouldn't be picking winners and losers through the tax code - accurate language would diminish enthusiasm for these proposals."[31]

By the same token, the current policy of providing subsidies and negative tax rates for renewable energy, energy efficiency and alternative fuel vehicles should be reexamined with an eye toward balancing costs and benefits.

Conclusions

By encouraging the deployment of energy technologies that are more expensive than conventional energy, consumers and industry are forced to spend more on energy and have less for other purchases or for productive investment. As a result, GDP and job growth will be lower than otherwise as resources are diverted from their highest and best use.

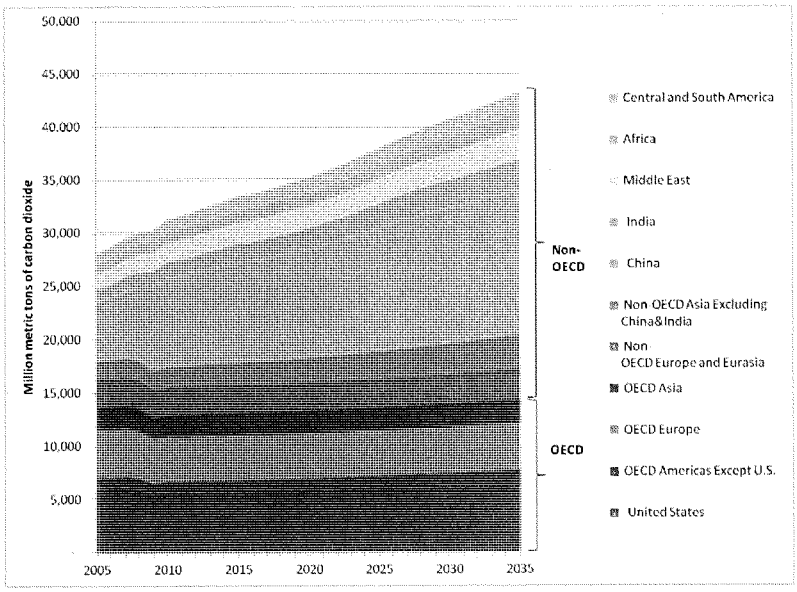
Another issue worth raising is the question of the effectiveness of renewable energy tax incentives and spending programs which are dependent on a financially strapped federal government and are therefore uncertain and possibly non-sustainable. The almost constant uncertainty about whether a tax code provision or direct spending program will still exist by the time the investment is deployed raises the hurdle rate and increases the cost of capital for investment. In the face of the federal government's huge budget deficits and the perceived need to close the budget gap, many potential investors in renewable energy projects may think the

[30] http://www.washingtontimes.com/news/2011/dec/7/debunking-the-big-oil-subsidy-myth/
[31] Ibid

risks are too great. Given this uncertainty, current federal programs to significantly increase the use of renewable energy and promote energy efficiency may simply be ineffective.

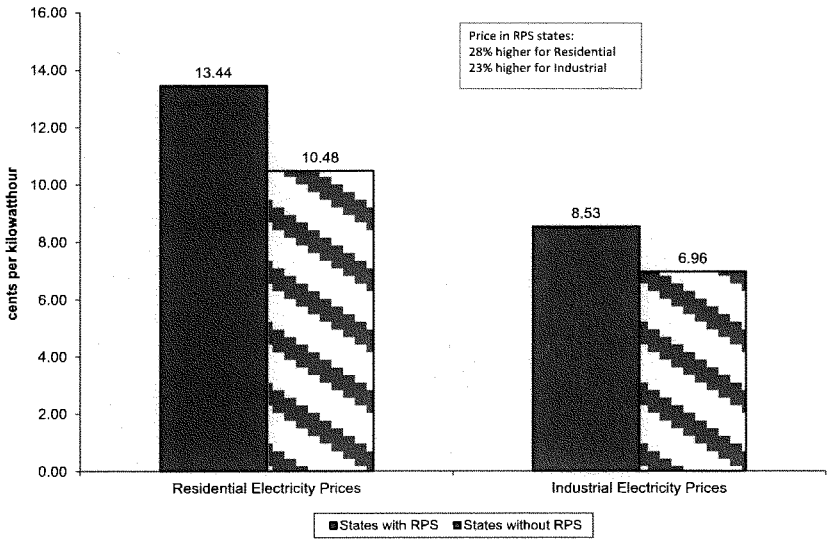
If markets are allowed to select the energy technologies that are deployed rather than government officials using tax incentives, subsidies or a CES mandate, costs to consumers and the federal government's budget will be reduced. Policies that encourage the responsible development and transportation of U.S. oil and gas resources should be accelerated so as to promote a cleaner environment and stronger economic and job growth.

Figure 1. World Carbon Dioxide Emissions by Region



Source: International Energy Outlook 2011, Energy Information Administration, U.S. Department of Energy.

Figure 2. Electricity Prices: States with Renewable Portfolio Standards versus States without RPS



Source: Data for August 2011. Energy Information Administration, Table 5.6.A, http://www.eia.gov/electricity/data.cfm#sales

Table 1. Jobs in Solar PV and Wind Projects Funded by 1603 Grant Program

1603 Program: Payments for Specified Energy Property in Lieu of Tax Credits	Cost	Jobs Created		Cost Per Job		U.S. Median Wage
		Low	High	Low	High	
Short-Term Jobs in 2011	$4.7 Billion	52,000	75,000	$91,275	$63,284	$45,230
Permenant Jobs Created by 1603 for next 20 years per year	$9 Billion	5,100	5,500	$88,235	$81,818	$45,230

Sources: * 1603 cost numbers are from U.S. Treasury Website, http://www.treasury.gov/initiatives/recovery/Pages/1603.aspx List of Awards file.

* Job numbers are from "Preliminary Analysis of the Jobs and Economic Impacts of Renewable Energy Projects Supported by the §1603 Treasury Grant Program" http://www.nrel.gov/docs/fy12osti/52739.pdf

* U.S. Median Wage, May 2011 National Occupational Employment and Wage Estimates http://www.bls.gov/oes/current/oes_nat.htm#00-0000

Table 2. Estimated Levelized Cost of New Generation Resources, 2016.

Plant Type	Capacity Factor (%)	U.S. Average Levelized Costs (2009 $/megawatthour) for Plants Entering Service in 2016				
		Levelized Capital Cost	Fixed O&M	Variable O&M (including fuel)	Transmission Investment	Total System Levelized Cost
Conventional Coal	85	65.5	3.9	24.5	1.2	95.1
Advanced Coal	85	74.7	7.9	25.9	1.2	109.7
Advanced Coal with CCS	85	92.9	9.2	33.3	1.2	136.5
Natural Gas-fired						
Conventional Combined Cycle	87	17.5	1.9	44.6	1.2	65.1
Advanced Combined Cycle	87	17.8	1.9	41.2	1.2	62.2
Advanced CC with CCS	87	34.7	3.9	48.6	1.2	88.4
Conventional Combustion Turbine	30	45.8	3.7	69.9	3.5	123.0
Advanced Combustion Turbine	30	31.7	5.5	61.3	3.5	102.1
Advanced Nuclear	90	90.2	11.1	11.7	1.0	114.0
Wind	34	83.5	9.5	0.0	3.4	96.1
Wind – Offshore	34	200.7	28.1	0.0	5.9	243.7
Solar PV[1]	25	194.9	12.1	0.0	4.0	211.0
Solar Thermal	18	259.8	46.6	0.0	5.8	312.2
Geothermal	91	77.4	11.9	9.5	1.0	99.8
Biomass	83	55.4	13.7	42.3	1.3	112.6
Hydro	53	78.5	4.0	6.2	1.8	90.5

[1] Costs are expressed in terms of net AC power available to the grid for the installed capacity

Source: Energy Information Administration, Annual Energy Outlook 2011, April 2011, DOE/EIA-0383(2011)

Table 3. Cost of Electric Generation under 1603 Program (As of March 29, 2012)	
Total 1603 funding (federal)	$11.2 billion
Total private and federal investment in 1603 projects	$37 billion
Total Estimated Electricity Generation from funded projects	42 TWh
Cost per mwh	$880.95
Source: http://www.treasury.gov/initiatives/recovery/Documents/Status%20overview.pdf	

Table 4. Effective Tax Rates for Energy-Related Capital Investments, 2007

	2007 Law	No Tax Credits	Economic Depreciation
Electric Utilities: Generation			
Nuclear	-99.5	32.4	-49.4
Coal (Pulverized Coal)	38.9	38.9	39.3
Coal (IRCC)	-11.6	38.9	-10.3
Gas	34.4	34.4	39.3
Wind	-163.8	12.8	-13.7
Solar Thermal	-244.7	12.8	-26.5
Petroleum			
Oil Drilling, Non-Integrated	-13.5	-13.5	39.3
Oil Drilling, Integrated	15.2	15.2	39.3
Refining[a]	19.1	19.1	39.3
Natural Gas			
Gathering Pipelines	15.4	15.4	39.3
Other Pipelines	27.0	27.0	39.3

Source: See http://www.nationalaglawcenter.org/assets/crs/R41953.pdf. Data from Gilbert E. Metcalf, "Investment in Energy Infrastructure and the Tax Code," in *Tax Policy and the Economy*, ed. Jeffery R. Brown, 24 ed. (The University of Chicago Press, 2010), pp. 1-33.

Notes:

a. The effective tax rate on refining capital reflects the 50% expensing allowance available in 2007 for investments in additional refinery capacity.

Chairman BROUN. Thank you, Dr. Thorning.

Now, Ms. Linowes, you are recognized for five minutes.

STATEMENT OF MS. LISA LINOWES,
EXECUTIVE DIRECTOR,
INDUSTRIAL WIND ACTION GROUP

Ms. LINOWES. Thank you, Mr. Chairman, and Chairman Broun, Chairman Harris, Members of the Committee, I appreciate the opportunity to be here and to speak with you. And Congressman McNerney, I am sorry that you think this is a sounding board for the leadership. I hope that you will listen to the comments that are made today.

I would like to start with a quick comment that places wind energy in its proper context. In 2008 the DOE published "20 Percent Wind Energy by 2030," a report which examined the feasibility of using wind to produce 20 percent of the Nation's electricity. A 20 percent scenario means transforming the midsection of the country, as well as our coastal waters into a massive wind generating facility connected together by thousands of miles of new 765 kV lines. Those green lines you see on the map, those are all new transmission lines that stand 200 feet tall.

But what do we get in return? According to the DOE, we get generation that cannot replace our capacity resources, those generators we rely on day to day and hour by hour to meet our energy needs. Most people do not understand this point, and when I have spoken to people in the past, including energy executives in a room, they are not aware that this statement; these comments are in the 20 percent by 2030 report.

For the authors of this study, which included AWEA, the American Wind Energy Association, and NREL, satisfying the 20 percent wind goal is entirely independent of our need for reliable power. Claims by industry proponents that wind can power over 12 million American homes or is the reason for coal plants retiring grossly overstates wind energy's purpose and its limited contribution to our energy portfolio.

So why build wind at all? Two words: low emissions. This fact is validated by the ISO New England's Wind Integration Study, which concluded that New England could achieve 20 percent wind, but doing so requires existing fleet of power plants to remain online and any new capacity resources proposed to be built also brought online. Bottom line: wind can displace fossil fuel; it cannot replace it.

Switching to my next slide, this shows wind growth from 1992 through until, I believe, 2009. The wind industry has complained over 10 years that each time the Production Tax Credit was allowed to expire, new wind installations stalled. And here we are again. But attributing wind activity to the—wind market activity to the PTC is overly simplistic and fails to consider other more significant factors that impact growth like energy prices and the availability of State mandates. In fact, these factors are likely the primary impetus for wind growth or decline.

The PTC is an overly generous, highly inefficient policy, and at 2.2 cents a kilowatt hour, this open-ended subsidy has a pretax

value of about 3.7 cents a kilowatt hour, more than the price of wholesale electricity in most parts of the country today.

Quick point about 6 and 1603: there is a claim that 1603 and PTC are somehow monetarily equivalent, that the cash paid up front is equivalent to the PTC Tax Credit spanned over 10 years. In fact, that is not the case. Aside from the intrinsic value of cash in hand being more valuable than a tax credit spanned over a period of time, I looked at 12 projects, 10 wind projects in particular, that received 1603 or will receive 1603 in lieu of PTC, and what I found was that the Section 1603 more than not, in all of my cases, exceeded the amount of money the project would receive under PTC.

The last point I want to make is about the hidden subsidies that wind energy receives. I want to mention one case where the Federal Government is paying money to the Production Tax Credit 1603 and is also paying money to fund the development of our—the highest quality RADAR systems in our country. The bottom line is wind energy and wind turbines interfere with our national radar systems, and the Federal Government is paying millions of dollars today to try to mitigate for that problem and it hasn't been mitigated. I cite two examples in my testimony. I hope you will look at that. There is a problem with radar and turbines, and we are paying the cost of it.

Thank you.

[The prepared statement of Ms. Linowes follows:]

U.S. House of Representatives
Committee on Science, Space, and Technology
Subcommittee on Investigations and Oversight
Subcommittee on Energy and Environment

Impact of Tax Policies on the Commercial Application of Renewable Energy Technology

Testimony of Lisa C. Linowes

April 19, 2012

I. Introduction

My name is Lisa Linowes. Since 2006, I've served as executive director and spokesperson for the Industrial Wind Action (IWA) Group, a national advocacy group focused on the impact/benefits analysis and policy issues associated with industrial-scale wind energy development. As publisher and editor of IWA's website (windaction.org), I track news and research pertaining to industrial wind, provide commentary, and facilitate information sharing on the issue. I hold a BS in Software Science from the Rochester Institute of Technology in Rochester, New York and a Masters in Business Administration from Southern New Hampshire University. A more complete biography is included with this testimony. The findings and opinions I am presenting here are entirely my own but reflect the official position of IWA.

II Background and Purpose

Energy policy in the United States calls for the aggressive deployment of renewable generation which has led to an explosion of expensive renewable resources that are variable, operating largely off-peak, off-season and are located in rural areas with limited transmission.

By the end of 2011, nearly 47,000 megawatts (MW) of on-shore wind was installed in the United States representing less than 3% of total electricity generation in the country. Based on the interconnection queues of each grid region in the US, industrial wind is the dominant renewable resource representing more than 90% of the proposed generating capacity of all renewable energy projects in the United States.

My testimony looks at recent trends in the US wind industry including the impacts of advancing significant wind resources. I also examine the effect of the production tax credit and Section 1603 in driving growth.

III Testimony

1. The Wind Mandate: 20% Wind Power By 2030

In 2008, the US Department of Energy (DOE) published *20% Wind Energy by 2030*[1], a report that examined the technical feasibility of using wind energy to generate 20% of the nation's electricity demand by 2030. The report, which called for the deployment of 305,000 MW of wind by the year 2030, including 54,000 MW offshore, has served as the foundation for ongoing advocacy of wind development in the US.

The American Wind Energy Association insists the industry is on track to meet the Department of Energy's goal of 20% wind but getting to a 20% scenario is neither realistic nor wise. The report's authors failed to accurately characterize the purpose and scale of such development, the technology challenges and staggering financial costs, and the fundamental changes to electricity infrastructure necessary to achieve the hoped-for 2030 levels.

This below excerpt from the report has gone largely unnoticed by most people but is essential in understanding the premise behind DOE's 20% wind scenario:

> *Wind power cannot replace the need for many 'capacity resources,' which are generators and dispatchable load that are available to be used when needed to meet peak load. If wind has some capacity value for reliability planning purposes, that should be viewed as a bonus, but not a necessity.*

DOE is well aware of the fact that wind energy is an unpredictable, variable resource that cannot be relied on to deliver electricity when needed. Claims by industry proponents that installed wind today powers, on average, over 12 million American homes misrepresents wind energy's purpose and limited contribution to our energy portfolio. For the authors of the report, satisfying the 20% wind energy goal is entirely <u>independent</u> of our need for reliable power plants meant to meet

[1] 20% Wind Power by 2030 - http://www1.eere.energy.gov/windandhydro/pdfs/41869.pdf

demand. In fact, no amount of wind installed in the US will result in an existing power plant being decommissioned nor will it negate the need to build new reliable generation.

So why build wind at all? Wind is being installed to generate low-emissions energy. Any opportunity beyond that is, as DOE correctly states, is "a bonus, but not a necessity."

Nonetheless, the cost and impacts of achieving 20% wind in the United States are staggering. Assuming a start point of 47,000 MW of wind now operating in the US (with none offshore), over 13,000 MW of new wind would need to be installed *year after year* through to 2030 to reach 305,000 MW. In addition, average capacity factors would need to dramatically increase from a current nationwide average of 30%[2] to over 40%.

Even if the industry were able to overcome all manufacturing and construction barriers to meet this goal, other barriers still remain including a) the public's resistance to wind turbines sited near their homes or on publicly-owned lands, national forests and wilderness areas; b) sustained and substantial taxpayer-funded subsidies to ensure project economic viability; c) above-market energy prices for wind and increased capacity payments for reliable resources, and d) the requirement for expansive and expensive power lines to access remote areas of the country.

Moving Wind Offshore

In September 2010, the National Renewable Energy Laboratory (NREL) expanded on DOE's study with the release of its *Large-Scale Offshore Wind Power in the United States*,[3] a report that described the benefits and feasibility of building 54,000 MW of wind offshore along our eastern seaboard, the Gulf of Mexico, and the Great Lakes. Water depths on the Pacific Coast, according to NREL, posed a 'technology challenge'.

No operating offshore wind plants are sited anywhere in the US. The controversial Cape Wind (130 turbines, 468 MW) project proposed ten years ago is still under challenge. Property owners within the viewshed of the project were joined by Wal-Mart, the Associated Industries of

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[2] Wiser R. and M. Bolinger. LBNL-4820E. June 2011, *2010 Wind Technologies Market Report*, http://eetd.lbl.gov/ea/emp/reports/lbnl-4820e.pdf

[3] *Large-Scale Offshore Wind Power in the United States*, September 2010 http://www.nrel.gov/docs/fy10osti/49229.pdf

Massachusetts, and wind developer TransCanada[4] among others in protesting the no-compete, high-priced power purchase agreement approved by the Commonwealth of Massachusetts. In Rhode Island, approval of Deepwater Wind's pilot project is under fire. In Delaware, NRG Bluewater Wind terminated its power purchase agreement with Delmarva[5] due to poor economics and growing public opposition to expensive renewable energy. A fight sparked in Michigan over a proposed 1000 MW wind facility in Lake Michigan packed hearing rooms[6] with angry protests. A similar response came from communities along northern New York after NYPA sought bids to build turbines in Lake Ontario and Lake Erie. Both the Michigan and NYPA plans were shelved[7].

None of these projects, in total, match the scale and cost of what NREL claims can be built offshore. Fifty-four thousand megawatts would mean 115 projects equivalent in size to Cape Wind, or 15,000 turbines located within 10-20 miles of our coastlines and spanning 3,000 square miles of open water. The eastern seaboard from Florida to Maine is 1,342 miles.

Obvious environmental and visual impacts are only a part of the issue. Problems with the technology are also very real[8].

And then there's the cost.

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[4] Providence Business News, *Cape Wind energy prices high, not competitive with other green projects* http://www.pbn.com/Cape-Wind-energy-prices-too-high-not-competitive-with-other-green-projects,52862

[5] North American Windpower, *NRG Bluewater officially ends contract for Delaware offshore wind project,* http://www.nawindpower.com/e107_plugins/content/content.php?content.9130

[6] Muskegon Chronicle, *Oceana County Board rejects Scandia Wind's Offshore proposal,* http://www.mlive.com/news/muskegon/index.ssf/2010/08/oceana_county_board_rejects_sc.html

[7] North America Windpower, *NYPA cancels 150MW Great Lakes offshore project,* http://www.windpowermonthly.com/news/1095655/NYPA-cancels-150MW-Great-Lakes-offshore-project/

[8] Turbine failures offshore are harder to repair and are often addressed on an aggregated basis. It's not unusual to wait as long as three months before turbines are fixed, leading to lower equipment availability. While wind conditions offshore might be better for energy generation, harsh environmental conditions could mean turbines are available for fewer hours in the year. In 2005, all eighty Vestas V90 turbines at Denmark's offshore Horns Rev facility had to be removed and repaired owing to the effect of salty water and air. A similar repair was reported on 30 Vestas turbines off the UK coast. In 2010 hundreds of European offshore wind turbines were found to have a design fault that caused the towers to slide on their bases. The problem was universal and not specific to any one project or turbine manufacturer.

The Cape Wind project will cost $2.5 billion for 468 megawatts ($5500/kw), an enormous expense for any individual power plant, especially one expected to deliver only 39% of the time with no guarantee the generation will arrive when most needed. With high upfront costs and fewer hours to spread the cost over, offshore wind is not economically viable without significant public support, above-market, long-term purchase agreements and constraints imposed on more reliable sources of generation.

NREL addresses some of the obstacles to building offshore wind in a very superficial manner. On visual effects, the authors acknowledge that coastal dwellers might object to the turbines and recommend added study to understand coastal communities and their ability to accept changes to the seascape. Regarding property values, NREL relies on the poorly defined Hoen/Wiser[9] study to claim no impact but admit more work is needed for offshore properties. On tourism, NREL concedes the evidence is ambiguous but still claims, "actual effects appear to be minimal". And finally, on marine safety they admit collisions may pose a potentially significant risk to the marine environment or to human safety but offer cold comfort that no incidents have occurred to date.

The true impact of a national renewable vision based on wind is in the public cost, both in dollars and in the impacts wrought by transforming our open spaces, on- and offshore into massive industrial power plants with associated transmission and other infrastructure. Wind proponents advocate for a national energy policy that mandates renewable energy, but public policy requires credible analysis with an objective eye on reality. To my knowledge, no such analysis has been undertaken by DOE.

2. Federal Subsidies Programs: PTC and Section 1603

a. The Production Tax Credit

The AWEA insists the industry is at risk of a slow-down if Congress does not act quickly to extend the production tax credit (PTC), the federal incentive most often credited for market growth in the wind sector. The PTC expires at the end of 2012.

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[9] Wilson, Albert R., *Wind farms, residential property values, and rubber rulers*, http://www.arwilson.com/pdf/newpdfs/WindFarmsResidentialPropertyValuesandRubberRulers.pdf

But if the PTC were to expire, the damage would be less than what AWEA claims.

Attributing wind market activity to the PTC is overly simplistic and fails to consider other crucial factors driving development in the US.

The PTC was established by the Energy Policy Act of 1992 to stimulate use of renewable technologies for power generation by providing a production-based credit for the first 10 years of project operations. Initially set at 1.5¢/kWh, the credit is adjusted annually for inflation and today stands at 2.2¢/kWh.

When adopted, the House Ways and Means Committee insisted on an expiration date (June 30, 1999) to give Congress an opportunity to assess the effectiveness of the credit in meeting its goal. In each of the five years following the PTC's enactment wind capacity declined[10]. It wasn't until 1998 and 1999 before the trend drifted upward. (see Exhibit 2)

While it's possible the market needed time to respond to the new subsidy, other more significant factors likely stalled growth.

The US was awash in generation and oil prices were low and stable. Deregulation shifted plant ownership to independent power producers which led to improved plant management and increased efficiencies. This was particularly true for nuclear power where average capacity factors grew from 66% in 1990 to over 90% currently[11].

The demand for renewable energy largely didn't exist except in States with programs that encouraged renewable generation. It's no accident that the bulk of new wind built in 1998-99 occurred in four states[12] with renewable programs -- California, Iowa, Minnesota and Texas.

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[10] http://www.eia.gov/totalenergy/data/annual/xls/stb0811a.xls

[11] http://www.nei.org/resourcesandstats/documentlibrary/reliableandaffordableenergy/graphicsandcharts/usnuclearindustrycapacityfactors

[12] http://www.windpoweringamerica.gov/wind_installed_capacity.asp

When the Asian financial crisis hit in 1997, oil prices collapsed[13] taking with them any financial incentive to build new renewable generation. The PTC expired in 1999, the same year oil prices bottomed out, and new wind installations went bust the following year.

AWEA has complained for over ten years that expiration of the PTC in 1999 caused development to slow calling it the boom-bust cycle. Yet given available data, it's impossible to isolate the factors that contributed to the decline. Clearly other macroeconomic issues played a crucial role. Some energy experts maintain the PTC was largely irrelevant in those years.

After 2004, the PTC may have contributed to growth in the wind market, but so did State policies mandating renewables. Wind benefited from rising natural gas prices as well (over $5 per million BTU) making wind power contracts an attractive way to displace higher-cost natural gas generation.

By the middle of 2008 the US economy stumbled and energy prices dropped off quickly. With incomes falling, tax-based policy incentives lost much of their effectiveness as tax equity investors disappeared. Section 1603 cash grants created under the 2009 stimulus were designed to fill the void.

In a press reports this month, AWEA CEO Denise Bode credited the industry's recent growth to the fact that the PTC has not expired for the past five years. This is not accurate. The vast majority, of the wind built since 2008 through to the end of 2012 is directly tied to Section 1603 grant funding.

But with 1603 now expired the wind industry has again turned its attention to extending the production tax credit (PTC). Ditlev Engel, chief executive officer of Vestas Wind Systems A/S complained that US turbine sales may "fall off a cliff"[14] unless lawmakers extend tax credits beyond 2012.

Turbine sales may decline but not because of the PTC.

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[13] http://www.slideshare.net/FNian/asian-financial-crisis-presentation (Slide 26)

[14] Bloomberg News, US wind market set to 'Fall Off a Cliff,' Vestas CEO says, http://www.bloomberg.com/news/2011-11-09/u-s-wind-market-may-fall-off-a-cliff-in-2013-vestas-ceo-says.html

The 2008 recession slowed economic growth causing demand for electricity to drop. Many States, including California[15], are now signaling their renewable mandates are being met which will weaken demand for wind. Recent discoveries of abundant shale gas reserves are expected to keep gas prices low and stable through to 2020 and likely longer. Since natural gas is among the important elements in determining the competitiveness of wind, low gas prices will generally reduce wind's attractiveness as a 'fuel saver'. In fact, the Energy Information Administration is forecasting flat growth[16] in the wind sector for the next ten years regardless of what happens with the PTC.

The production tax credit largely benefits corporate investors and wind project owners. For investors like General Electric, the credit is an open-ended subsidy[17] offered for each kilowatt-hour of electricity produced. Because the PTC directly reduces the amount of federal income taxes paid, it should be thought of as providing 2.2¢/kWh of after-tax income (in 2011 dollars).

This represents a pre-tax value of approximately 3.7¢/kWh (assumes a 40% marginal tax rate). When measured relative to the price of wholesale power, the PTC is exceptionally generous.

Claims by AWEA of wind being at cost parity with non-renewable resources should not be taken on face value.

For consumers, the production tax credit disproportionately benefits ratepayers in States with renewable energy mandates by distributing the high cost of wind to taxpayers at large. And since the subsidy is uniform across the country it's highly inefficient, supporting poorly sited projects as well as projects that would have been built regardless of the credit. This is certainly true in Texas and the Pacific Northwest where wind exceeds transmission capacity, in New York where average annual capacity factors are under 25% and in New England where utilities routinely sign long-term power contracts at prices significantly above market.

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[15] Letter by Michael Picker, Senior Advisor to the Governor of California for renewable energy facilities, to the Western Electricity Coordinating Council, http://www.windaction.org/documents/33056

[16] EIA Table 16. *Renewable Energy Generating Capacity and Generation*, http://www.eia.gov/forecasts/aeo/er/tables_ref.cfm

[17] Congressional Joint Committee on Taxation, May 2005, *Present Law And Background Relating To Tax Credits For Electricity Production From Renewable Sources*, http://www.jct.gov/publications.html?func=startdown&id=1579

b. Section 1603 vs. PTC

The Section 1603 cash grant program enabled developers to secure direct monetary outlays from the Federal government to cover 30 percent of a project's qualifying cost. The criteria for receiving the grant were not onerous and the Treasury Department was prohibited by law from ranking the projects before distributing the funds.

Spanish energy giant Iberdrola Renewables, Inc. received over a billion dollars in cash grants alone. A preliminary evaluation[18] of the grant outlays published by Lawrence Berkeley National Laboratory (LBNL) in 2010 found that 61% of the grants distributed through to March 2010 "likely would have deployed under the PTC [production tax credit] if the grant did not exist." In many cases, money went to projects that were already under construction, and in some cases already producing electricity. Wind developers whose projects received Section 1603 money complained[19] that it was unfair to criticize them for taking the funds because their projects otherwise would have received the production tax credit. They insisted the cost to the taxpayers was not materially different.

Aside from the obvious intrinsic value of cash in hand versus tax credits earned over a period of ten years, I was prompted to look further into the numbers themselves to test the claim of equivalence.

I looked at two operating geothermal facilities, five operating onshore wind energy facilities and five approved, but not built wind projects including two offshore applications.

Exhibit 3 shows my findings. In all cases, cash grants that were (or will be) distributed exceeded anticipated production tax credit amounts in total by over one-half billion dollars. In general, projects with greater development costs (more than $2150/kw for wind) and/or lower average capacity factors (under 30% for wind) received substantially higher benefits from the cash grant

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[18] Lawrence Berkeley National Laboratory Bolinger, M., Wiser, R., Darghouth, N., *Preliminary Evaluation of the Impact of the Section 1603 Treasury Grant Program on Renewable Energy Deployment in 2009,* http://eetd.lbl.gov/ea/emp/reports/lbnl-3188e.pdf

[19] The New York Times, *Stimulus Cash Flowed to Completed, Under-Way Renewable Energy Projects,* http://www.nytimes.com/gwire/2010/10/14/14greenwire-stimulus-cash-flowed-to-completed-under-way-re-95989.html?pagewanted=all

than the current PTC. To keep the table simple, I did not apply a 7.5% discount rate to the production tax credit. If I had, the monetary differences of the two programs would have been more stark since the cash grant is received at the start of the operational life of a renewable energy project.

With upfront cash grants developers have minimal incentive to negotiate lower prices with suppliers. In fact, the more expensive a project is to construct the better for vendors, contractors and developers.

There are other qualitative benefits under the cash program which shift the rewards to developers while laying project debt and risk at the feet of American taxpayers. Unlike the PTC, the cash grant is not dependent on project performance. If a project's capacity factor is marginal the public still grants the cash. Projects that would normally not meet financial threshold requirements are apt to get built anyway. The Section 1603 program substitutes government payments for private investments after which the government just walks away.

c. The high cost of subsidizing wind

Since the PTC was adopted in 1992, its annual cost has ballooned from $5 million a year in 1998 to over $1 billion annually today. Even if the PTC were to sunset, taxpayers are still obligated to cover nearly $8 billion in tax credits for wind projects built in the last decade. (Exhibit 4) This is in addition to the over $15 billion paid out or accruing for projects built under Section 1603.

Exhibit 4 compares yearly installations of wind under the PTC and 1603 and looks at the cost of each subsidy. If the goal of a subsidy is getting wind turbines erected in the US, Section 1603 is the more aggressive program for driving development. But the grants under 1603 are excessive.

The New York Times examined the government largess secured by Canadian investment giant Brookfield Asset Management for its Granite Reliable Wind park, a 99 MW facility now under construction in northern New Hampshire. According to the Times, the project "will receive so many subsidies for a New Hampshire wind farm that they are worth 46 percent to 80 percent of

the $229 million price of the project, when measured in today's dollars"[20]. Brookfield received subsidies under Section 1603, Section 1705 (partial loan guarantee), and the Modified Accelerated Cost-Recovery System (MACRS)

3. Wind energy and jobs claims

In 2007, the AWEA touted that the industry represented 50,000 direct and indirect jobs in the US, a figure that jumped to 85,000 in 2008 but by 2010 dropped to 75,000 with roughly 20,000 in the manufacturing sector.

AWEA's 2010 annual report lists pages of facilities it claims are US Wind Industry Manufacturing Facilities. Of the 450+ facilities listed, a less than 75 represent plants dedicated to building turbine parts (blades, towers, nacelles) including Vestas and Gamesa plants in Colorado and Pennsylvania respectively. The rest build components for industrial uses. Many have been in business for decades and their sole business is not wind-specific. AWEA omits any details showing the percentage of each company's gross revenues tied to the wind industry so verifying job counts is not possible.

Wind construction jobs are not permanent so the industry would need to reach peak levels of development year after year just to maintain current job levels. When installations dropped in 2010, it was no surprise that jobs dropped as well. And since growing the manufacturing base is predicated on installing more wind turbines it's difficult to envision a scenario where job growth is sustainable.

This month, NREL released a report entitled *Preliminary Analysis of the Jobs and Economic Impacts of Renewable Energy Projects Supported by the §1603 Treasury Grant Program*[21]

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[20] New York Times, Lipton, E. and Krauss, C., *A Gold Rush of Subsidies in Clean Energy Search*, http://www.nytimes.com/2011/11/12/business/energy-environment/a-cornucopia-of-help-for-renewable-energy.html?_r=1&pagewanted=all

The wide range reflects a disagreement between the experts on the future price of electricity in New Hampshire. Brookfield received subsidies under Section 1603, Section 1705 (partial loan guarantee), and Modified Accelerated Cost-Recovery System (MACRS) as well as state and local benefits.

[21] NREL April 2010, *Preliminary Analysis of the Jobs and Economic Impacts of Renewable Energy Projects Supported by the §1603 Treasury Grant Program* http://www.nrel.gov/docs/fy12osti/52739.pdf

which examined the impact Section 1603 had on job growth and development for the wind and PV solar industries.

Using a modified version of its JEDI model to enable modeling on a national level, NREL estimated that 1603 grants for *both* wind and PV solar projects supported between 52,000 and 75,000 direct and indirect jobs annually. For wind alone, average jobs per year were between 44,000 and 66,000. It's difficult to map NREL's results to AWEA's job numbers but it would appear that job growth in the wind industry since Section 1603 has declined.

But that's only part of the jobs tale.

In 2010, the State of Vermont published the results of its study[22] to evaluate the consequences of adding just 50 megawatts of renewable energy at prices that were higher than market-based alternatives.

The analysis found the *Feed in Tariff* program would increase Vermont capital investment and create jobs during its 26 year life cycle, however, the net gain in employment was found to be far less than conventionally thought. Following an initial increase in temporary construction-related jobs, long term employment would average thirteen full time jobs per year, including both direct and indirect employment in the energy sector as well as the job and income related effects of increased electricity costs. But other sectors, predominately service sectors, would suffer long term net job losses. In essence jobs would be created in one sector of the Vermont economy at the expense others.

But job transfer was not the only finding reported from the study. The model also showed that above-market energy costs due to higher electricity prices would have the deleterious effects of "reshuffling consumer spending and increasing the cost of production for Vermont businesses" and that "increased costs for households and employers would reduce the positive employment impacts of renewable energy capital investment and the annual repair and maintenance activities".

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[22] The Economic Impacts of Vermont Feed in Tariffs
http://publicservice.vermont.gov/planning/DPS%20White%20Paper%20Feed%20in%20Tariff.pdf

NREL's report makes clear (footnote 2) that its analysis omits any evaluation of job displacement or loses due to wind and PV solar development under Section 1603. In essence, NREL modeled benefit of 1693 without acknowledging any cost.

4. The hidden subsidies for wind power

Independent of the PTC and Section 1603, millions of public dollars have been spent supporting wind power development in the US. One example is the work undertaken by DOE, FAA and the DOD to evaluate and try to mitigate for the impacts of large-scale wind turbines on military and navigational radar in the US. By 2008, nearly 40% of our long-range radar systems were already compromised by wind turbines[23]. We've doubled our wind capacity since then but the problem of radar interference persists.

Our military services and federal agencies have conducted numerous studies on the radar question, as have multiple international military and private interests[24]. Not all studies agree on levels of severity and potential mitigations, but all agree that large scale industrial wind turbines have the potential to negatively affect military installations, radar, and navigation aids.

According to Raytheon lead radar engineer, Peter Drake[25], radar mitigation technology does not yet exist: ' ...These things [wind turbines] inside of 20 miles, look like a 747 on final approach, the trick for us is to somehow make them disappear, while still being able to see a real 747...we have not figured that out yet.'

While most of the information pertaining to turbine interference is not readily available to the public, the below situations are known:

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[23] Long Range Radar Joint Program Office Wind Farm Brief
http://www.windaction.org/?module=uploads&func=download&fileId=2178 (Slide 3)

[24] Report to the Congressional Defense Committees, *The Effect of Windmill Farms On Military Readiness 2006*, http://www.defense.gov/pubs/pdfs/windfarmreport.pdf

[25] NAS Kingsville Wind Farm Effects on Air Traffic Control and Compatible Siting Collaboration
http://growinggreencommunities.com.ismmedia.com/ISM3/std-content/repos/Top/Text%20Blocks/Speakers/Presentations/AP/AP%20McLaughlin.pdf

a. **Travis AFB.** The Travis Midair Collision Avoidance (MACA) pamphlet[26] warns that wind farms southeast of the base interfere with primary radar. Pilots are urged to fly with their transponders on to be seen by the secondary radar system (SSR) installed at air traffic control facilities. Transponder-only airspace but relies on pilots complying with the warning. Recreational pilots may not remember to comply or their aircraft might not be adequately equipped. SSR also assumes pilots want to be seen.

b. **Naval Air Station Kingsville, Texas (NASK).** Despite proposed technical mitigations, documentations released by the Texas Comptroller's office recommended[27] that at least one school district near NASK deny special tax treatment for a wind project due to impacts at NASK radars. NASK trains 50% of our US naval aviators.

It is critical that Congress investigate this issue more closely and fully ascertain the costs in dollars and reduced radar surveillance occurring due to wind development. We can easily define and quantify the cost of subsidies like the PTC and 1603, subsidies meant to support renewable energy. Such hidden subsidies, however, are easily kept from public view but the risk to our national security and military readiness is far more impacting.

5. Summary

a. The Department of Energy's goal of 20% wind by 2030 is entirely independent of our need for reliable power plants. No amount of wind installed in the US will result in an existing power plant being decommissioned nor will it negate the need to build reliable generation. Wind is being installed to generate low-emissions energy.

b. The cost and impacts of achieving 20% wind in the United States, including 54,000 MW offshore are staggering and not realistic.

c. The production tax credit disproportionately benefits ratepayers in States with renewable energy mandates by distributing the high cost of wind to taxpayers at large. And since the

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[26] Travis Midair Collision Avoidance (MACA) pamphlet, http://www.windaction.org/?module=uploads&func=download&fileId=2180 (Page 8)

[27] Economic impact evaluation of wind turbines in the vicinity of the Naval Air Station Kingsville http://www.windaction.org/documents/34352

subsidy is uniform across the country it's highly inefficient, supporting poorly sited projects as well as projects that would have been built regardless of the credit.

d. Section 1603 cash grants shift the rewards to developers while laying project debt and risk at the feet of American taxpayers. The cash grant is not dependent on project performance. Even project with marginal capacity factor still receive the cash. Projects that would normally not meet financial threshold requirements are apt to get built anyway.

e. Since the PTC was adopted in 1992, its annual cost has ballooned from $5 million a year in 1998 to over $1 billion annually today. Even if the PTC were to sunset, taxpayers are obligated to cover nearly $8 billion in tax credits for wind projects built in the last decade. This is in addition to the over $15 billion paid out or accruing for projects built under Section 1603.

f. In 2007, the AWEA claimed 50,000 direct and indirect jobs in the US, a figure that jumped to 85,000 in 2008. By 2010, jobs dropped to 75,000 with roughly 20,000 in the manufacturing sector.

g. Independent of the PTC and Section 1603, millions of public dollars have been spent evaluating and trying to mitigate for the impacts of large-scale wind turbines on military and navigational radar in the US. Developers have been asked to provide some funding but there are no clear rules for establishing funds and how costs can be shared between developers.

Chairman BROUN. Thank you, Ms. Linowes. I appreciate it very much. I appreciate your testimony.

I want to remind Members that Committee rules limit questioning to five minutes per Member. And the Chair at this point will open the first round of questions. And I will recognize myself for five minutes.

Dr. Thorning, how have U.S. household electricity bills changed in the recent years?

Dr. THORNING. They have gone up substantially. In fact, the average household bill has gone up by almost $1,420 a year in 2010 compared to earlier years. The last eight or so years they have gone up—the last five years they have gone up about 30 percent. And last year, they increased even more in spite of the fact that there is increased natural gas electric generation going on. So household electricity prices have risen sharply, especially in States that have implemented a renewable portfolio mandate.

Chairman BROUN. Thank you, ma'am.

To me, this is not fair. It is not fair to the poorest people in this country and senior citizens on limited incomes that we are forcing their electric bills to go up because of us forcing the renewable energy when we have lots of natural gas.

Also to Dr. Thorning, how does the cost of electricity generated by wind and solar in 1603 grants compare to conventional electricity costs?

Dr. THORNING. According to the Treasury's data, it is 14 times more expensive than the generation cost for, say, advanced coal—advanced natural gas powered plants. In fact, the EIA data show that advanced natural gas plant is $62 per megawatt hour for the generating capacity; it is $880 for the wind and solar generating capacity financed through the 1603(b) programs.

Chairman BROUN. Dr. Zycher, the nonpartisan Congressional Budget Office recently issued a report which stated tax incentives are "generally an effective way to reduce environmental and other external costs of energy." And "they often reward businesses for investments and actions they intended to take anyway." How can the government guarantee that taxpayer money is actually incentivizing the private sector rather than just lining the coffers of preferred companies?

Dr. ZYCHER. Well, you can always structure an incentive to induce a firm to do something you want it to do. Just to pick one obvious example that we have already discussed here, the PTC provides an incentive to produce electricity. The Section 1603 grant provides an incentive to build facilities, independent of whether any electricity is produced at all.

On the environmental front, I really would make a different point, if I may. The argument that wind and solar power reduce pollution is simply wrong because they are so unreliable that they require the installation of backup capacity power, either by coal or natural gas, and so there was a BENTEK engineering study of Colorado and Texas which found that pollution problems—or effluence actually went up because of the inefficient operation of the backup capacity, which had to be fired up and down depending whether the wind was blowing that day or not. And so I think that the argument that there is some sort of environmental advantage to re-

newable sources of electricity is sort of based on people ignoring the environmental problems caused by renewable electricity.

Chairman BROUN. Very good. Mr. Resch, last month, the U.S. Department of Commerce made a preliminary determination in response to a case brought by SolarWorld Industries America Inc. that China's subsidization of solar exports in the U.S. market is illegal and warrants trade remedies. How might the imposition of tariffs aid domestic manufacturers?

Mr. RESCH. Thank you, Chairman. What we see in the solar industry today is a global industry and that we are exporting products from the United States to China, we are importing products from China to the United States, Europe, around the world, and so ultimately the tariff will not have an impact. There is a global oversupply of PV products on the market today, about twice as much PV is manufactured as consumed that has led to the lower costs. But the tariffs will not have a substantial impact on the price of solar, but it will encourage companies to invest in new manufacturing in the United States.

Chairman BROUN. Mr. Erby, how would impositions of tariffs impact your cost in your business outlook?

Mr. ERBY. Not terribly, sir. Most of the companies since the ARRA program are built here in the United States, a lot of the panels are. They may be an Italian manufacturer, but they are built here in New Jersey so——

Chairman BROUN. Okay. My time is expired.

I now recognize Mr. Tonko for five minutes.

Mr. TONKO. Thank you, Mr. Chair. While you chided me for not asking any questions of the first panel, I promise you I will ask questions of this panel. And I promise also to even let the witnesses answer the question.

So, Mr. Erby——

Mr. ERBY. Yes?

Mr. TONKO. You have succeeded in growing a business with the support of Section 1603 funds. Something we hear a lot is that the government doesn't need to support solar companies because venture capital firms will step in to do that. You are in the market. What is your reaction to that?

Mr. ERBY. Unfortunately, the size systems that we build, Congressman, are 50 to 150,000 watts. It is not desirable for a venture capitalist to come in on a project this small. Everything we have done has been self-financed through credit cards, bank home equity loans, things of that nature. Even today, with the sales volume that we have, getting a venture capitalist to step in without wanting to take over a 50 percent share is almost impossible. Even being a veteran with the Patriot loans, banks are not extending credit for these products. So without the 1603, we would not exist.

Mr. TONKO. Thank you. And Mr. Resch, we are told that government subsidies to renewables are a waste of money, that we should let the market pick winners and losers. But as I said earlier, every source of energy receives subsidies. Some sources have received them for almost a century. Is it fair to expect renewable sources of energy to succeed in the market without the kind of support existing sources received and still receive?

Mr. RESCH. You know, we built this industry in solar really since 2006, and so just in a six-year time frame, we have seen the industry go from about 50 megawatts this last year, nearly 2,000 megawatts installed. It proves that this type of program works.

Now, when you look across the board at all of the various energy technologies, we as a country have made strategic investments in these industries in order to grow our economy—oil since 1916, coal since the '30s, nukes since the '50s. They have received permanent tax credits in all of those cases. Now, when we got our tax credit, we got a tax credit in the 2005 energy bill for two years and it was capped at $2,000. You can't build an industry like that. So without some kind of long-term policy that gives us enough of a vision to be able to attract investment and lower our costs, it is going to be difficult. It is absolutely critical we keep these programs in place.

Mr. TONKO. And to you also, Mr. Resch, what are the international consequences of not supporting our wind and solar industries? If we don't have a domestic market for these products, are we likely to hold on to a manufacturing base for them?

Mr. RESCH. No, absolutely not. The manufacturing jobs will go overseas in a heartbeat. I mean these are industries that were invented in the United States but are rapidly being commercialized by the Germans, the Japanese, and the Chinese. And you tend to build your factories where your markets are. That is exactly what we have seen in the United States. That is why we have 600 manufacturing facilities that support the solar industry, because we have a rapidly growing solar market. You kill the market for solar or wind in this country, those factories will go out of business and they will go to China, they will go to other countries. And they will own not only the manufacturing jobs but also the intellectual property and all the growth of these industries in the future.

Mr. TONKO. Um-hum. And Mr. Erby, you are out in schools and businesses and municipal offices all the time. You indicated the growing number of customers that your company has secured. Describe the receptivity, if you will, of the community to solar energy.

Mr. ERBY. They have been overwhelmingly positive. In fact, this month, we have a sales quota internally of 300,000 watts per month. We achieved that on the third day of the month—we hit our sales quota for the month. So the communities are embracing it. We had a system we turned down at a school the other day, and the Superintendent, Bob Peron, was supposed to throw the switches and turn it on. He actually, just before we were going to do it, he goes hold it, hold it. Wait. And he ran in the school and he come back out a few minutes later with a young girl he wanted to turn the system on because she wants to study the renewable energy and she is applying to colleges. That excitement was—just made me smile ear to ear. I mean he went running into that school and pulled her right out of class and that is what we see. We just cannot answer the phone quick enough. The community wants this and that is prevalent, or relevant, in the number of sales that we have achieved.

Mr. TONKO. And thank you.

And Mr. Royer, in terms of the support for our wind and solar industries, and the whole question about the manufacturing of

those systems here, if we don't have a domestic market, your response to that?

Mr. ROYER. Yeah, exactly as what we have already heard. In fact, you know, we have scaled this industry up to 400 companies like my company, nearly 500 companies now in the last four years. I went from 11 employees to 380 employees. So without continuation of this industry, these jobs are going to be lost. The numbers I said are very reflective of my company starting in the fall of this year without the PTC.

Mr. TONKO. Thank you so much, sir.

Thank you, gentlemen.

Chairman BROUN. Thank you, Mr. Tonko.

And I recognize Dr. Harris for five minutes.

Mr. HARRIS. Thank you very much, Mr. Chairman. And I want to thank you again for holding the hearing.

And I am going to apologize to Mr. Royer and Mr. Erby right up front for the false promise that the American government has made to your companies. It basically has created a program that means that you got to come and beg to the government for the continuation of your livelihoods. And so I am going to apologize up front for that. That is terrible public policy, but that is what we live with.

Now, Mr. Resch—and I am going to apologize to Dr. Thorning because my numbers I am going to use are a little lower, because I am going to use the EIA numbers. Do you argue against the—this is the levelized cost of electricity generating technologies—in 2016—that is their estimate—that solar PV will be over 20 cents a kilowatt hour. Is that the levelized cost?

Mr. RESCH. No, it is not.

Mr. HARRIS. And so have you written——

Mr. RESCH. It is not that high.

Mr. HARRIS [continuing]. To the EIA and complained about this?

Mr. RESCH. We do on a regular basis——

Mr. HARRIS. Okay.

Mr. RESCH [continuing]. With EIA and try to get——

Mr. HARRIS. What do you think it is, the levelized cost without subsidies, levelized cost, what are you thinking?

Mr. RESCH. The levelized cost today is below 15 cents.

Mr. HARRIS. Okay. And what do you think it is for natural gas at $1.95 a million BTU in an advanced combined cycle natural gas facility?

Mr. RESCH. Chairman Harris——

Mr. HARRIS. What do you think it is?

Mr. RESCH [continuing]. I have worked in this——

Mr. HARRIS. Mr. Resch, what do you think it is?

Mr. RESCH. I worked in the natural gas industry before I came to——

Mr. HARRIS. What do you think it is?

Mr. RESCH [continuing]. Solar and I can tell you one thing about natural gas——

Mr. HARRIS. Mr. Resch, do you know what it is? It was 6 cents when natural gas was over $5 a million BTU. What do you think it is at $1.95 a million BTU? Don't beat around the bush. You worked in the industry. It is under 5 cents.

Mr. RESCH. What it should be is about——

Mr. HARRIS. It is 1/3 the cost.

Mr. RESCH [continuing]. Four cents per kilowatt hour.

Mr. HARRIS. Four cents?

Mr. RESCH. That is right.

Mr. HARRIS. One-fourth. Now, Mr. Resch, who is going to pay that difference? My ratepayer and my taxpayer in my district? Who is going to pay that difference for an inefficient delivery of an electric—of electric generation to my seniors and my veterans and my schools because my school system has got to pay three times as much for their power they don't have as much for books and they don't have as much for teachers? Who is going to pay it? We have a $1.3 trillion deficit. We have to borrow that 1603 money from China. Mr. Resch, you are smiling there——

Mr. RESCH. Because your numbers are wrong.

Mr. HARRIS. Why are you smiling?

Mr. RESCH. Mr. Chairman, with all due respect——

Mr. HARRIS. Mr. Resch, we have a $1.3——

Mr. RESCH [continuing]. You are speaking about natural gas——

Mr. HARRIS. Mr. Resch, excuse me.

Mr. RESCH [continuing]. Which is wholesale generation——

Mr. HARRIS. It is my time——

Mr. RESCH [continuing]. And solar electricity——

Mr. HARRIS. Mr. Chairman——

Mr. RESCH [continuing]. Is generated——

Mr. HARRIS [continuing]. Would you remind the witness——

Mr. RESCH [continuing]. Distributed generation.

Mr. HARRIS [continuing]. It is my time, not his. Mr. Resch, you had your five minutes; now I get mine. Now, you are sitting there smiling because we have a $1.3 trillion deficit. You are coming to ask us to borrow money from China to pay for——

Mr. RESCH. Not at all. That is not what we are asking at all.

Mr. HARRIS. Where do you think we are going to get this money? Do we just print it over at the Treasury? Oh, actually, we might. Mr. Resch, and you are sitting and grinning again, but people in my district don't grin about a $1.3 trillion deficit. They don't grin about paying three times as much for energy that you want to force them to pay in higher taxes and higher rates. Now, you might think that is funny——

Mr. RESCH. It is not.

Mr. HARRIS [continuing}. But the taxpayers and ratepayers in my district don't.

Mr. RESCH. It is not accurate.

Mr. HARRIS. What is disturbing is you sit there——

Mr. RESCH. What you are saying is not accurate, Chairman. It is not accurate.

Chairman BROUN. Mr. Resch, Mr. Resch——

Mr. HARRIS. You can reply in writing.

Chairman BROUN. Mr. Resch, would you just——

Mr. HARRIS. Dr. Thorning——

Chairman BROUN. Dr. Harris, suspend just for a moment. I know you feel a little attacked, but please allow the gentleman to ask questions and please answer the questions.

Mr. RESCH. If I am asked a question, I am happy to answer it.

Chairman BROUN. Well——

Mr. TONKO. Mr. Chairman, if I might, I think there should be a decorum here that at least shows respect to our witnesses. They have come—traveled the long miles to be here and there should be a sign of respect for the witnesses that are here.

Chairman BROUN. Well, thank you, Mr. Tonko.

Mr. TONKO. We are here to glean information, and I would think if they are asked a question, they should respond.

Chairman BROUN. Well, I think Dr. Harris is trying to get some information and the witness——

Mr. TONKO. Harassing the witness is not asking a question.

Chairman BROUN. Okay. Thank you, Mr. Tonko.

Dr. Harris, you may continue.

Mr. HARRIS. Thank you very, very much.

Dr. Zycher, are my figures wrong? Is in fact this an incredible economic inefficiency to force Americans to pay—and I will tell you, Mr. Resch, I am going to go with the EIA numbers more than four times as much for their energy to subsidize an inefficient industry. Am I wrong somewhere here? Can we compete in a world economy paying four times as much for energy?

Dr. ZYCHER. I—well, no. I would say—you are absolutely right, but I would say it a bit differently. The rationales have been offered in support of subsidies for very expensive power are uniformly wrong. The green jobs argument, the sustainability are all the ones I talked about in my oral testimony here today in the testimony for the record. There is simply no—and all the hand waving in the world cannot erase the fact renewable power is very, very expensive. It is not cleaner. That is simply a myth. And somebody has to pay for it, ultimately, either taxpayers or ratepayers.

Mr. HARRIS. Sure. Doctor, do you think that the student who is just running up to pull that switch was told that that power was at least four or five, six, seven times more expensive than the power and was taking money from taxpayer and ratepayer dollars that could be used for something else in the economy? Do you think Americans understand that without a subsidy and even with a subsidy how expensive this power is?

Dr. ZYCHER. Well, I don't know. The surveys of taxpayer attitudes on this are varied. It is certainly—I would be rather surprised if that student were informed of the realities of the relative cost. At a more general level, it is certainly true that there has been a decades-long effort to propagandize students on green politics, which I think has been quite destructive.

Mr. HARRIS. I couldn't agree with you more and I see it in my children's textbooks that they bring home.

Thank you, Mr. Chairman.

Chairman BROUN. Thank you, Dr. Harris.

I recognize Mr. McNerney for five minutes.

Mr. MCNERNEY. Thank you, Mr. Chairman.

Mr. Resch, I apologize for the attempt at intimidation that we just witnessed.

Mr. Royer, you seemed to address the domestic production issues, but wouldn't it be true to say that developing superior technology here in the United States will open up significant opportunities for U.S. export and manufacturing?

Mr. ROYER. Yes, and actually it already has. In fact, I am entertaining an order of my business right now that will result in a project that is going to Uruguay, for example. Many of my customers are not only looking at sales of equipment in the United States but the rest of the Americas as we speak. Exactly the project I just mentioned, for example.

Mr. MCNERNEY. Thank you.

Mr. Erby.

Mr. ERBY. Yes, sir.

Mr. MCNERNEY. In your testimony, you concluded—I concluded from your testimony that the 1603 Program has been very helpful in helping startups getting established.

Mr. ERBY. Correct.

Mr. MCNERNEY. Could you comment on that?

Mr. ERBY. Correct. It has made a level playing field, if you will. We cannot compete with the national companies. With a startup industry, we need this leg up, if you will, to get started in this industry. And the overall response that we are finding is the American people want this, and that is proven in our sales.

Mr. MCNERNEY. And both—as a comment, both Democratic and Republican politicians point to small businesses as the job creators of this country, so thank you for what you are doing, and I hope that we can continue that sort of program.

Ms. Linowes, I hope I am not mispronouncing your name.

Ms. LINOWES. It is Linowes.

Mr. MCNERNEY. Linowes, thank you for your thoughtful testimony and also for recognizing my concern about the political nature of this hearing. I do have a question, though, that concerns me about your organization—the Industrial Wind Action Group. Does that group, IWAG, receive any money from oil companies or gas companies or coal companies?

Ms. LINOWES. We do not. I am probably the only person in the room not being paid to be here. I don't represent anyone. The organization does not pay to present anyone else's views. My views and—represent tens of thousands of people who have been negatively impacted by Section 1603 because——

Mr. MCNERNEY. In your opinion, that is. You said tens of thousands of people that are negatively impacted. That is, in your opinion, they are being natively impacted.

Ms. LINOWES. It is not my opinion. I have worked directly with these people. We have——

Mr. MCNERNEY. Tens of thousands of people?

Ms. LINOWES. Yes, I have a network of organization by—that is networked across the country. Each State has key people that have their own people that have contacts with people that live within the vicinity of wind energy facilities, and we have easily collected names from tens of thousands of people. I am not making that number up.

Mr. MCNERNEY. Well, I would like to see a little more transparency in your organization's funding if you are going to be making those kinds of claims.

Ms. LINOWES. We are not funded——

Mr. MCNERNEY. You also claim——

Ms. LINOWES. I have no money.

Mr. MCNERNEY. You also claim that the Production Tax Credit will—that allowing the Production Tax Credit to expire will lead to significant—will not lead to significant economic damages, but I strongly disagree. I think it is, during a time of economic difficulty, to pull the rug out from any number of people in the clean energy sector is a travesty. And I think that is going to be the impact of this expiration.

Ms. LINOWES. May I clarify my point on that?

Mr. MCNERNEY. Sure.

Ms. LINOWES. It is not the Production Tax Credit that is driving wind energy development. What is driving wind energy development are natural gas prices and the mandates, the State mandates, the RPS policies. And the—each case—in each situation where the Production Tax Credit was allowed to expire, at those same instances we also had extremely low gas prices, and we also had—we didn't have that many RPS policies in place. So the demand for wind wasn't there and the gas prices were too low to justify anyone going out and building wind. The only time that we saw wind energy actually going up when there was a threat of PTC was back in 2008, when we had gas prices, again, up—and these are transportation gas prices—up around $4 a gallon. And at that time, there is a connection between gas and natural gas and when the transportation prices were up, so was gas prices. But——

Mr. MCNERNEY. All right. I just want to move on to Mr. Zycher.

And you argued that renewable energy is flawed because it is intermittent and a few other reasons. But I would say with complete confidence that any energy source has its problems and difficulties. Some of us are concerned about global warming, about groundwater pollution. It is very appropriate that we look at these energy sources on a level playing field and decide on economic and environmental basis what is the best long-term vision for our country.

You had a fairly impressive list of economic erroneous projections, and I applaud you for that——

Chairman BROUN. The gentleman's time is expired. I am sorry.

Mr. MCNERNEY. All right.

Chairman BROUN. If you have——

Dr. ZYCHER. I would be happy——

Chairman BROUN. Dr. Zycher, you could very quickly answer the question, please do.

Dr. ZYCHER. Which erroneous projections are you talking about, if I may ask?

Mr. MCNERNEY. Oh, you had a whole list of erroneous projections——

Dr. ZYCHER. Well, could you name one for me?

Mr. MCNERNEY. That you—well, the projections of running out of oil and so on that you had a whole list of projections that showed that——

Dr. ZYCHER. No, I said that the argument that the world is going to run out of oil and that justifies——

Mr. MCNERNEY. Right.

Dr. ZYCHER [continuing]. Is itself incorrect.

Mr. MCNERNEY. But my comment is that it is a lot easier to project the present than the future. Everyone makes mistakes

when they project the future, and we should be very much on guard about these kinds of projections.

Chairman BROUN. The gentleman's time is expired.

Mrs. Adams, you are recognized for five minutes.

Mrs. ADAMS. Thank you, Mr. Chairman. And I have just been sitting here listening.

And Mr. Resch, it is interesting; facts are stubborn things, you know. You have heard that old saying, but can you tell me 4 cents versus approximately 96 cents a kilowatt? What is the better value for the American people?

Mr. RESCH. Well, if those were the facts, then I would say 4 cents is but that is not the fact. Remember, solar is distributed generation. It generates at the point——

Mrs. ADAMS. Mr. Resch——

Mr. RESCH [continuing]. Of consumption so you are continually retailing——

Mrs. ADAMS [continuing]. This is the time I have, okay?

Mr. RESCH. Okay. I am answering——

Mrs. ADAMS. And I am not going——

Mr. RESCH [continuing]. Your question.

Mrs. ADAMS [continuing] To be filibustered. I just asked you one simple question and then you said those are not the facts. But I was sitting here when you said you thought it was about 4 cents. Are you changing that cost analysis now?

Mr. RESCH. Four cents is for wholesale——

Mrs. ADAMS. Thank you——

Mr. RESCH [continuing]. Generation——

Mrs. ADAMS. Thank you——

Mr. RESCH [continuing]. Solar is retail generation. You cannot compare the two.

Mrs. ADAMS. So what would wholesale——

Mr. RESCH. You don't pay 4 cents at your house. You pay 16 cents at your house because it is generated at power plant, it goes through——

Mrs. ADAMS. So 16 cents versus——

Mr. RESCH [continuing]. Transmission lines through utilities and taxes——

Mrs. ADAMS [continuing]. Ninety six cents, tell me that?

Mr. RESCH. Solar today is less than that. Solar today, as I pointed out before, is about 20 cents or less per kilowatt hour distributed generation. It is not 96.

Mrs. ADAMS. Well, the—Dr. Harris has the research and the information, and apparently you disagree with the companies so we will move on. But I, you know, this——

Mr. RESCH. I represent the industry. These are the facts——

Mrs. ADAMS. Mr. Resch——

Mr. RESCH [continuing]. Of the industry.

Mrs. ADAMS. —I currently hold the time.

Mr. RESCH. Fine.

Mrs. ADAMS. And I have five minutes and I plan on getting my questions answered.

Dr. Thorning or Dr. Zycher, Dr. Sherlock's testimony earlier said, "for renewable energy projects with longer planning horizons tax uncertainty might prevent marginal projects from moving for-

ward"—marginal projects. Can you speak to how the possibility of increased capital gains and dividend tax rates and marginal income tax rates impact the perception of the tax certainty for energy firms?

Dr. THORNING. Yeah, I will take a shot at that. Increasing the capital gains tax rate from the current 15 percent to 20 percent and dividends up to 39.8, which is what is going to happen at the beginning of 2013 will certainly raise the cost of capital and the hurdle rate for new energy investments but for all investments and is likely to have a negative impact on overall investment.

Mrs. ADAMS. And would likely cause utility bills to do what?

Dr. THORNING. Well, it will certainly mean that any new utility project is going to have to earn a larger rate of return, so that will have to be passed on to utility customers, households, and industries.

Mrs. ADAMS. Well, I can tell you, in our district I think my constituents believe that utility bills are high enough but not too high. So Dr. Thorning, how would you reduce—how would reducing the overall corporate tax rate influence the global competitiveness of American energy firms?

Dr. THORNING. I think it would be helpful. Lowering the corporate tax rate would certainly tend to reduce the cost of capital. Each new investment would have a lower hurdle rate so more investments would occur. However, if at the same time you reduce the corporate tax rate and eliminate accelerated depreciation deferral, LIFO, other provisions that are currently in the code, those have an offsetting impact. As you know, the Bowles-Simpson plan proposed to eliminate most deductions that companies use. So those—it is going to be a tradeoff and, you know, one would have to look carefully at what the cost of—what you have to give up to lower the corporate tax rate.

Mrs. ADAMS. So Dr. Sherlock's testimony states, "ideally, the energy tax policy should be designed to allow markets to choose which technologies best meet energy policy objectives." If America's energy policy objective were to provide the cheapest form of energy, what would such an energy tax policy look like?

Dr. THORNING. Well, there should be neutrality in the tax code, provisions that are available like accelerated depreciation, LIFO, Section 199 should be available to all types of energy investments. We need a level playing field.

Mrs. ADAMS. And Dr. Zycher, presumably the reason for tax subsidies for projects to reduce carbon dioxide emissions is to reduce possible impacts from global warming. Has anyone calculated what lower baseline carbon emissions specifically from these projects would mean to global warming?

Dr. ZYCHER. Yeah, there are a number of projections. Pat Michaels at Cato has done that, Chip Knappenberger at—I forget the name of his institution—has done that. There have been various—essentially, the policies being proposed by the IPCC audience for want of a better term if implemented by the entire industrialized world, including China and India, would have the effect of reducing global temperatures if you believe the IPCC models—which I don't, by the way, but if you do believe them—by an amount that is im-

perceptible over the next century. It is all cost and no benefit even under the terms of the IPCC models.

Mrs. ADAMS. All cost, no benefit.

Dr. ZYCHER. Right.

Mrs. ADAMS. My time is expired. I yield back.

Chairman BROUN. Thank you, Mrs. Adams.

I want to thank the witnesses for your valuable testimony and the Members for their questions. The Members of either Subcommittee may have additional questions for you all, for the witnesses and we will ask you to respond to those in writing. The record will remain open for two weeks for additional comments from Members.

The witnesses are excused and the hearing is now adjourned. And I thank you.

[Whereupon, at 12:33 p.m., the Subcommittees were adjourned.]

ANSWERS TO POST-HEARING QUESTIONS

ANSWERS TO POST-HEARING QUESTIONS

MEMORANDUM May 25, 2012

To: Committee on Science, Space, and Technology, Subcommittee on Investigations and Oversight
Attention: John Serrano

From: Molly Sherlock, Specialist in Public Finance, 7-7797

Subject: **Written Responses to Member Questions for the Record**

This memorandum provides written responses to Member Questions for the Record following the April 19, 2012, hearing titled, "Impact of Tax Policies on the Commercial Application of Renewable Energy Technology." The questions, as submitted, are reproduced in **bold** below followed by CRS responses.

Questions submitted by Dr. Paul Broun, Chairman, Subcommittee on Investigations and Oversight

1. **On page 12 of your testimony, you mention one concern of renewable energy tax credits is that state-level Renewable Portfolio Standards (RPS) might drive up the costs associated with federal tax incentives—as you say "tax credits might be simply be rewarding existing activity." And there is a similar concern about tax incentives for biofuels under the Renewable Fuel Standard (RFS) which has largely driven their consumption.**

   How big of a problem is this? Is there any way to estimate how much renewable energy investment is driven by state-level RPS, as opposed to federal renewable energy tax credits?

Through 2011, ethanol blenders qualified for a $0.45 per gallon tax credit, the so-called volumetric ethanol excise tax credit (VEETC). A certain amount of ethanol use is also mandated as part of the Renewable Fuel Standard (RFS).[1] A 2009 Government Accountability Office (GAO) report found that the VEETC and the RFS "can be duplicative with respect to their effects on ethanol consumption."[2] The GAO report went on to conclude that removing the VEETC would not affect ethanol consumption.

[1] For additional background, see CRS Report R40155, *Renewable Fuel Standard (RFS): Overview and Issues*, by Randy Schnepf and Brent D. Yacobucci.

[2] U.S. Government Accountability Office, *Biofuels: Potential Effects and Challenges of Required Increases in Production and Use*, GAO-09-466, August 2009, pp. 93-100, http://www.gao.gov/assets/160/157718.pdf.

Similar concerns exist regarding the relationship between state-level Renewable Portfolio Standards (RPS) and the renewable energy production tax credit (PTC). State-level RPS programs vary along a number of dimensions. Some states have mandatory renewable energy requirements, while other states have renewable energy goals that are not enforced by financial penalty.[3] Cost caps are also used in some states to limit price increases for consumers and to ensure that renewable energy resources are cost-effective to consumers.[4]

The PTC for renewable energy is more likely to be duplicative in states with stringent or binding RPS policies. If the RPS serves as a binding mandate, than renewable energy will be produced by the state to meet the mandate, regardless of cost. Thus, the mandate (not the tax credit) is motivating renewable energy production. However, in states where cost caps or less stringent mandates are in place, the PTC and the RPS may work together to promote renewable energy production. Specifically, the PTC may contribute to reduced costs for renewables, allowing the state to stay within cost caps.

Wind resource potential is also an important factor driving investment in wind energy capacity.[5] In Texas, for example, strong wind resources and tax credits have been identified as factors driving investment in wind power.[6] While Texas does have an RPS, wind power exceeds mandated levels, making the policy effectively nonbinding.[7]

Given the large degree of variation in state-level policies, and the diversity of wind site potential across the United States, empirically identifying and specifically quantifying the impact of various policies on wind capacity installations would be challenging. At this time, CRS is not aware of any studies that have attempted this specific type of analysis.

2. **Could you please comment on the use of feed-in tariffs, which guarantee renewable electricity generators the right to connect to the grid and requires the purchase of these generators' power at subsidized rates above market prices for an extended period of time? Are such tariffs economically efficient?**

The economic efficiency of a particular policy depends on the goal the policy aims to achieve. A common rationale for subsidies for renewable energy is to address environmental issues associated with the use of fossil fuels. To economists, the pollution resulting from the use of fossil fuels to generate electricity is an example of a "negative externality."[8] One option for addressing negative externalities is to impose a tax on the activity that generates the externality. By increasing the price, this tax would cause markets to internalize the costs associated with the externality, reducing pollution to economically efficient levels.

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[3] For details on state-level RPS program parameters, see the Database of State Incentives for Renewables & Efficiency, at http://www.dsireusa.org/rpsdata/index.cfm.

[4] Illinois, for example, stipulates that the retail cost to consumers for electricity under the RPS cannot exceed 0.5% of the amount paid per kilowatt-hour (kWh) during the year ending May 31, 2007.

[5] Maps illustrating wind-power potential can be found on the Department of Energy's (DOE) website, at http://www.windpoweringamerica.gov/wind_maps.asp.

[6] Sean D. Johnson and Elisabeth J. Moyer, *Feasibility of U.S. Renewable Portfolio Standards Under Cost Caps and Case Study for Illinois*, The Center for Robust Decision Making on Climate and Energy Policy, Working Paper No. 12-07, March 2012.

[7] Ibid., p. 3.

[8] In economics, an externality arises when voluntary transactions undertaken by two parties affect the well-being of a third party, and the effects on the third party are not reflected in market prices. For example, if harmful emissions are not priced, these emissions are considered a negative externality.

An alternative, but less economically efficient policy option for addressing negative externalities associated with pollution, is to subsidize non-polluting alternative energy sources. Tax subsidies for alternative energy are a less economically efficient policy option for several reasons. First, subsidies for alternative energy reduce the overall cost of electricity, encouraging additional electricity use. Second, instead of raising revenues for the government, subsidies must be financed through taxes on other economic activity. Finally, instead of directly increasing the cost of the activity to be discouraged, subsidies require the government to identify alternative technologies to receive the subsidy. Thus, there are "picking winners" concerns.[9]

As a subsidy, feed-in tariffs may be more economically efficient than general investment or production tax credits. However, feed-in tariffs are less economically efficient than a direct tax on polluting activities. Feed-in tariffs may be more economically efficient than direct tax subsidies when feed-in tariffs are designed to be paid by the ratepayer. Feed-in tariffs that are financed through higher electricity prices decrease the overall demand for electricity, whereas general investment and production tax credits reduce the overall prices (and thus increase demand for electricity). Feed-in tariffs that are financed through general government funds (e.g., tax revenues) are less economically efficient than those that are financed through premiums paid by ratepayers.

3. Last November's CRS report on the Section 1603 Program you coauthored with Phillip Brown stated on page 24 that "any job creation estimate" attributed to the Program "be viewed with skepticism." Could you please elaborate on this?

It is very difficult to empirically estimate the number of jobs that are created as the direct result of a particular tax incentive or grant program. The central reason for this difficulty is the inability to observe the activity that would have occurred without the program. In particular, if the Section 1603 grant program had not been enacted, it is likely that a number of projects that received Section 1603 grants would have taken place absent the grant.[10] Thus, just because there were jobs associated with projects that received the Section 1603 grant, it does not mean that the Section 1603 grant program created those jobs.

Studies that focus on job creation often highlight "gross jobs." The Section 1603 grant program may have directed investment dollars towards renewables, simultaneously reducing investment in other industries. Reduced investment in these other industries may have led to job loss in those industries. Thus, the net impact of the Section 1603 grant program should consider not only jobs created in the renewable energy sector, but also potential jobs lost in other industries. The recent National Renewable Energy Laboratory (NREL) report examining job creation under the Section 1603 grant program models gross jobs, and thus does not consider potential job loss in other industries.[11] Nor does the NREL report on Section 1603 job creation consider jobs that would have occurred in renewable energy without the program.

[9] Picking winners concerns arise when government policies may contribute to the success of certain or selected technologies, favoring selected technologies over alternatives.

[10] These projects may still have claimed renewable energy tax credits.

[11] Daniel Steinberg, Gian Porro, and Marshall Goldberg, *Preliminary Analysis of the Jobs and Economic Impacts of the Renewable Energy Projects Supported by the Section 1603 Treasury Grant Program*, National Renewable Energy Laboratory, NREL/TP-6A20-52739, April 2012.

Questions submitted by the Honorable Randy Neugebauer

1. **Is it a fair assessment to say that subsidizing inefficient technologies that would not otherwise survive on the market removes a critical market signal that would spur faster innovation without those subsidies?**

Well-functioning markets tend to direct economic resources to their most productive use. Subsidies that divert economic resources away from their most productive use reduce economic efficiency. In this sense, subsidies can distort market signals that would otherwise direct scarce economic resources to where they are most valuable.

To fully evaluate subsidies, it is important to consider the policy objectives, or goals, of the subsidy. In the case of subsidies for renewable energy, policy objectives include addressing environmental concerns, job creation, and technological innovation. Further, if there are negative externalities, or other market failures, market outcomes may not generate the most economically efficient outcome possible. If this is the case, it is possible that subsidies or other policy interventions can improve economic efficiency.

2. **Do you believe that false market signals derived from tax subsidies can convince the market (and a business or industry) that an inefficient technology is "good enough" and that drastic improvements in efficiency and reductions in cost are not necessary for the product to survive, thus slowing the development of more economically viable technologies.**

Subsidies for low-carbon technologies require the identification of certain technologies as being explicitly eligible for the subsidy. This may create a bias against newly emerging technologies, as it takes time to update the tax code to expand the list of qualifying technologies.[12] Further, once a specific product or technology begins to take hold in the market, it is possible that path dependence (or the tendency for markets to prefer technologies that are already being used) can create a barrier to entry for new technologies.[13]

[12] This point was made by Molly Sherlock in written testimony submitted to the House Committee on Science, Space, and Technology, Subcommittee on Investigations and Oversight and Subcommittee on Energy and Environment on April 19, 2011, for a hearing titled, "Impact of Tax Policies on the Commercial Application of Renewable Energy Technology."

[13] Subsidies for renewable energy technologies could also be viewed as a policy designed to help overcome barriers to entry created by the market's heavy reliance on fossil energy resources.

QUESTIONS FOR THE RECORD
U.S. House Committee on Science, Space, and Technology
Subcommittees on Investigations & Oversight and Energy & Environment Joint Hearing

"Impact of Tax Policies on the Commercial Application of Renewable Energy Technology"

Thursday, April 19, 2012

Questions for Mr. John Parcell
Acting Deputy Tax Legislative Counsel
U.S. Department of the Treasury

Questions submitted by Dr. Paul Broun, Chairman, Subcommittee on Investigations & Oversight

1603 Program

1. How many Treasury staff administer the 1603 Program?

   In addition to the core staff of 6 people responsible for operating the program, we have been able to leverage other resources both within and outside of Treasury to ensure the program is properly staffed. Staff from both Treasury's Office of Tax Policy and the Internal Revenue Service support the program as needed. Additionally, we have entered an interagency agreement with the Department of Energy under which DOE's National Renewable Energy Laboratory provides the needed technical expertise to operate the program. We continuously evaluate workforce needs and make adjustments if necessary.

2. How much did Treasury initially estimate the 1603 Program would cost?

   The American Recovery and Reinvestment Act of 2009 (ARRA) provided three principal incentives for renewable power production: (1) a three-year extension of the Section 45 production tax credit; (2) an election by the taxpayer to claim the Section 48 energy investment tax credit in lieu of the Section 45 production tax credit for investments in qualified property; and (3) an election by the taxpayer to take the Section 1603 grants in lieu of the tax credits for facilities for which construction had commenced by the end of 2010. In addition, ARRA repealed the cap on the investment credit for small wind facilities and repealed the limitation on property financed by subsidized energy financing. The Treasury initially estimated that the overall cost of these incentives would be about $7.9 billion for the fiscal years 2009 through 2019. The outlays for the 1603 program were estimated to be only about $1.1 billion over this time period. The initial analysis projected that a majority of taxpayers would elect to take the Section 45 production tax credit or the Section 48 investment tax credit. However, due to economic conditions, many taxpayers opted to claim the Section1603 grants in lieu of the applicable tax credits. The large number of grant claims reduced the amount of tax credits that would have been claimed.

3. The March 13, 2012 list of 1603 awardees includes three for geothermal projects (Geysers Power Co., LLC; CPN Wild Horse Geothermal, LLC; and Shalmuk Investors, LLC) and eight for geothermal electricity projects (Orni 18 LLC; NGP Blue Mountain I LLC; Enel Stillwater, LLC; Enel Salt Wells, LLC; Amor IX, LLC; Beowawe Binary, LLC; Solutions In Human Resources, INC; and Thermo No. 1 BE-01, LLC). What is the difference between a geothermal project and a geothermal energy project?

   The awards for geothermal projects (Geysers Power Co., LLC; CPN Wild Horse Geothermal, LLC; and Shalmuk Investors, LLC) are for property described in Internal Revenue Code (Code) section 48(a)(3)(A)(iii). This is equipment used to produce, distribute, or use energy derived from a geothermal deposit (within the meaning of Code section 613(e)(2)), but only, in the case of electricity generated by geothermal power, up to (but not including) the electrical transmission stage. To qualify for a section 1603 payment, the facility must be placed in service before 2017.

   The awards for geothermal electricity projects (Orni 18 LLC; NGP Blue Mountain I LLC; Enel Stillwater, LLC; Enel Salt Wells, LLC; Amor IX, LLC; Beowawe Binary, LLC; Solutions In Human Resources, INC; and Thermo No. 1 BE-01, LLC) are for property that is part of a facility described in Code section 45(d)(4). This is a facility using geothermal energy to produce electricity. To qualify for a section 1603 payment the facility must be placed in service before 2014. Thus, the class of facilities qualifying for these awards is narrower than the class of facilities described in section 48(a)(3)(A)(iii). Only facilities that produce electricity qualify as geothermal electricity projects described in section 45(d)(4), whereas geothermal projects described in section 48(a)(3)(A)(iii) may include, for example, facilities producing only thermal energy. In addition, only facilities placed in service before the end of 2013 qualify as geothermal electricity projects described in section 45(d)(4) whereas geothermal projects described in section 48((a)(3)(A)(iii) also include facilities placed in service in before the end of 2016.

4. How many recipients of 1603 cash grants have filed for bankruptcy, failed to produce energy, or laid off employees? Please identify each such recipient.

   Recipients of Section 1603 funds are not required to report to Treasury regarding bankruptcy filings, unless the result of such a filing is that the energy property for which the Section 1603 award was made is sold or ceases to be specified energy property. Recipients of Section 1603 awards are also not required to report whether or not employees have been laid off. The Section 1603 payment is not made until the property is placed in service (that is, ready and available for use in producing energy).

5. The Treasury Inspector General (IG) audit of the EcGrove Wind LLC 1603 Program payment issued September 19, 2011, questioned $2,080,452 of EcoGrove's award as a result of identifying $6,934,838 of questionable costs included in EcoGrove's 1603 Program claim.[1] EcoGrove management did not agree with all the costs that the IG questioned and

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[1] *Recovery Act: Audit of EcoGrove Wind LLC Payment Under 1603 Program*, Office of Inspector General. Department of the Treasury, OIG-11-103, September 19, 2011 (http://www.treasury.gov/about/organizational-structure/ig/Agency%20Documents/OIG%20Report%20(OIG-11-103%20)-

agreed to reimburse only $35,479 of its award to Treasury. The IG recommended that the Fiscal Assistant Secretary: (1) ensure that EcoGrove reimburse Treasury $2,080,452 for the excessive 1603 Program payment received for the subject property; and (2) direct EcoGrove and affiliated companies not to include in applications for 1603 Program awards inappropriate or otherwise ineligible costs in the claimed cost basis. According to the audit report, Treasury management agreed in part with the IG's findings, related to the reimbursement of $35,479 of EcoGrove's 1603 Program award, but could not make a determination with respect to the remainder of the questioned costs without further analysis. What is the final outcome of this dispute?

To date, Treasury has determined that a total of $284,827 was erroneously paid to EcoGrove. All of this amount has been returned to the Treasury.

6. A February 24, 2012 *Wall Street Journal* article, titled "Cost of $10 Billion Stimulus Easier to Tally Than New Jobs,"[2] noted that Raser Technologies, Inc. filed for bankruptcy protection last April after receiving a $33 million grant for a geothermal plant on Beaver County, Utah. Is Treasury going to recover any of that money or will the taxpayers have to take the fall?

   To clarify, the entity that received Section 1603 funds for a geothermal plant in Beaver County, Utah is Thermo No. 1 BE-01, LLC. Before the bankruptcy filing, Thermo No. 1 was a consolidated subsidiary of Raser Technologies, Inc. According to Thermo No. 1's most recent annual report filed on May 6, 2012, the project continues to operate and produce energy.

7. The same February 24, 2012 *Wall Street Journal* article also said:

   > "Private-equity firm Wayzata Investment Partners created neither jobs nor energy with the $6.5 million it received for a plant in Thompson Falls, Mont. The facility had state permits to burn coal and wood for energy, and Wayzata had invested more than $20 million to comply with government rules, said a person familiar with the matter.
   >
   > "After finishing the work, this person said, Wayzata told Treasury officials the plant would burn only wood; coal-burning plants don't qualify for 1603 money.
   >
   > "But Wayzata found it couldn't make money operating the plant on just wood without investing millions of dollars more in equipment improvements, said three people with knowledge of the project.

%20Audit%20of%20EcoGrove%20LLC%20Payment%20Under%201603%20Program%20-%20508%20compliant.pdf).

[2] Ianthe Jeanne Dugan and Justin Scheck, "Cost of $10 Billion Stimulus Easier to Tally Than New Jobs" *The Wall Street Journal*, Friday, February 24, 2012 (http://online.wsj.com/article/SB10001424052970203710704577705412494713178.html).

> "Wayzata submitted its application to the Treasury Department and in June 2010 received its payment. By then, the plant had not produced power for months, regulatory filings show. The facility, which still doesn't produce power, is for sale."

Is Wayzata entitled to retain the $6.5 million even if the plant never produces any more power or if it sells it to someone else?

If the plant permanently ceases to produce power from biomass Treasury will seek to recapture the funds. Sale of the project to a Section 1603 eligible entity or a temporary suspension of biomass power production (provided the owner intends to resume production) does not trigger recapture.

8. The same February 24, 2012 *Wall Street Journal* article also said:

> "Another wood-burning plant, Blue Lake Power in Northern California, received more than $5.3 million in October 2010. The plant had a number of temporary shutdowns around that time, said Chief Executive Kevin Leary. About a year ago, it laid off most of its staff and stopped producing power. Mr. Leary said the plant is now scheduled to start operating again on March 15. If the plant doesn't work, he said, it may face bankruptcy."

Will Treasury be able to recover any of the $5.3 million grant if Blue Lake Power goes bankrupt?

Bankruptcy, in and of itself, does not trigger recapture unless the bankruptcy results in the property ceasing to be specified energy property. The most recent annual report for this property filed on May 14, 2012 indicates that the property is producing energy.

48C Program

9. Treasury's Internal Revenue Service (IRS) issued Notice 2009–72 containing detailed 48C Program guidance was effective on August 14, 2009. The Notice stated that the IRS would consider projects under the 48C Program "only if" DOE provided "a recommendation and ranking for the project," and that DOE would "provide a recommendation and ranking only if it determines that the project has a reasonable expectation of commercial viability and merits a recommendation based on the criteria in §48C(d)(3)(B)".

   However, missing from these criteria is the §48C(d)(3)(B)(iv) statutory requirement that the Secretary of the Treasury "shall take in to consideration which projects" "have the lowest levelized cost of generated or stored energy, or of measured reduction in energy consumption or greenhouse gas emission (based on the cost of the full supply chain)". Also the Program Guidance included "Program Policy Factors" (Geographic Diversity, Technology Diversity, Project Size Diversity, and Regional Economic Development) that were not part of the law.

   9.1 Why are there inconsistencies between the IRS criteria and the 48C statutory criteria, and in particular, why was the lowest levelized cost criterion ignored?

Section 48C(d)(1) authorized the Secretary of the Treasury, in consultation with the Secretary of Energy, to establish a qualifying advanced energy program to consider and award certifications for qualified investments eligible for credits under section 48C. To qualify for a credit under section 48C, an investment was required to satisfy the definitional provisions in section 48C(c)(1) and the requirement of section 48C(d)(3)(A) regarding commercial viability. In addition, the factors listed in section 48C(d)(3)(B) were required to be considered in determining which projects to certify. Section 48C(d)(3)(B) is not structured as an exclusive list of the factors that may be considered and Notice 2009-72 did not interpret the provision as providing an exclusive list.

All factors listed in section 48C(d)(3)(B), including the lowest levelized cost criterion, were taken into account. The lowest levelized cost criterion is subsumed within the following criterion:

> *Evaluation Criterion 3: has the greatest potential for technological innovation and commercial deployment, as indicated by (i) the production of new or significantly improved technologies, (ii) improvements in levelized costs and performance, and (iii) manufacturing significance and value.*

The levelized cost criterion is described more extensively in Appendix B of Notice 2009-72 in sections G.III.C. and G. IV.

9.2 What is the statutory authority for the addition of "Program Policy Factors"?

As noted above, section 48C(d)(1) provides the authority to establish the program. While section 48C(d)(3)(B) provides a list of factors that must be considered, the list does not purport to be exclusive and the guidance is structured accordingly.

9.3 How did these inconsistencies impact project rankings?

It is likely that some rankings would have differed if the program policy factors not listed in section 48C(d)(3)(B) had not been taken into account.

10. How many 48C awardees have filed for bankruptcy or laid off employees? Please identify each such awardee.

Section 48C awardees are not required to report to the Treasury Department when they file for bankruptcy or lay off employees.

QUESTIONS FOR THE RECORD
U.S. House Committee on Science, Space, and Technology
Subcommittees on Investigations & Oversight and Energy & Environment Joint Hearing

"Impact of Tax Policies on the Commercial Application of Renewable Energy Technology"

Thursday, April 19, 2012

Questions for Dr. Michael Pacheco
Vice President, Deployment and Industrial Partnerships
National Renewable Energy Laboratory

Questions submitted by Dr. Paul Broun, Chairman, Subcommittee on Investigations & Oversight

1. How many NREL staff are dedicated to the Treasury 1603 Program?

   Currently there are 28 staff members working on the 1603 Program. Many of the reviewers contribute their expertise to the program while meeting other responsibilities and completing a range of other tasks. The assigned part-time staff typically devote from 8 to 35 hours per week to their 1603 Program work. Given part-time involvement of a number of reviewers, the 28 personnel assigned to the 1603 Program average 18 FTEs (full time equivalent) per week on the 1603 Project.

2. How much has Treasury reimbursed NREL for each of FY 2009, FY 2010, FY 2011, and FY 2012 for provision of technical assistance to the1603 Program?

   FY 2009: $1,787,800. FY 2010: $450,000. FY 2011: $4,702,025. FY 2012: $1,454,332.

Questions submitted by Dr. Andy Harris, Chairman, Subcommittee on Energy & Environment

1. With respect to the 1603 program, you noted that all applications are rigorously evaluated against the criteria based on the tax codes.

   1.1 Please list the criteria wind projects need to meet in order to gain approval, including as they relate to the Treasury Department's five percent "safe harbor" rule.

   The attached Program Guidance details eligibility requirements. In summary, requirements are:

   Applicant eligibility;
   Commissioning of the system;
   Technical eligibility;
   Cost basis eligibility.
   Application must be submitted by an eligible member of the applying entity.

In regards to "safe harbor," applicants must prove that they have incurred or paid at least 5 percent of the costs associated with the energy system before 2012. The attached FAQ's on "Begun Construction" further details the "safe harbor" requirements.

1.2 What project qualifications did NREL spend the most time validating?

Technical eligibility, cost basis, applicant eligibility, commissioning/operation date.

1.3 You cited approximately 3,000 applications as having been withdrawn or disqualified. Of applications withdrawn or rejected, approximately how many of each were for wind, solar, or other technologies?

Rejected: *1 – Wind*
64 – Solar
13 – Other technologies

Disqualified: *51 – Wind*
2,798 – Solar
50 – Other technologies

1.4 What were the primary reasons applications were rejected?

Applicant was ineligible;
Technology was ineligible;
Applicant did not provide an eligible cost basis.

2. Tables five and six of the NREL report[1] assessing the economic impact of 1603 program spending include estimates of direct and indirect jobs and economic output for large wind and solar projects during the construction and operation phases. In order to better assess the cost effectiveness of tax credit spending under this program, such spending should be considered in light of its economic impacts.

   Accordingly, for each row in tables five and six, please calculate the tax credit spending that corresponds to the estimated jobs supported. For example, with respect to the data in table five, what is the estimated 1603 spending per direct job (and job-per-year) supported during the construction period? Additionally, please calculate the cost of each permanent job.

[1]Daniel Stenberg, Gian Porro, and Marshall Goldberg, *Preliminary Analysis of the Jobs and Economic Impacts of Renewable Energy Projects Supported by the §1603 Treasury Grant Program*, NREL/TP-6A20-52739, April 2012 (http://www.nrel.gov/docs/fy12osti/52739.pdf).

Determining an estimate of tax credit spending per job, be it construction or permanent employment, was not part of the analysis that NREL conducted on behalf of the Department of Energy. The Department of Energy is a more appropriate respondent to this question.

Additionally, there are several reasons the information that the report does provide may be inappropriate for use in calculating the "cost" of each construction, and each permanent, job. First, the report acknowledges that its conclusions are preliminary in nature, and thus do not go to the depth that would be required to produce an accurate calculation of cost per job. Second, the "snapshot in time" nature of the report could lead to an inaccurate representation of the overall program. The number of projects which have participated in the program to date is nearly 50 percent larger than those that NREL was able to assess in its report. Moreover, the total mix of project sizes, project types and project technologies is considerably different today than it was when the report analysis was conducted.

3. **Please provide a detailed summary of NREL's Cooperative Research and Development Agreements (CRADAs) related to the renewable energy technologies considered at the hearing, including a list of the partners, technology types, and approximate value of the partner-contributed funds under such CRADAs.**

   Please see attached list.

Payments for Specified Energy Property in Lieu of Tax Credits

under the

AMERICAN RECOVERY AND REINVESTMENT ACT OF 2009

U.S. Treasury Department
Office of the Fiscal Assistant Secretary
July 2009/ Revised March 2010/ Revised April 2011

Payments for Specified Energy Property in Lieu of Tax Credits under the American Recovery and Reinvestment Act of 2009

Program Guidance

Under Section 1603 of the American Recovery and Reinvestment Tax Act of 2009 (Section 1603), the United States Department of the Treasury (Treasury) makes payments to eligible persons who place in service specified energy property and apply for such payments. The purpose of the payment is to reimburse eligible applicants for a portion of the expense of such property. Eligible property under this program includes only property used in a trade or business or held for the production of income. Nonbusiness energy property described in section 25C of the Internal Revenue Code (IRC) and residential energy efficient property described in section 25D of the IRC do not qualify for payments under this program but may qualify for tax credits under those provisions.

By receiving payments for property under section 1603, applicants are electing to forego tax credits under sections 48 and 45 of the IRC with respect to such property for the taxable year in which the payment is made or any subsequent taxable year. Applicants must agree to the terms and conditions applicable to the Section 1603 program.

This Guidance establishes the procedures for applying for payments under the Section 1603 program and is intended to clarify the eligibility requirements under the program. Treasury welcomes questions about the program and the application process at 1603Questions@do.treas.gov.

I. Overview

On February 17, 2009, President Obama signed the American Recovery and Reinvestment Act of 2009 (Public Law 111-5). The purpose of the Recovery Act is to preserve and create jobs and promote economic recovery in the near term and to invest in infrastructure that will provide long-term economic benefits.

Section 1603 of the Act's tax title, the American Recovery and Reinvestment Tax Act, as amended by Section 707 of the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010 (Public Law 111-312), appropriates funds for payments to persons who place in service specified energy property during 2009, 2010, or 2011 or after 2011 if construction began on the property during 2009, 2010 or 2011 and the property is placed in service by a certain date known as the credit termination date (described more fully below in the Property and Payment Eligibility section). Treasury will make Section 1603 payments to qualified applicants in an amount generally equal to 10% or 30% of the basis of the property, depending on the type of property. Applications will be reviewed and payments made within 60 days from the later of the date of the

complete application or the date the property is placed in service. Applicants who receive payments for property under Section 1603 are not eligible for the production or investment tax credit under sections 45 and 48 of the IRC with respect to the same property for the taxable year of the payment or subsequent years. In addition, any credit under section 48 previously allowed with respect to progress expenditures for the property will be recaptured.

It is expected that the Section 1603 program will temporarily fill the gap created by the diminished investor demand for tax credits. In this way, the near term goal of creating and retaining jobs is achieved, as well as the long-term benefit of expanding the use of clean and renewable energy and decreasing our dependency on non-renewable energy sources.

II. Application Procedures

Applicants interested in receiving payments under Section 1603 may submit an application on-line by going to www.treasury.gov/recovery. Applications may only be submitted after the property to which the application relates is placed in service, or is under construction. A completed application will include the signed and complete application form; supporting documentation; signed Terms and Conditions; and complete payment information. All applications must be received before the statutory deadline of October 1, 2012.

For property placed in service in 2009, 2010 or 2011, applications must be submitted after the property has been placed in service and before October 1, 2012. Treasury will review the applications and make payment to qualified applicants within 60 days from the date the completed application is received by Treasury.

For property not placed in service in 2009, 2010 or 2011 but for which construction began in 2009, 2010 or 2011, applications must be submitted after construction commences but before October 1, 2012. If the property has been placed in service at the time of the application, Treasury will make payments to qualified applicants within 60 days from the date the completed application is received. For property not yet placed in service at the time of the application, Treasury will review such applications and notify the applicant if all eligibility requirements that can be determined prior to the property being placed in service have been met. If so notified, applicants must then submit, within 90 days after the date the property is placed in service, supplemental information sufficient for Treasury to make a final determination. Treasury will conduct a final review of the application at that time and make payment to qualified applicants within 60 days after the supplemental information is received by Treasury. Instructions provided on the application will indicate which portions of the application must be completed at the time the application is initially submitted and which portions must be completed at the time the application is supplemented.

If an applicant is applying for Section 1603 payments for multiple units of property that are treated as a single, larger unit of property (see Section IV. D. below), all such units may be included in a single application.

The application form requests, among other identifying data elements, the applicant's Data Universal Numbering System (DUNS) number from Dun and Bradstreet. If the applicant does not already have a DUNS number, it may request one at no cost by calling the dedicated toll-free DUNS Number request line at 1-866-705-5711.

Applicants must also register with the Central Contractor Registration (CCR). To register, go to www.ccr.gov/startregistration.aspx. The registration must be completed before a payment can be made.

When Treasury determines that an application is approved, it will send a notice to the applicant. The notice informs the applicant that the payment will be made and incorporates the information contained in the applicant's completed application form and the Terms and Conditions. Treasury makes payment to the applicant no later than five days from the date of the notice. Payment will be made by Electronic Funds Transfer based upon the banking information in the CCR.

In cases where an applicant has not submitted sufficient information upon which a determination can be based, the applicant will be so notified and given 21 days from the date of the notice to submit additional information. If additional information is not received within the 21 day period, the application will be denied.

When Treasury determines that the application does not qualify for payment, the applicant will be so notified. Such notification will include the reasons for the determination and will be considered the final agency action on the application.

III. Applicant Eligibility

Certain persons are not eligible to receive Section 1603 payments. These include:

- any Federal, state or local government, including any political subdivision, agency or instrumentality thereof
- any organization that is described in section 501(c) of the IRC and is exempt from tax under section 501(a) of the IRC
- any entity referred to in paragraph (4) of section 54(j) of the IRC or
- any partnership or other pass-thru entity, any direct or indirect partner (or other holder of an equity or profits interest) of which is an organization or entity described above unless this person only owns an indirect interest in the applicant through a taxable C corporation.

As long as each direct and indirect partner in the partnership or shareholder or similar interest holder in any other pass-thru entity is eligible to receive Section 1603 payments, the partnership or pass-thru entity is eligible to receive Section 1603 payments. Having as a direct or indirect partner, shareholder, or similar interest holder a taxable C corporation any of whose shareholders are not eligible to receive Section 1603 payments does not affect the eligibility of the partnership or pass-thru entity. Neither a Real Estate Investment Trust, nor a cooperative organization described in section 1381(a) of the IRC is a pass-thru entity for this purpose.

For an applicant to be eligible to receive a Section 1603 payment it must be the owner or lessee of the property and must have originally placed the property in service. Lessees are eligible to apply for Section 1603 payments only if the conditions described in Section VI of this Guidance are met.

A foreign person or entity may be eligible for a Section 1603 payment if the person or entity qualifies for the exception in section 168(h)(2)(B) of the IRC.

Applicant eligibility will be determined as of the time the application is received.

IV. Property and Payment Eligibility

A. Placed in Service
Qualified property must be originally placed in service between January 1, 2009, and December 31, 2011, (regardless of when construction begins) or placed in service after 2011 and before the credit termination date (see below) if construction of the property begins between January 1, 2009, and December 31, 2011. Qualified property includes expansions of an existing property that is qualified property under section 45 or 48 of the IRC.

Placed in service means that the property is ready and available for its specific use.

B. Credit Termination Date and Applicable Payment Percentage
The following chart lists the Credit Termination Date and the applicable percentage of eligible cost basis used in computing the payment for each specified energy property.

Specified Energy Property	**Credit Termination Date**	**Applicable Percentage of Eligible Cost Basis**
Large Wind	Jan 1, 2013	30%
Closed-Loop Biomass Facility	Jan 1, 2014	30%
Open-loop Biomass Facility	Jan 1, 2014	30%
Geothermal under IRC sec. 45	Jan 1, 2014	30%
Landfill Gas Facility	Jan 1, 2014	30%
Trash Facility	Jan 1, 2014	30%
Qualified Hydropower Facility	Jan 1, 2014	30%
Marine & Hydrokinetic	Jan 1, 2014	30%
Solar	Jan 1, 2017	30%
Geothermal under IRC sec. 48	Jan 1, 2017	10%*
Fuel Cells	Jan 1, 2017	30%**
Microturbines	Jan 1, 2017	10%***
Combined Heat & Power	Jan 1, 2017	10%
Small Wind	Jan 1, 2017	30%
Geothermal Heat Pumps	Jan 1, 2017	10%

*Geothermal Property that meets the definitions of qualified property in both § 45 and § 48 is allowed either the 30% credit or the 10% credit but not both.
** For fuel cell property the maximum amount of the payment may not exceed an amount equal to $1,500 for each 0.5 kilowatt of capacity.
*** For microturbine property the maximum amount of the payment may not exceed an amount equal to $200 for each kilowatt of capacity.

C. Beginning of Construction

Construction begins when physical work of a significant nature begins. Work performed by the applicant and by other persons under a written binding contract is taken into account in determining whether construction has begun. An applicant may elect the safe harbor described below to determine when construction begins.

Physical work of a significant nature. Both on-site and off-site work may be taken into account for purposes of demonstrating that physical work of a significant nature has begun. For example, in the case of a facility for the production of electricity from a wind turbine, on-site physical work of a significant nature begins with the beginning of the excavation for the foundation, the setting of anchor bolts into the ground, or the pouring of the concrete pads of the foundation. If the facility's wind turbines and tower units are to be assembled on site from components manufactured off site and delivered to the site, physical work of a significant nature begins when the manufacture of the components begins at the off-site location. If a manufacturer produces components for multiple facilities, reasonable methods must be used to associate individual components with particular facilities. Physical work of a significant nature does not include preliminary activities such as planning or designing, securing financing, exploring, researching, clearing a site, test drilling of a geothermal deposit, test drilling to determine soil condition, or excavation to change the contour of the land (as distinguished from excavation for footings and foundations).

Self construction. If an applicant manufactures, constructs, or produces property for use by the applicant in the applicant's trade or business (or for the applicant's production of income), the work performed by the applicant is taken into account in determining when physical work of a significant nature begins.

Construction by contract. For property that is manufactured, constructed, or produced for the applicant by another person under a written binding contract (as described below) that is entered into prior to the manufacture, construction, or production of the property for use by the applicant in the applicant's trade or business (or for the applicant's production of income) the work performed under the contract is taken into account in determining when physical work of a significant nature begins. A contract is binding only if it is enforceable under State law against the applicant or a predecessor, and does not limit damages to a specified amount (for example, by use of a liquidated damages provision). For this purpose, a contractual provision that limits damages to an amount equal to at least 5 percent of the total contract price will not be treated as limiting damages to a specified amount. If a contract provides for a full refund of the purchase

price in lieu of any damages allowable by law in the event of breach or cancellation, the contract is not considered binding. A contract is binding even if the contract is subject to a condition, as long as the condition is not within the control of either party or a predecessor. A contract will continue to be binding if the parties make insubstantial changes in its terms and conditions or any term is yet to be determined by a standard beyond the control of either party. For example, minor modifications to the design specifications of property to be produced under a contract, such as a cold weather package for wind turbines, do not affect the binding nature of the contract. A contract that imposes significant obligations on the applicant or a predecessor will be treated as binding notwithstanding the fact that certain terms remain to be negotiated by the parties to the contract. An option to either acquire or sell property is not a binding contract. A binding contract does not include a supply, or similar, agreement if the amount and design specifications of the property to be purchased have not been specified.

Safe Harbor. An applicant may treat physical work of a significant nature as beginning when more than 5 percent of the total cost of the property has been paid or incurred and may treat physical work of a significant nature as not having begun until more than 5 percent of the total cost of the property has been paid or incurred. In the case of property constructed by the applicant, costs of the property are treated as paid or incurred when paid or incurred by the applicant. In the case of property manufactured, constructed, or produced for the applicant by another person under a binding written contract that is entered into prior to the manufacture, construction, or production of the property (i) the cost of the property under the contract is treated as paid or incurred when the property is provided to the applicant, and (ii) for periods before the property is provided to the applicant, costs paid or incurred with respect to the property by such other person are treated as costs of the property that are paid or incurred when paid or incurred by such other person. If the property includes both self-constructed components and components constructed under a contract, the costs relating to the self-constructed components and the costs relating to the components constructed under a contract are combined in determining if the 5 percent of total costs has been exceeded. All costs included in the eligible basis (as described in section V) of the specified energy property and only such costs are taken into account in determining if 5 percent of total costs has been exceeded. If the applicant is a lessee of property for which the lessor has elected to pass-through the payment to the lessee, this safe harbor must be met by the lessor (unless the applicant sold and leased back the property). An applicant may elect to use this safe harbor by stating in section 2F of the application that the applicant is electing this safe harbor and describing the costs that satisfy the requirements for this election. See also section 6B of the application regarding supporting documentation.

Reliance on prior Guidance. An applicant may determine when construction begins under the Program Guidance in effect before March 15, 2010. This Guidance can be found at
http://www.treasury.gov/initiatives/recovery/Documents/SUMMARY%20OF%20PROPOSED%20CHANGES%20TO%20SECTION%201603%20PROGRAM%20GUIDANCE.doc

D. Units of Property

For purposes of determining the beginning of construction of property or the date property is placed in service, all the components of a larger property are a single unit of property if the components are functionally interdependent. Components of property that are produced by, or for, the applicant are functionally interdependent if the placing in service of each of the components is dependent on the placing in service of each of the other component. For example, on a wind farm for the production of electricity from wind energy, the electricity generating wind turbine, its tower, and its supporting pad are the single unit of property. Each wind turbine on the wind farm can be separately operated and metered and can begin producing electricity individually. A control system on a wind farm that optimizes the operation of the farm is a unit of property that is separate from the wind turbines.

The owner of multiple units of property that are located at the same site and that will be operated as a larger unit may elect to treat the units (and any property, such as a computer control system, that serves some or all such units) as a single unit of property for purposes of determining the beginning of construction and the date the property is placed in service. In such a case, the entire cost of such larger unit of property is taken into account in applying the safe harbor. The owner may not include within this larger unit any property that was placed in service before January 1, 2009. For example, the owner of a wind farm may treat as a single unit a wind farm that will consist of fifty turbines, their associated towers, their supporting pads, a computer system that monitors and controls the turbines, and associated power condition equipment. In cases where the applicant treats multiple units of property as a single unit, failure to complete the entire planned unit will not preclude receipt of a Section 1603 payment. For example, in the example noted above if only 40 of the planned 50 turbines were placed in service by the credit termination date, an otherwise eligible applicant would be eligible for a payment based on the 40 turbines placed in service.

E. Specified Energy Property Installed on Other Property

Only the portion of a facility that is described in section 48 of the IRC is taken into account in computing the Section 1603 payment. For example, in the case of a building with solar property on its roof, only the cost of the solar property (including the cost of mounting the solar property on the roof) qualifies for a Section 1603 payment; the cost of the building does not qualify. In the case of a truck on which solar energy property is mounted, the cost of the solar energy property and the cost of mounting the property may be eligible for a Section 1603 payment. However, the truck on which the property is mounted is not specified energy property. Likewise, in the case of a forklift powered by a fuel cell power plant, the fuel cell power plant may be eligible for a Section 1603 payment. However, the forklift in which it is used is not specified energy property.

F. Location of Property

Property which is used predominantly outside the United States does not qualify for a payment under section 1603. The determination of whether property is used predominantly outside the United States is made by comparing the period of time during which the property is physically located outside the United States with the period of time

during which the property is physically located within the United States in a given year. If the property is located outside the United States during more than 50% of the year, such property is considered to be used predominantly outside the United States during that year. This limitation does not apply to property described in section 168(g)(4) of the IRC.

G. Original Use
The original use of the property must begin with the applicant. If the cost of the used parts contained within the property is not more than 20 percent of the total cost of the property (whether acquired or self-constructed), an applicant will not fail to be considered the original user of property because it contains used parts.

If new property is originally placed in service by a person and is sold to an applicant and leased back to the person by the applicant within three months after the date the property was originally placed in service by the person, unless the lessor and lessee elect otherwise, the applicant-lessor is considered the original user of the property and the property is considered to be placed in service not earlier than when it is used under the lease back.

H. Required Documentation
Applicants must submit supporting documentation demonstrating that the property is eligible property and that it has been placed in service, and if placed in service after December 31, 2011, that construction began in 2009, 2010 or 2011 (See section V below for documentation required to support costs). The following documents are required as indicated below:

Eligible Property – the following documentation must be provided, as applicable, to demonstrate that the property is eligible (for further details on property eligibility, see sections 45 or 48 of the IRC):
Design plans (required of all applicants). Final engineering design documents, stamped by a licensed professional engineer.

Documentation demonstrating that the property is designed to have a nameplate capacity that meets required minimums or maximums (see Section 4A of the Application for properties with minimum or maximum nameplate capacity requirements) : [open-loop biomass facility (livestock waste nutrients), marine and hydrokinetic renewable energy facility, fuel cell property, microturbine property, combined heat and power system property, and small wind energy property only]. This documentation can be included within the required design plans or commissioning report, or with the original equipment manufacturer (OEM)/equipment vendor specification sheets.

Documentation demonstrating that the property is designed to meet the electricity-only generation efficiency requirements described in Section 4A of the Application (fuel cell property and microturbine property only). The system efficiency is typically calculated as a ratio of the electrical energy output from the device to the amount of fuel consumed to produce the electricity divided by the lower heating value (LHV) of the fuel (if

alternating current, be sure to include conversion losses). OEM/equipment vendor specification sheets that specify the above values can be used as supporting documentation for nameplate capacity and system efficiency. This documentation can also be included within the required design plans or commissioning report, as long as it specifies the above values.

For combined heat and power system property only, documentation demonstrating that the system is designed to meet the requirements described in Section 4A of the Application. See IRC section 48(c)(3)(C) for calculation of the system energy efficiency percentage. This documentation can be included within the required design plans or commissioning report, or with OEM/equipment vendor specification sheets.

For a closed-loop biomass facility modified to use closed-loop biomass to co-fire with coal, other biomass, or both, documentation demonstrating approval under the Biomass Power for Rural Development Program or documentation demonstrating that the facility is part of a pilot project of the Commodity Credit Corporation.

FERC certification (applicable to incremental hydropower production projects only). Certification provided by the Federal Energy Regulatory Commission that certifies the baseline and incremental increase in energy production for incremental hydropower production.

FERC license (applicable to hydropower facility installed on a qualifying nonhydroelectirc dam only).

Placed in Service - the following documentation must be provided, as applicable, to demonstrate that the property is placed in service:
Commissioning report (required for all properties placed in service). A report provided by the project engineer, or the equipment vendor, or an independent third party that certifies that the equipment has been installed, tested, and is ready and capable of being used for its intended purpose.

Interconnection agreement (required only for properties placed in service that are interconnected with a utility). A formal document between the applicant and the local utility that establishes the terms and conditions under which the utility agrees to interconnect with the applicant's system. Applicants must also submit any subsequent documentation to demonstrate that the interconnection agreement has been placed in effect.

Under Construction but not yet Placed in Service - the following documentation must be provided, as applicable, to demonstrate that construction has begun on the property:
Paid invoices and/or other financial documents demonstrating that physical work of a significant nature has begun on the property as described in Section IV.C. If beginning of construction is based on the safe harbor, these documents must demonstrate that more than 5 percent of the total cost of the property) has been incurred or paid by the applicant.

Binding contract (required for property not yet placed in service that is being manufactured, constructed or produced for the applicant by another person). The binding contract for the manufacture, construction or production of the property as described in section IV.C above.

Leased Property - the following documentation must be provided where the applicant is the lessee of the property to demonstrate that the lessor and lessee have entered into the agreement required by section VI of this Guidance.
The written agreement with the lessor described in Section VI of this Guidance.

I. Types of Property

Property eligible to receive Section 1603 payments is "specified energy property." Specified energy property includes only tangible property (not including a building) that is an integral part of the facility. The tangible property is tangible personal property and other tangible property as defined in sections 1.48-1(c) and (d) of the Income Tax Regulations. Specified energy property is property for which depreciation (or amortization in lieu of depreciation) is allowable.

Qualified property must be placed in service in 2009, 2010 or 2011 or, in the case of property placed in service after 2011 for which construction begins in 2009, 2010 or 2011, before the credit termination date. Property that satisfies this placed-in-service requirement may be qualified property even if it is an addition to or expansion of a qualified facility placed in service before 2009.

Qualified property includes only tangible property that is an integral part of the qualified facility. Qualified property does not include a building but may include structural components of a building. Property is an integral part of a qualified facility if the property is used directly in the qualified facility and is essential to the completeness of the activity performed in that facility. Roadways and paved parking areas located at the qualified facility and used for transport of material to be processed at the facility or equipment to be used in maintaining and operating the facility are integral to the activity preformed there, but roadways or paved parking lots that provide solely for employee and visitor vehicle traffic are not an integral part a qualified facility. Property is considered used as an integral part of a qualified facility if so used either by the owner of the property or by the lessee of the property.

In the case of an open-loop biomass, closed-loop biomass, or municipal solid waste facility, an integral part of the qualified facility may include property used for unloading, transfer, storage, reclaiming from storage, or preparation (shredding, chopping, pulverizing, or screening) of the material to be processed at the plant. If the facility uses a gas or liquid derived from open-loop biomass, closed-loop biomass, or municipal solid waste to produce electricity, equipment used to produce and process such gas or liquid may also be an integral part of the facility. However, equipment used to cultivate closed-loop biomass, equipment used to collect open-loop biomass, closed-loop biomass, or municipal solid waste, and trucks, railroad cars, barges and pipelines that transport open-loop biomass, closed-loop biomass, or municipal solid waste (or a gas or liquid

produced from any of the foregoing) to a qualified facility or between noncontiguous parts of a qualified facility are not an integral part of the facility. Property that is integral to a geothermal facility includes equipment that transports geothermal steam or hot water from a geothermal deposit to the site of ultimate use. This includes components of a heating system, such as pipes and ductwork that distribute within a building the energy derived from the geothermal deposit and, if geothermal energy is used to generate electricity, includes equipment that transports hot water from the geothermal deposit to a power plant.

For qualified property that generates electricity, qualified property includes storage devices, power conditioning equipment, transfer equipment, and parts related to the functioning of those items but does not include any electrical transmission equipment, such as transmission lines and towers, or any equipment beyond the electrical transmission stage, such as transformers and distribution lines.

Specified energy property, within the meaning of Section 1603, consists of two broad categories of property - certain property that is part of a facility described in IRC section 45 (Qualified Facility Property) and certain other property described in IRC section 48. The following types of property are specified energy property within the meaning of Section 1603[1]:

Qualified Facility Property:
Qualified Facility Property is property that is an integral part of a qualified facility described in IRC section 45(d)(1), (2), (3), (4), (6), (7), (9), or (11).Although this Guidance does not address the placed-in-service requirements of IRC section 45,Qualified Facility Property must be part of a facility that meets those requirements. Qualified Facility Property may, however, be a post-2008 addition to or modification of a facility placed in service before 2009 so long as the facility meets the placed-in-service requirements of section 45. In the case of a post-2008 addition to or modification of a qualified facility described in section 45(d)(1), (2), (3), (4), (6), (7), (9), or (11) and placed in service before 2009, no credit is allowed with respect to such facility under section 45, or with respect to such property under section 48, in the taxable year a Section 1603 payment is made or in any subsequent year.

> *Wind facility:* A wind facility is a facility using wind to produce electricity (wind turbines 100kW or less may also qualify as qualified small wind energy property, but only one payment is allowed with respect to the property).
>
> *Closed-loop biomass facility:* A closed-loop biomass facility uses closed-loop biomass to produce electricity. Closed-loop biomass is any organic material from a plant that is planted exclusively for purposes of being used at a qualified facility to produce electricity. A closed loop biomass facility includes the modifications to

[1] The property descriptions included in this Guidance are intended to assist applicants in determining if a property qualifies for funding. They are not intended to change the meaning of the terms as they are used in sections 45 or 48 of the IRC.

a facility that was originally placed in service and modified to use closed-loop biomass to co-fire with coal, with other biomass, or with both, but only if the modification is approved under the Biomass Power for Rural Development Programs or is part of a pilot project of the Commodity Credit Corporation as described in 65 Fed. Reg. 63052.

Open-loop biomass facilities: An open-loop biomass facility uses open-loop biomass to produce electricity. Open-loop biomass is any agriculture livestock waste nutrients or any solid, nonhazardous, cellulosic waste material or any lignin material that is derived from qualified sources.

- Agricultural livestock waste nutrients are agriculturale livestock manure and litter, including wood shavings, straw, rice hulls, and other bedding material for the disposition of manure. Agricultural livestock includes bovine, swine, poultry, and sheep.
- The qualified sources from which solid, nonhazardous, cellulosic waste material or any lignin material must be derived are:
    1. Any of the following forest-related resources: mill and harvesting residues, precommercial thinnings, slash, and brush;
    2. Solid wood waste materials, including waste pallets, crates, dunnage, manufacturing and construction wood wastes (other than pressure-treated, chemically-treated, or painted wood wastes), landscape or right-of-way tree trimmings, but not including municipal solid waste, gas derived from the biodegradation of solid waste, or paper that is commonly recycled; and
    3. Agriculture sources, including orchard tree crops, vineyard, grain, legumes, sugar, and other crop by-products or residues.

An open-loop biomass facility does not include:

- A facility that burns fossil fuel (co-firing) beyond such fossil fuel required for startup and flame stabilization; or
- A facility using agricultural livestock waste nutrients that has a nameplate capacity rating of less than 150 kilowatts.

Geothermal facility: A geothermal facility uses geothermal energy to produce electricity. Geothermal energy is energy derived from a geothermal deposit. A geothermal deposit is a geothermal reservoir consisting of natural heat that is stored in rocks or in an aqueous liquid or vapor (whether or not under pressure).

Landfill gas facilities: A landfill gas facility is a facility producing electricity from gas derived from the biodegradation of municipal solid waste.

Trash facilities: A trash facility is a facility, other than a landfill gas facility, that uses municipal solid waste to produce electricity. In the case of a new unit placed in service in connection with a trash facility placed in service before October 23, 2004, only property related to the new unit can qualify as specified energy property that is eligible for a Section 1603 payment.

Qualified hydropower facility:

Incremental hydropower: A facility that produces incremental hydropower production described in IRC section 45(c)(8)(B). The percentage of incremental hydropower and baseline must be certified by the Federal Energy Regulatory Commission. The determination of incremental hydropower production shall not be based on any operational changes at such facility not directly associated with the efficiency improvements or additions of capacity. Only property related to the efficiency improvements and additions to capacity to which the incremental hydropower production is attributable can qualify as specified energy property that is eligible for a Section 1603 payment.

Nonhydroelectric dam: Qualified hydropower facilities also include any hydropower producing facility described in IRC section 45(c)(8)(C) (relating to hydroelectric projects installed on a nonhydroelectric dams that were placed in service before August 8, 2004, and did not produce hydroelectric power on August 8, 2004). The hydroelectric project must be licensed by the Federal Energy Regulatory Commission and must meet all other applicable environmental, licensing, and regulatory requirements. The hydroelectric project must be operated so that the water surface elevation at any given location and time that would have occurred in the absence of the hydroelectric project is maintained, subject to any license requirements imposed under applicable law that change the water surface elevation for the purpose of improving environmental quality of the affected waterway. The Secretary of the Treasury, in consultation with the Federal Energy Regulatory Commission, shall certify that the hydroelectric project licensed at a nonhydroelectric dam meets these criteria. Only property related to the turbines or other generating devices added to the facility to produce hydroelectric power can qualify as specified energy property that is eligible for a Section 1603 payment.

Marine and hydrokinetic renewable energy facilities: A marine or hydrokinetic renewable energy facility is a facility that produces electricity from marine and hydrokinetic renewable energy and has a nameplate capacity rating of at least 150 kilowatts. Marine and hydrokinetic renewable energy is energy derived from:

- Waves, tides, and currents in oceans, estuaries, and tidal areas, free flowing water in rivers, lakes, and streams;
- Free flowing water in an irrigation system, canal, or other man-made channel, including projects that utilize nonmechanical structures to accelerate the flow of water for electric power production purposes; or
- Differentials in ocean temperature (ocean thermal energy conversion).

Marine and hydrokinetic renewable energy does not include any energy that is derived from any source that utilizes a dam, diversionary structure (except as provided above for man-made projects), or impoundment for electric power production purposes.

Energy property described under IRC section 48:

Specified energy property for purposes of Section 1603 includes, in addition to qualified property that is part of a qualified facility, any other energy property described under IRC section 48. Such energy property must meet performance and quality standards that are prescribed either in IRC section 48 or in associated Treasury Regulations and that are in effect at the time of the acquisition of the property.

Solar property: Equipment that uses solar energy to generate electricity, to heat or cool (or provide hot water for use in) a structure, or to provide solar process heat, excepting property used to generate energy for the purposes of heating a swimming pool; equipment that uses solar energy to illuminate the inside of a structure using fiber-optic distributed sunlight.

Geothermal property: Equipment used to produce, distribute, or use energy derived from a geothermal deposit, but only, in the case of electricity generated by geothermal power, up to (but not including) the electrical transmission stage. A geothermal deposit is a geothermal reservoir consisting of natural heat that is stored in rocks or in an aqueous liquid or vapor (whether or not under pressure).

Qualified fuel cell property: Qualified fuel cell property is a fuel cell power plant that has a nameplate capacity of at least 0.5 kilowatt of electricity using an electrochemical process and has an electricity-only generation efficiency greater than 30%. A fuel cell power plant is an integrated system comprised of a fuel cell stack assembly and associated balance of plant components that converts a fuel into electricity using electrochemical means. Payments for qualified fuel cell property cannot exceed an amount equal to $1,500 for each 0.5 kilowatt of capacity of such property.

Qualified microturbine property: Qualified microturbine property is a stationary microturbine power plant that has a nameplate capacity of less than 2,000 kilowatts and has an electricity-only generation efficiency of not less than 26% at International Standard Organization conditions. A stationary microturbine power plant is an integrated system comprised of a gas turbine engine, a combustor, a recuperator or regenerator, a generator or alternator, and associated balance of plant components which converts a fuel into electricity and thermal energy. The microturbine power plant also includes all secondary components located between the existing infrastructure for fuel delivery and the existing infrastructure for power distribution, including equipment and controls for meeting relevant power standards, such as voltage, frequency, and power factors. Payments for qualified microturbine property cannot exceed an amount equal to $200 for each kilowatt of capacity of such property.

Combined heat and power (CHP) system property: Combined heat and power system property is property comprising a system that meets the following requirements:

- The system uses the same energy source for the simultaneous or sequential generation of electrical power, mechanical shaft power, or both in

combination with the generation of steam or other forms of useful thermal energy (including heating and cooling applications).

- The system--
  - Produces at least 20% of its total useful energy in the form of thermal energy that is not used to produce electrical or mechanical power (or combination thereof); and
  - Produces at least 20% of its total useful energy in the form of electrical or mechanical power (or combination thereof); and
  - Has a system energy efficiency percentage in excess of 60%. This requirement does not apply to a facility designed to use biomass [within the meaning of IRC section 45(c)(2) and (3) without regard to the last sentence of paragraph (3)(A)] for at least 90% of the energy source. (See IRC section 48(c)(3)(C) for calculation of the system energy efficiency percentage and IRC section 48(c)(3)(D) for the reduction in payment for biomass systems with an energy efficiency of less than 60%.)
  - Does not have a capacity in excess of 50 megawatts or a mechanical energy capacity in excess of 67,000 horsepower or an equivalent combination of electrical and mechanical energy capacities.

CHP system property does not include property used to transport the energy source to the facility or to distribute energy produced by the facility.

Qualified small wind energy property: Qualified small wind energy property is property that uses a qualifying small wind turbine to generate electricity. A qualifying small wind turbine is a wind turbine that has a nameplate capacity of not more than 100 kilowatts.

Geothermal Heat Pump Property: Equipment that uses the ground or ground water as a thermal energy source to heat a structure or as a thermal energy sink to cool a structure.

V. Eligible Basis

The basis of property is determined in accordance with the general rules for determining the basis of property for federal income tax purposes. Thus, the basis of property generally is its cost (IRC section 1012), unreduced by any other adjustment to basis, such as that for depreciation, and includes all items properly included by the taxpayer in the depreciable basis of the property, such as installation costs and the cost for freight incurred in construction of the specified energy property. If property is acquired in exchange for cash and other property in a transaction described in IRC section 1031, in which no gain or loss is recognized, the basis of the newly acquired property is equal to the adjusted basis of the other property plus the cash paid.

Costs that will be deducted for federal income tax purposes in the year in which they are paid or incurred are not includible in the basis on which the payment is determined. For example, if the applicant will take the IRC section 179 deduction for all or part of the cost

of the property, then no payment is allowed for the portion of the cost of the property for which the IRC section 179 deduction will be taken. For geothermal property, if intangible drilling and development expenses will be deducted by the applicant, no payment will be allowed on the costs that will be deducted as intangible drilling and development expenses. If the applicant will capitalize intangible drilling and development expenses, only those costs that may be recovered through depreciation are includible in the basis on which the payment is allowed. However, if the applicant will elect under IRC § 59(e) to deduct intangible drilling and development costs over 60 months, the payment is based on the amount for which the election under § 59(e) applies because the effect of § 59(e) is to treat these costs as amortizable.

Only the cost basis of property placed in service after 2008 is eligible for a Section 1603 payment. Thus, if property is placed in service in 2009 at a qualified facility that was placed in service in an earlier year, only the basis of the property placed in service in 2009 is eligible for a Section 1603 payment.

Limitation on eligible basis. The eligible basis of a qualified facility does not include the portion of the cost of the facility that is attributable to a non qualifying activity. For example, for a biomass facility that burns fuel other than open-loop biomass or closed-loop biomass, the eligible cost basis is the percentage of total eligible costs that is equal to the percentage of the electricity produced at the facility that is attributable to the open-loop biomass and closed-loop biomass. In the case of costs that relate to both a nonqualifying activity and a qualifying activity, the costs must be reasonably allocated between the nonqualifying and qualifying activities. For example, if combustion equipment burns both qualifying biomass and other fuel, the equipment's eligible cost basis is limited to the percentage of its otherwise eligible cost corresponding to the percentage of the equipment's electricity production that is attributable to the qualifying biomass. Similarly, the eligible basis of a qualified hydropower facility producing incremental hydropower includes the entire costs of the modification even though only a portion of the power produced from the modification is attributable to the modification.

Applicants must submit with their application for a Section 1603 payment documentation to support the cost basis claimed for the property. Supporting documentation includes a detailed breakdown of all costs included in the basis. Other supporting documentation, such as contracts, copies of invoices, and proof of payment must be retained by the applicant and made available to Treasury upon request. For properties that have a cost basis in excess of $500,000 applicants must submit an independent accountant's certification attesting to the accuracy of all costs claimed as part of the basis of the property.

VI. Leased Property

A lessor who is eligible to receive a Section 1603 payment with respect to a property may elect to pass-through the Section 1603 payment to a lessee. The election may only be made with respect to property that would be eligible for the Section 1603 payment if owned by the lessee. Such an election will treat the lessee as having acquired the property for an amount equal to the independently assessed fair market value of the

property on the date the property is transferred to the lessee and will generally follow the rules in the IRC and Treasury regulations governing elections to allow lessees to receive energy tax credits.

The lessor and lessee must agree that the lessor waives all right to a Section 1603 payment or a production or investment tax credit with respect to the eligible property, before the lessee may apply for a Section 1603 payment with respect to such property. The lessee must agree to include ratably in gross income over the five year recapture period an amount equal to 50 % of the amount of the Section 1603 payment.

In order to make this election, both the lessor and the lessee must be persons eligible to receive a payment under Section 1603. Additionally, this election may not be made by a lessor that is a mutual savings bank or similar financial organization, a regulated investment company or a real estate investment trust.

The election of a lessor to allow the lessee to receive a Section 1603 payment may be made with respect to each property leased by the lessor to the lessee. The lessee's written consent is required. The lessor's election is made by a written agreement with the lessee that contains the following information:

- A waiver of the lessor's right to receive any payment under Section 1603 with respect to the property, as well as a waiver of the lessor's right to claim a production or investment tax credit under sections 45 and 48 of the IRC with respect to the same property for the taxable year of the payment or subsequent years;
- All information necessary to determine the amount of lessee's Section 1603 payment;
- The name, address, and employer identification number of the lessor and the lessee;
- A description of each property with respect to which the election in being made;
- The date on which possession of the property is transferred to the lessee; and
- The lessee's consent to the election.

A copy of this agreement must be included in the lessee's application for the Section 1603 payment. This election is irrevocable.

Special Rule for Sale-leaseback Transaction

In a sale-leaseback transaction, the lessee, who is not the owner of the property, may claim the Section 1603 payment, if three conditions are satisfied:

- First, the lessee must be the person who originally placed the property in service.
- Second, the property must be sold and leased back by the lessee, or must be leased to the lessee, within three months after the date the property was originally placed in service.
- Third, the lessee and lessor must not make an election to preclude application of the sale-leaseback rules.

VII. Recapture

If the applicant disposes of the property to a disqualified person or the property ceases to qualify as a specified energy property within five years from the date the property is placed in service (hereinafter "disqualifying event"), the Section 1603 payment must be repaid to the Treasury as follows: 100% of the payment must be repaid if the disqualifying event takes place within one year from the date placed in service; 80% of the payment must be repaid if the disqualifying event takes place after one year but before two years from the date placed in service; 60% of the payment must be repaid if the disqualifying event takes place after two years but before three years from the date placed in service; 40% of the payment must be repaid if the disqualifying event takes place after three years but before four years from the date placed in service; and 20% of the payment must be repaid if the disqualifying event takes place after four years but before five years from the date placed in service.

Property is considered to have been disposed of to a disqualified person if any interest in the property or in the applicant or in any partnership or pass-thru entity that is a direct or indirect owner of an interest in the applicant is sold to: any Federal, state or local government, including any political subdivision, agency or instrumentality thereof; any organization that is described in section 501(c) of the IRC and is exempt from tax under section 501(a) of the IRC; any entity referred to in paragraph (4) of section 54(j) of the IRC; or any partnership or other pass-thru entity any partner (or other holder of an equity or profits interest) of which is a Federal, state or local government, including any political subdivision, agency or instrumentality thereof; an organization that is described in section 501(c) of the IRC and is exempt from tax under section 501(a) of the IRC; or an entity referred to in paragraph (4) of section 54(j) of the IRC. A taxable corporation some or all of whose shareholders are disqualified persons is not a disqualified person and such a corporation's ownership of an interest in a partnership or other pass-thru entity will not cause the partnership or other entity to be treated as a disqualified person.

Property ceases to qualify as a specified energy property if the use of the property changes so that it no longer qualifies as specified energy property. For example, use of property predominantly outside the United States in a year will result in recapture. Temporary cessation of energy production will not result in recapture provided the owner of the property intends to resume production at the time production ceases. Permanent cessation of production will result in recapture. Permanent cessation of production due to natural disaster will not result in recapture unless the property is replaced with property for which a Section 1603 payment is allowed. Replacement would be treated as occurring if the applicant uses IRC section 1033 to avoid gain recognition.

For a hydropower property where incremental hydropower production has been licensed by FERC, recapture will not take place if actual incremental increases in energy production do not occur that year due to environmental and/or regulatory factors. Recapture for a hydropower facility installed on a nonhydroelectric dam will occur if the Federal Energy Regulatory Commission license is surrendered or repealed based on significant changes in water surface elevation caused by operation of the facility.

If the amount of the Section 1603 payment depends on the percentage of electricity produced from biomass (in the case of closed-loop and open-loop biomass facilities) or the energy efficiency percentage (in the case of combined heat and power system property using biomass) and the percentage is reduced, a proportionate percentage of the property ceases to qualify as specified energy property. The applicable percentages will be determined on an annual basis for the year beginning on the date the property is placed in service and for each succeeding year within the recapture period. No additional grant will be allowed in a subsequent year in which the percentage increases.

Selling or otherwise disposing of the property to an entity other than a disqualified person does not result in recapture provided the property continues to qualify as a specified energy property and provided the purchaser of the property agrees to be jointly liable with the applicant for any recapture. Recapture would occur in the event the property is resold to a disqualified person or ceases to qualify as a specified energy property. The applicant remains jointly liable to the Treasury for the recapture amount even if the applicant no longer has control over the property.

Where a lessor elects to pass through the Section 1603 payment to a lessee, if the lessor sells the property to a disqualified person, the lessee is liable to the Treasury for the recapture amount even if the lessee maintains control over the property. If the lease is terminated and possession of the property is transferred by the lessee to the lessor or any other person, the lessee is liable to the Treasury for the recapture amount if the use of the property changes during the recapture period so that it no longer qualifies as specified energy property.

Applicants are not required to post a bond as a condition of receiving payment under the section 1603 program and receipt of payment does not create a lien on the property in favor of the United States. However, funds that must be repaid to the Treasury under these rules are considered debts owed to the United States and if not paid when due, will be collected by all available means against any assets of the applicant, including enforcement by the United States Department of Justice. Debts arising under these rules are not considered tax liabilities.

VIII. Miscellaneous Provisions

A. Assignment of Payment

Applicants may submit, along with their request for payment, a Notice of Assignment, assigning the payment to a third party provided the requirements of the Federal Assignment of Claims Act (31 U.S.C. 3727) are met. The Notice of Assignment will include the DUNS number for the third party. The third party will be required to register in CCR.

B. National Environmental Protection Act (NEPA)

A Section 1603 payment with respect to specified energy property does not make the property subject to the requirements of NEPA and similar laws.

C. Davis- Bacon

A 1603 payment with respect to specified energy property does not make the property subject to the requirements of the Davis-Bacon Act.

D. Treatment of Payments as Taxable Income
Except as described in Section IV of this Guidance with respect to leased property, a Section 1603 payment with respect to specified energy property is not includible in the gross income of the applicant. The basis of the property is reduced by an amount equal to 50% of the payment.

E. Real Estate Investment Trusts
A Real Estate Investment Trust (REIT) will be eligible to receive Section 1603 payments only to the extent allowed by section 50 of the IRC. IRC section 50(d)(1) specifies that rules similar to the rules of former IRC section 46(e) will apply. IRC section 46(e)(1)(B) provides that, in general, in the case of a REIT, qualified investment is limited to the REIT's ratable share of such qualified investment. The ratable share is a ratio, the numerator of which is its taxable income and the denominator of which is its taxable income computed without regard to the deduction for dividends paid (provided by IRC section 857(b)(2)(B)). For this purpose, the REIT's taxable income is determined without regard to any deduction for capital gains dividends and by excluding any net capital gain.

F. Applicability of Normalization Rules
Payments received under the Section 1603 program must be normalized. See former IRC Section 46(f).

G. Reporting
Applicants will be required to provide reports, as required by Treasury, including an annual performance report as set forth in the Terms and Conditions.

Payments for Specified Energy Property in Lieu of Tax Credits Under the American Recovery and Reinvestment Act of 2009

FREQUENTLY ASKED QUESTIONS AND ANSWERS
BEGUN CONSTRUCTION

Q1. How does an applicant demonstrate that construction has begun on a project in 2009, 2010 or 2011?
A1. There are two ways to show that construction has begun. One is to begin physical work of a significant nature. The other is to meet a 5% safe harbor.

Physical Work of a Significant Nature

Q2. What does it mean to begin physical work of a significant nature?
A2. This means that physical work on the specified energy property has started. Physical work of a significant nature includes any physical work on the specified energy property at the site. Physical work of a significant nature also includes physical work that has taken place under a binding written contract for the manufacture, construction, or production of specified energy property for use by the applicant's facility provided the contract is entered into prior to the work taking place.

Q3. What is included in specified energy property in the case of a qualified facility described in section 45 of the Internal Revenue Code?
A3. In the case of a qualified facility described in section 45, specified energy property is limited to tangible personal property and other tangible property used as an integral part of the activity performed by the qualified facility and located at the site the qualified facility. For such a facility, specified energy property includes property integral to the production of electricity, but does not include property used for electrical transmission. Thus, physical work on a transmission tower located at the site is not physical work of a significant nature because the transmission tower is not part of the qualified facility. However, physical work on a transformer that steps up the voltage of electricity produced at the facility to the voltage needed for transmission is physical work of a significant nature because power conditioning equipment is part of the qualified facility.

Q4. How much physical work is required? Is laying the foundation for one wind turbine that is part of a larger wind farm sufficient?
A4. In general any physical work on the specified energy property will be treated as the beginning of construction even if such work relates to only a small part of the facility, but see Q5/A5 below.

Q5. Once physical work has begun, must physical work on the project be continuous to satisfy the requirement that construction has begun? For example, if a single foundation for a wind

turbine is laid in 2011 but no other physical work on a 50-turbine project takes place until 2013, has the requirement been met?
A5. Treasury will closely scrutinize any construction activity that does not involve a continuous program of construction or a contractual obligation to undertake and complete within a reasonable time, a continuous program of construction. Disruptions in the work schedule that are beyond the applicant's control (for example, unusual weather or a site at which work can only be performed during certain seasons) will be taken into account in determining whether or not an applicant has undertaken a continuous program of construction.

Q6. Is starting work on roads physical work of a significant nature?
A6. Only work on specified energy property is physical work of a significant nature for purposes of showing that construction has begun. In the case of a qualified facility described in section 45, roads on the site that are integral to the qualified facility are specified energy property; these include onsite roads that are used for moving materials to be processed (for example, biomass) and roads for equipment to operate and maintain the qualified facility. Starting construction on these roads constitutes the beginning of construction. Roads for access to the site, or roads used solely for employee or visitor vehicles are not specified energy property; starting construction on these roads is not starting physical work of a significant nature on specified energy property.

Q7. Is preliminary work such as clearing land, obtaining permits or putting up fencing physical work of a significant nature?
A7. Preliminary work such as clearing land and obtaining permits is not physical work of a significant nature on specified energy property. Erecting a fence (or beginning to erect a fence) is not the beginning of physical work of a significant nature because, generally, fencing is not an integral part of the qualified facility.

Q8. An applicant plans to build a new facility for the production of electricity from wind power. The facility will be constructed on an existing wind facility site. In order to construct the new wind facility, the existing facility will be dismantled and removed. If an applicant begins to remove portions of the existing facility has physical work of a significant nature commenced?
A8. No. Generally, the cost of removal is associated with the property being removed or is capitalized to non-depreciable land. Removal of the existing turbines and towers is preliminary work and, therefore, does not constitute physical work of a significant nature on specified energy property.

Q9. Is the construction at the site of a building that will be used for operations and maintenance physical work of a significant nature?
A9. Because a building is not specified energy property, construction of a building is not physical work of a significant nature. However, the following structures are not treated as buildings for this purpose: (1) a structure that is essentially an item of machinery or equipment, or (2) a structure that houses property used as an integral part of a qualified activity if the use of the structure is so closely related to the use of the housed property that the structure clearly

can be expected to be replaced when the property it initially houses is replaced. See Treas. Regs.§ 1.48-1(e)(1).

Q10. Is test drilling of a geothermal deposit considered physical work of a significant nature?
A10. Test drilling for a geothermal deposit is a preliminary activity and is not physical work of a significant nature.

Q11. When is a contract binding?
A11. To be binding, a contract must be enforceable under state law. Additionally, the contract terms cannot limit damages in the event of a breach to less than 5% of the total contract price.

Q12. What is included in work performed under a binding written contract?
A12. Work performed under the contract includes only work that takes place after the binding written contract is entered into. The work is treated as physical work of a significant nature only if it is work on property that will become specified energy property of the applicant. For example, if a contractor is manufacturing solar panels specifically for the applicant under a binding written contract, any physical work on those panels is physical work of a significant nature on specified energy property of the applicant. If an applicant has a binding written contract with a contractor who is manufacturing solar panels for a number of customers, physical work on the panels would only be considered work performed under the applicant's binding written contract if the contractor can reasonably demonstrate that physical work has started on panels that will become specified energy property of the applicant. The contractor may use any reasonable, consistent method to allocate work it performs among its customers. Whether a method is reasonable depends on all the relevant facts and circumstances.

Q13. If an applicant purchases components or other parts from the inventory of a vendor under a binding written contract entered into before January 1, 2012, has physical work of a significant nature begun?
A13. No. Work performed under a contract does not include work to produce components or parts that are in existing inventory or are normally held in inventory by a manufacturer.

Q14. If physical work takes place pursuant to a binding written contract on property manufactured, constructed or produced for the applicant's project but the specific site for the project will not be identified prior to the deadline for submitting initial applications (or the site changes after an initial application is submitted), has physical work of a significant nature begun?
A14. If the work performed otherwise meets the requirements for physical work of a significant nature and work on the project is continuous (see Q5/A5), the fact that the specific site of the project has not been identified at the time of the initial application (or changes after the initial application) does not impact whether or not construction has begun.

5% Safe Harbor

Q15. How is the 5% safe harbor met?

A15. An applicant meets the 5% safe harbor if the applicant pays or incurs 5.00% or more of the total cost of the specified energy property before the end of 2011.

Q16. What does "paid or incurred" mean?
A16. The term "paid or incurred" generally means paid or incurred within the meaning of Treas. Regs. §1.461-1(a)(1) and (2). That is, costs are taken into account when cash-method taxpayers "pay" them and when accrual-method taxpayers "incur" them. A cost is generally "incurred" for tax purposes when 1) the fact of the liability is fixed, 2) the amount of the liability is determinable with reasonable accuracy, and 3) the economic performance test (see Treas. Regs. §1.461-4) has been met with respect to such cost. Although the specific reference to the §461(h) economic performance rules was deleted in the revised Program Guidance, the economic performance rules continue to apply in determining whether costs have been incurred. The 5% safe harbor contained in the Program Guidance includes a single exception to the general principles that are used to determine when amounts are "incurred." Under general rules for property manufactured, constructed, or produced for the applicant by another person under a binding written contract that is entered into prior to the manufacture, construction, or production of the property, the cost of such property is treated as "incurred" when the property is provided to the applicant. The exception is that for periods before the property is provided to the applicant, costs incurred with respect to the property by such other person are treated as costs of the property that are incurred by the applicant when the costs are incurred by such other person.

Q16A: When are costs paid or incurred by the person providing the property to the applicant under a binding contract?
A16A: Costs are paid or incurred by the person providing property to the applicant as that person pays or incurs costs in connection with providing property to the applicant. For example: In 2011, accrual-method taxpayer W enters a binding written contract to provide a wind turbine to A in June 2013. In 2011, W, pursuant to a contract with Y, pays Y to provide parts in May 2012 for use in the wind turbine. W's employees provide W with services necessary to design and plan for the production of the wind turbine in 2011 and with services to manufacture (assemble) the wind turbine in 2013. W incurs the cost to design and plan for the production of the turbine assembly in 2011, incurs the costs for the parts in May 2013 when Y delivers the parts to W, and incurs the costs for W's employees to assemble the wind turbine in 2013. See § 1.461-4(d)(4), § 1.446-1(c)(1)(ii), and Example 3 of § 1.461-4(d)(7) of the Income Tax Regulations. For purposes of determining whether A has met the 5% safe harbor, A may only include the costs incurred by W to pay its employees to plan and design the turbine in 2011.

Q17. If title to the property has passed to the applicant, but the property remains in storage at the manufacturer's site, has the property been provided to the applicant?
A17. Property is provided to the applicant either when title to the property passes to the applicant or when it is delivered to or accepted by the applicant, depending on the applicant's method of accounting. In addition, property that the applicant reasonably expects to be

provided within 3-1/2 months of the date of payment will be considered to be provided on the payment date. See, generally, Treas. Regs. §1.461-4(d)(6).

Q18. In the case of property manufactured, constructed, or produced for the applicant by another person (the supplier) under a binding written contract that is entered into prior to the manufacture, construction, or production of the property, how does the applicant determine what costs have been paid or incurred on its behalf by the supplier? (Note that this Question and Question 19 assume that the supplier uses the accrual method of accounting)
A18. The applicant may rely on a statement by the supplier as to the amount incurred by the supplier with respect to the property to be manufactured, constructed, or produced for the applicant under the binding written contract. The supplier may use any reasonable, consistent method to allocate the costs incurred by the supplier among the units of property to be manufactured, constructed, or produced by the supplier. Only costs incurred by the supplier after the binding written contract is entered may be reasonably allocated to the property manufactured, constructed, or produced under that contract. The economic performance rules apply to determine when costs have been incurred by the supplier. The exception described in Q16/A16 does not apply in determining when costs are incurred by the supplier. Thus, if components are manufactured for the supplier by a subcontractor, the cost of those components is incurred only when the components are provided to the supplier and not as the subcontractor pays or incurs the costs of manufacturing the components.

Q19. An applicant may enter into a binding written contract for multiple units of property to be manufactured, constructed, or produced for the applicant by another person under a binding written contract that is entered into prior to the manufacture, construction, or production of the property. How does the applicant allocate the costs paid or incurred with respect to the contract to the units of property acquired pursuant to the contract?
A19. Costs incurred when property is delivered to the applicant are allocated to such property. Costs that are treated under Q16/A16 as incurred when incurred by the supplier with respect to the property are allocated to the property with respect to which the supplier incurred the costs. The supplier may use any reasonable method to allocate the costs it incurs among the units of property manufactured, constructed or produced by the supplier and to allocate the units of property it produces among its customers. Whether a method is reasonable depends on all the relevant facts and circumstances. In addition, property that the supplier reasonably expects to receive from a subcontractor within 3-1/2 months of the date of the supplier's payment to the subcontractor is considered to be provided by the payment date. See, generally, Treas. Regs. §1.461-4(d)(6).

Q20. A developer may enter into a binding written contract for multiple units of property to be manufactured, constructed, or produced for the developer by another person under a binding written contract (a "master contract") that is entered into prior to the manufacture, construction, or production of the property. The developer may then assign its rights to certain units of property to an affiliated special purpose vehicle (generally, a limited liability company) that will own the project for which such property is to be used and will apply for the payment. Such assignment typically is represented by a new contract (the "project contract") between

the special purpose vehicle and the person manufacturing, constructing, or producing the property. An adjustment is then made to the master contract between the developer and the person manufacturing, constructing, or producing the property to reflect the assignment. Assume costs paid or incurred with respect to the master contract between the developer and the person manufacturing, constructing, or producing the property are considered to have been paid or incurred in 2009, 2010, or 2011 for purposes of determining whether construction has started. For purposes of determining whether construction has started, may these costs then be allocated to the special purpose vehicle if its project contract and the master contract, as adjusted, both reflect this assignment?
A20. Costs that are allocated to the property under the principles of Q19/A19 are treated as costs of the property notwithstanding the substitution of the project contract with respect to such property.

Q21. What happens if the project's costs are more than expected? Is it sufficient to show that an applicant reasonably expected costs paid or incurred before the end of 2011 to be 5% of the project costs?
A21. No. To satisfy the 5% safe harbor applicants must demonstrate that costs paid or incurred before the end of 2011 are equal to or greater than 5% of the actual total costs of the specified energy property. However, if the applicant's project includes multiple units of specified energy property, an applicant can opt to apply for a payment based on some, but not all, units of property. For example, if an applicant incurs $25,000 in costs in 2011 for specified energy property in a 5 turbine wind farm anticipating total costs for specified energy property of $500,000 but the actual total costs of specified energy property amount to $600,000, the safe harbor would not be satisfied. However, the applicant can opt to apply for a payment based on the costs of 3 turbines and would satisfy the safe harbor if the $25,000 of costs incurred in 2011 relates to the 3 turbines and their total cost does not exceed $500,000.

Q22. An applicant demonstrates that the applicant meets the 5% safe harbor as of December 31, 2011, with respect to a facility. The facility will not be placed in service until 2012. Must the applicant continue to work at the site in 2012 in order to qualify for payment in 2013?
A22. No.

Q23. For applicants relying on the 5% safe harbor, what happens if ownership of the energy property changes between the time the property is acquired for use in a project and the time the project is placed in service?
A23. If a person (the transferor) contributes, assigns or transfers property to a second person (the transferee) and the transferee uses the property in a project, the transferee is treated for purposes of the 5% safe harbor as having paid or incurred, at the same time as the transferor, the costs that the transferor paid or incurred to acquire the property, but only if the transferor acquired the property for use in that project and is related to the transferee. A transferee and transferor that are related persons within the meaning of section 197(f)(9)(C) of the Internal Revenue Code immediately before or immediately after the contribution, assignment, or transfer of the property will be considered related for this purpose. However, if property is sold to an unrelated purchaser after December 31, 2011, the purchaser may not take the costs that

the transferor incurred with respect to the property into account in determining whether the 5% safe harbor is met. This limitation does not apply in the case of a sale/leaseback arrangement. If an entity which met the 5% safe harbor with respect to a facility sells the facility to an unrelated entity and leases the facility back from that entity within 90 days of the placed in service date, the purchaser of the facility (assuming all other eligibility requirements are met) would be treated as satisfying the 5% safe harbor.

Q24. For applicants relying on the 5% safe harbor, what happens if ownership of the entity that met the 5% safe harbor changes before the property is placed in service?
A.24. If ownership of the entity that met the 5% safe harbor changes after December 31, 2011, and before the property is placed in service, eligibility is not affected if (1) the purchaser is an otherwise eligible Section 1603 applicant and (2) the entity being sold had commenced development of a project as evidenced by activity such as acquiring land, obtaining permits and licenses, entering into a power purchase agreement, entering into an interconnection agreement, and contracting with an Engineering, Procurement and Construction contractor. The purchaser of an entity which holds equipment only may not rely on costs paid or incurred to acquire that equipment. For example, a project company meets the safe harbor and commences development of a project by acquiring permits, a power purchase agreement and an interconnection agreement. A partnership interest in the project company is sold to a tax equity investor (or the tax equity investor makes a capital contribution in exchange for a partnership interest) in a partnership flip transaction. The project company (with the tax equity investor as a partner) may rely on costs incurred by the project company to satisfy the 5% safe harbor. On the other hand, if a project company meets the safe harbor by purchasing and taking delivery of equipment but does no other activity, the purchaser of the project company may not rely on costs incurred by the project company to satisfy the 5% safe harbor.

Process

Q25. Under what circumstances and when is an applicant required to submit an application demonstrating that construction has begun?
A25. All applications must be submitted before the statutory deadline of October 1, 2012. For property that has been or will be placed in service in 2009, 2010, or 2011 an application demonstrating that construction has begun is not required. For property that is placed in service after December 31, 2011, but before October 1, 2012, applicants may submit an application before October 1, 2012, demonstrating both that construction began on the property in 2009, 2010, or 2011 and that the property has been placed in service. For property that is placed in service on or after October 1, 2012, applicants must submit a preliminary application before October 1, 2012, demonstrating that construction on the property began in 2009, 2010, or 2011. Such applications must then be supplemented at the time the property is placed in service.

Q26. If an applicant submits an application demonstrating that construction has begun, will the applicant receive a response?

A26. Yes. Although we cannot provide assurance that an applicant meets all the requirements for a payment until all facts and circumstances are known (at time the facility is placed in service), we will tell the applicant whether or not the work performed is physical work of a significant nature or, for applicants relying on the safe harbor, whether qualifying costs have been paid or incurred.

Q27. What documentation is required?
A27. For projects relying on "physical work of a significant nature" applicants must document the physical work. For example, to demonstrate that physical work of a significant nature has commenced at the site, applicants should submit a written report from the project engineer or installer, signed under penalties of perjury, describing the project's eligibility; including a detailed construction schedule; estimated budget for the project and a description of the work that has commenced including any invoices for the work performed. For projects with an anticipated cost basis of $1 million or more, the report must be from an independent engineer. To demonstrate that physical work of a significant nature has commenced under a binding written contract, applicants should submit a copy of the binding written contract and a statement from the contractor, signed under penalties of perjury, describing the work that has commenced and certifying that the work commenced pursuant to the binding written contract.

For projects relying on the 5% safe harbor, applicants must submit a statement from an authorized representative of the applicant signed under penalties of perjury, or for projects with an estimated eligible cost basis of $1 million or more, from an independent accountant, attesting to the method of accounting used by the applicant for federal tax purposes (cash or accrual). For applicants that use the cash method of accounting, the statement should state the amount that has been paid before the end of 2011; a detailed description of the costs that have been paid; and an estimate of the total cost of the specified energy property and must include evidence of payment such as invoices or other financial records. For applicants that use the accrual method of accounting, the statement should state the amount that has been incurred before the end of 2011; a detailed description of the costs incurred; and an estimate of the total cost of the specified energy property and must include evidence of the costs incurred such as invoices or other financial records. If an applicant is relying on costs paid or incurred by a contractor, a copy of the binding written contract and a statement from the contractor, signed under penalty of perjury, of costs paid or incurred and allocated to applicant's project must be included.

Additional documentation may also be required depending on the facts and circumstances. If additional documentation is required applicants will be notified.

Q3: Please provide a detailed summary of NREL's Cooperative Research and Development Agreements (CRADAs) related to the renewable energy technologies considered at the hearing, including a list of the partners, technology types, and approximate value of the partner-contributed funds under such CRADAs.

A listing of the partnerships related to the technologies considered at the hearing is provided below. A total of $20.5 million in partner-contributed funds have been committed to these wind and solar partnerships and most of these projects are executed over a three to five year period.

Solar Research (Partner Contributed Funds Totaling $17.1M)

3M Company

Abengoa Solar PV, Inc.

Ampulse Corporation

Applied Nanotech Holdings, Inc

Applied Optical Sciences Corporation

CH2M Hill

Colorado School of Mines (CSM)

Corning, Incorporated

Crystal Solar

Dass Tech Co., Ltd.

EPIR Technologies, Inc.

Greenville College

HelioVolt Corporation

Kansas State University

Konarka Technologies, Inc.

Mattson Technology

MEMC Electronic Materials Inc.

MicroLink Devices, Inc.

Natcore Technologies

National Institute of Advanced Industrial Science and Technology

New Energy Technologies, Inc.

Plextronics, Inc.

PrimeStar Solar

RF Micro Devices Inc.

Rohm and Haas Company

Sharp Laboratories of America

Solar Junction, Inc.

Solarmer

South Dakota School of Mines and Technology

Spectrolab Inc.

Sunshine Bottling LLC

Suntricity Corporation

SuperPower, Inc.

SVTC Technologies, LLC

TDA Research, Inc.

United Solar Ovonic LLC

University of Queensland

Wind Energy Research (Partner Contributed Funds Totaling $3.4M)

Alstom Power Inc.

Amonix, Incorporated

Boulder Wind Power

Catch the Wind, Inc.

CENER-CIEMAT Foundation

Energy Research Centre of the Netherlands

Florida Atlantic University Board of Trustees

Free Flow Power Corporation

Garrad Hassan & Partners Ltd.

Indiana University

Lake Benton Power Partners

Massachusetts Technology Collaborative

MidAmerican Energy Company

Mitsubishi Power Systems Americas, Inc.

Narec (National Renewable Energy Centre Limited)

New England Marine Renewable Energy Center (MREC)

Oregon State University

Principle Power

RES Americas Inc.

Siemens Energy and Automation Inc.

Southwest Windpower

SWAY AS

Technical University Delft

Texas Tech University

The Gear Works Seattle Inc

University of Colorado at Boulder

University of Delaware

University of Washington

Verdant Power

Xcel Energy

RESPONSE TO QUESTIONS FOR THE RECORD FOR

RHONE RESCH, PRESIDENT & CEO
SOLAR ENERGY INDUSTRIES ASSOCIATION

SUBMITTED TO THE

U.S. HOUSE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
SUBCOMMITTEE ON INVESTIGATION AND OVERSIGHT &
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT

REGARDING JOINT HEARING ON

IMPACT OF TAX POLICIES ON COMMERCIAL APPLICATION OF RENEWABLE ENERGY TECHNOLOGY

APRIL 19, 2012

SEIA Solar Energy Industries Association®

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Question submitted by Dr. Paul Broun, Chairman, Subcommittee on Investigations & Oversight

1. **I understand that some 30 states plus the District of Columbia have enacted renewable portfolio standards (RPS) and that eight more states have established "voluntary goals" for the use of renewable energy. Why won't meeting these standards drive solar and wind industry demand?**

Chairman Broun – I appreciate having the opportunity to address this issue.

Renewable portfolio standards ("RPS") have and will continue to help drive the deployment of renewable energy resources such as solar. States have enacted RPSs to address a variety of policy concerns. A state can use an RPS to diversify its energy portfolio, improve its energy security, and avoid dependence on a single source of energy. Since there are no fuel costs associated with solar projects, these projects are not subject to the price volatility often associated with commodity-based energy sources. Utilities and ratepayers can further benefit from solar's price stability through the use of long-term power purchase agreements ("PPAs"), which provide a stable, predictable means to account for future energy costs. A state can also employ an RPS to reduce harmful emissions as a way to address environmental and health concerns.

While state RPSs undoubtedly help deploy renewable technology, this patchwork of inconsistent state policies is not a substitute for a cogent federal policy that provides a stable, reliable framework that encourages the nationwide development of a diverse, abundant and affordable supply of energy.

Currently, there is not a federal RPS or other equivalent federal policy mechanism that compels the use of solar technology. The primary federal policy that drives the expanded deployment and use of solar energy technology is the residential and commercial solar Investment Tax Credit ("ITC"). For states that have RPS requirements, the RPS often functions as a ceiling, with utilities using the minimum amount of renewable energy required to comply with the state's RPS requirements. In these instances, the federal ITC provides a meaningful economic incentive to exceed the renewable requirements provided for by a state RPS. In states that do not have a RPS or a comparable renewable requirement, the federal solar ITC is the primary policy that encourages the expanded deployment and use of solar technology. Thus, the combination of these state and federal policies have helped rapidly expand the deployment of a variety of solar energy technologies; reduced costs for consumers; and helped build a nationwide solar value chain that now employs more than 100,000 Americans at 5,600 companies in all 50 states.

Questions submitted by Dr. Andy Harris, Chairman, Subcommittee on Energy & Environment

1. **There was significant discussion at the hearing regarding the comparative cost of electricity generation by solar PV versus combined cycle natural gas. You stated that, for solar PV, "the levelized cost today is below 15 cents" [per kilowatt/hr].**

Chairman Harris – I appreciate the chance to address these issues for the record.

During the hearing, you asserted that the cost of solar energy for end use by consumers exceeded 20 cents per kilowatt hour ("kWh"), and further indicated that this was four times higher than what retail consumers pay for electricity produced from natural gas. I would respectfully note that this is an inaccurate portrayal of the facts.

The levelized cost of electricity ("LCOE") figures for solar you referenced were derived from outdated figures in the Energy Information Administration's ("EIA") *Annual Energy Outlook 2011*. These LCOE figures, which represent an average cost and apply only to utility scale photovoltaic (PV) projects, are derived from calculations that are over 18 months old. During that time frame, the cost of utility scale PV has dropped 33 percent, and the price of solar panels has dropped by over 50 percent in the last year. The LCOE for solar is actually lower than 15 cents per kWh, and in the case of the recent California Renewable Auction Mechanism ("RAM"), contracts have been signed at lower than 9 cents per kWh. It is also worthwhile to note that due to the very nature of solar technology, solar production tends to coincide with peak loads – a time when electricity prices are highest.

In making the assertion that solar was four times more expensive for end-use consumers, you compared solar's **retail** costs to natural gas-fired advanced combined cycle generation, which represents the best-case **wholesale** cost scenario for electricity generated from natural gas. Pricing in wholesale and retail electricity markets are completely different, and thus, comparing retail solar prices to wholesale natural gas prices is, to use a common adage, an "apples to oranges" comparison. Further, solar energy does not compete against a single year of combined cycle production. Instead, solar competes against the 20 or 25 year expected cost of natural gas combined cycle production in *some cases*. This is due to the fact that both solar and natural gas generating assets are long-lived, and the fuel costs over the life of a natural gas plant need to be considered, not simply relying on current natural gas prices that have been at record lows. If one considers the expected LCOE for a 20-year contract for a new natural gas combined cycle plant, the likely prices is more likely to be in the 9-10 cents per kWh range. As I noted above, there are already instances where solar is competitive with this pricing, and as solar costs continue to fall, solar will be competitive with all energy sources in the marketplace.

It is also worthwhile to note that residential solar installations grew by 15 percent in the fourth quarter of 2011, and non-residential market grew by 44 percent in the same time frame. This growth occurred because solar technology allows residential and commercial customers to cut their electricity costs when compared to rates charged by incumbent utilities.

As the attached chart illustrates, we have historically seen significant volatility in natural gas prices. It is reasonable to assume that this volatility will persist in the future. This highlights the policy benefits of an energy policy that not only encourages an abundant, but a diverse supply of energy. Solar energy projects do not rely on a volatile commodity as a fuel source to produce energy. Residential, commercial and utility-scale solar projects provide a predictable – both from a cost and generation standpoint – source of energy that also happens to be the safest and cleanest form of energy production on the planet. And as I noted in my testimony before the committee, solar costs have and continue to fall in response to vigorous global competition and rapid advances in technology. Relying solely on existing, conventional energy technologies that are subject to commodity price volatility is a short-sighted policy that would ultimately hurt consumers and small businesses financially. However, developing a diversified portfolio of technologies with some having no fuel costs like solar, will provide a hedge against rising energy costs and save consumers money in the long run.

1.1 Please provide data or general/example contract information that support this figure.

Individual contracts are private and thus, not publicly available. That said, as I referenced above, the average solar contract presented under the recent California RAM provide electricity for less than 9 cents per kWh. In addition, attached is a frequently cited and respected LCOE analysis provided by Lazard demonstrating that the LCOE for solar can be as low a 7.3 per kWh.

1.2 Does this figure include full installation costs? If not, how much are such costs for the sub-fifteen cent contracts mentioned?

By definition, LCOE includes all costs associated with generating power including installation costs, operations and maintenance costs.

1.3 Does this figure include the 30% Federal tax credit for residential solar projects?

LCOE calculations include tax preferences provided for all sources of energy, both renewable and conventional.

1.4 Does this figure include the cost of lease payments associated with such contracts? If not, how much are such contracts?

LCOE analysis accounts for costs associated with lease payments.

2. What are the approximate installed costs per kilowatt/hr for central station solar PV and solar thermal?

As I noted both in my testimony and in a previous question, the cost of solar equipment has continued to drop dramatically. Thus, information published by the Energy Information Administration on this issue is typically dated due to the rapid and ongoing cost reductions in solar industry. With this in mind, the installed cost for a central station/utility scale solar facility is now in the $2,000 to $3,500 per kilowatt (kW) range. By comparison, this ranges from $3,000 to $8,000 per kW for coal generation facilities and $5,000 to $8,000 per kW range for nuclear. This information is based on solar PV projects. There is no comparable public information for solar thermal electric (otherwise known as concentrating solar power) projects.

2.1 What are the approximate transmission costs for solar electricity delivered to load centers?

Transmission costs vary based on the nature of a specific project. For example, rooftop residential and commercial distributed generation solar projects will have very little if any transmission costs and can potentially mitigate the need for some new transmission. For utility scale projects, transmission costs will vary based on the project's location. In many cases the transmission costs will be the same or higher for solar than for existing fossil generation on the same transmission line. To minimize these costs, increasingly project developers are locating plants at locations inside load centers to both help reduce transmission costs and inject power where it is most needed to alleviate grid congestion.

LEVELIZED COST OF ENERGY ANALYSIS – VERSION 5.0

LAZARD

LAZARD

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Introduction

Lazard's Levelized Cost of Energy Analysis ("LCOE") addresses the following topics:

- **Comparative "levelized cost of energy" for various technologies on a $/MWh basis, including sensitivities, as relevant, for:**
  - Fuel costs
  - U.S. federal tax subsidies
  - Anticipated capital costs, over time
- **Illustration of how the costs of solar-produced energy compare against peak power costs in large metropolitan areas of the United States**
- **Comparison of assumed capital costs on a $/kW basis for various generation technologies**
- **Decomposition of the levelized costs of energy for various generation technologies by capital costs, fixed operations & maintenance expense, variable operations & maintenance expense, and fuel costs, as relevant**
- **Considerations regarding the applicability of various generation resources, taking into account factors such as location requirements/constraints, dispatch characteristics, land and water requirements and other contingencies**
- **Summary assumptions for the various generation technologies examined**
- **Summary of Lazard's approach to comparing the levelized cost of energy for various conventional and Alternative Energy generation technologies, including identification of key potential sensitivities not addressed in the scope of this presentation**

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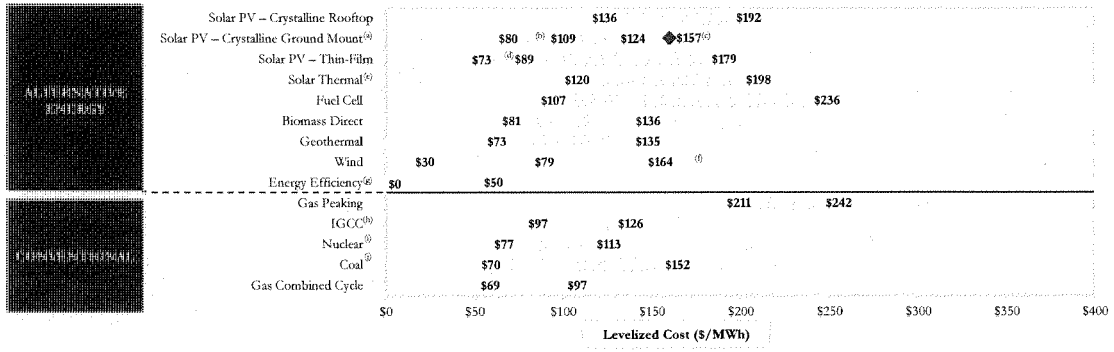
Levelized Cost of Energy Comparison

Certain Alternative Energy generation technologies are becoming increasingly cost-competitive with conventional generation technologies under some scenarios, before factoring in environmental and other externalities (e.g., RECs, transmission and back-up generation/system reliability costs) as well as construction and fuel costs dynamics affecting conventional generation technologies



Source: Lazard estimates.

Note: Reflects production tax credit, investment tax credit and accelerated asset depreciation, as applicable. Assumes 2010 dollars, 20-40-year economic life, 40% tax rate and 5-40 year tax life. Assumes 30% debt at 8.0% interest rate, 50% tax equity at 8.5% cost and 20% common equity at 12% cost for Alternative Energy generation technologies. Assumes 60% debt at 8.0% interest rate and 40% equity at 12% cost for conventional generation technologies. Assumes coal price of $2.50 per MMBtu and natural gas price of $5.50 per MMBtu.

(a) Low end represents single-axis tracking crystalline. High end represents fixed installation.
(b) Represents estimated implied levelized cost of energy in 2012, assuming a total system cost of $2.50 per watt for single-axis tracking crystalline.
(c) Represents a leading concentrating photovoltaic company's targeted levelized cost of energy, assuming a total system cost of approximately $4.00 per watt.
(d) Represents a leading thin-film company's targeted implied levelized cost of energy in 2012, assuming a total system cost of $2.00 per watt.
(e) Represents both solar tower and solar trough, each with 3 hour storage capability.
(f) Represents estimated midpoint of off-shore wind's levelized cost of energy, assuming a range of total system cost of $3.10 – $5.00 per watt.
(g) Estimates per National Action Plan for Energy Efficiency; actual cost for various initiatives varies widely.
(h) High end incorporates 90% carbon capture and compression.
(i) Does not reflect decommissioning costs or potential economic impact of federal loan guarantees or other subsidies.
(j) Based on advanced supercritical pulverized coal. High end incorporates 90% carbon capture and compression.

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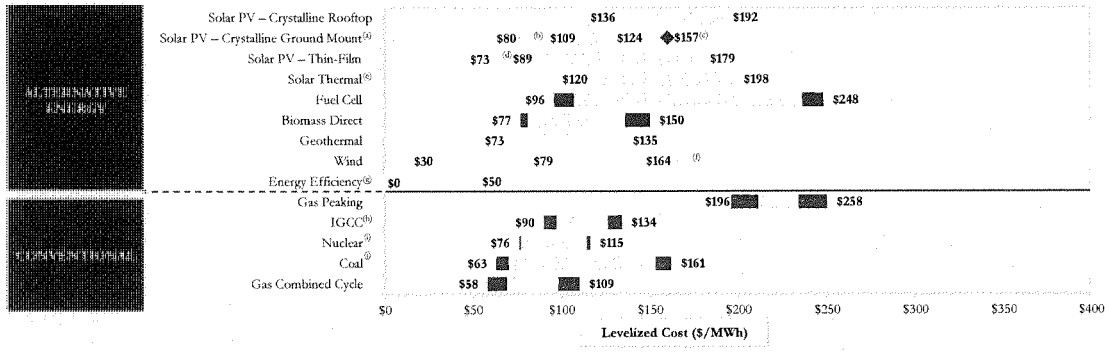
Levelized Cost of Energy Comparison – Sensitivity to Fuel Prices

Variations in fuel prices can materially affect the levelized cost of energy for conventional generation technologies, but direct comparisons against "competing" Alternative Energy generation technologies must take into account issues such as dispatch characteristics (e.g., baseload and/or dispatchable intermediate load vs. peaking or intermittent technologies)



Source: Lazard estimates.

Note: Darkened areas in horizontal bars represent low end and high end levelized cost of energy corresponding with ±25% fuel price fluctuations

(a) Low end represents single-axis tracking crystalline. High end represents fixed installation.

(b) Represents estimated implied levelized cost of energy in 2012, assuming a total system cost of $2.50 per watt for single-axis tracking crystalline.

(c) Represents a leading concentrating photovoltaic company's targeted levelized cost of energy, assuming a total system cost of approximately $4.00 per watt.

(d) Represents a leading thin-film company's targeted implied levelized cost of energy in 2012, assuming a total system cost of $2.00 per watt.

(e) Represents both solar tower and solar trough, each with 3 hour storage capability.

(f) Represents estimated midpoint of off-shore wind's levelized cost of energy, assuming a range of total system cost of $3.10 – $5.00 per watt.

(g) Estimates per National Action Plan for Energy Efficiency; actual cost for various initiatives varies widely.

(h) High end incorporates 90% carbon capture and compression.

(i) Does not reflect decommissioning costs or potential economic impact of federal loan guarantees or other subsidies.

(j) Based on advanced supercritical pulverized coal. High end incorporates 90% carbon capture and compression.

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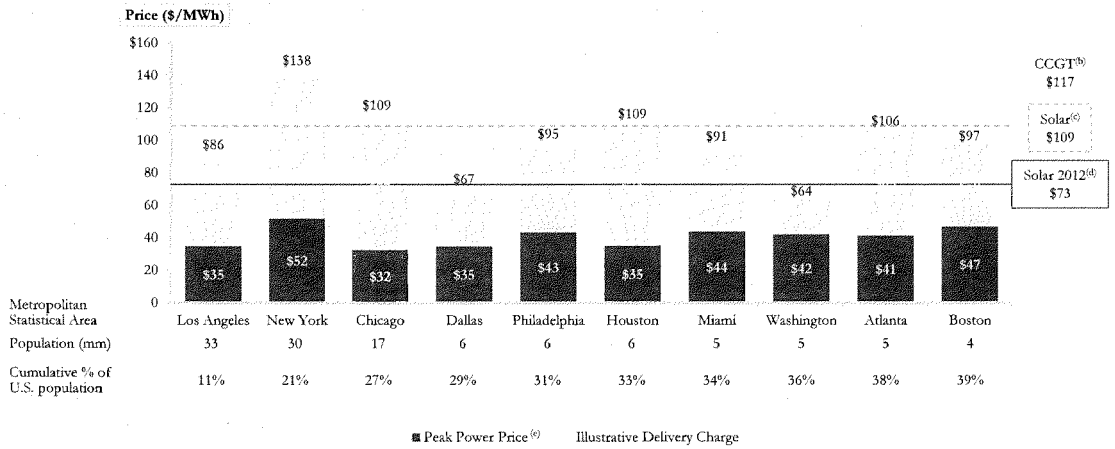
Peak Pricing for the 10 Largest U.S. Metropolitan Areas[a]

Setting aside the legislatively-mandated demand for solar and other Alternative Energy resources, solar is becoming a more economically viable peaking energy product in many areas of the U.S., and, as pricing declines, could become economically competitive across a broader array of geographies; this observation, however, does not take into account the full costs of incremental transmission and back-up generation/system reliability costs



(a) Defined as 10 largest Metropolitan Statistical Areas per the U.S. Census Bureau for a total population of 119 million.
(b) Assumes 25% capacity factor.
(c) Represents low end of solar PV crystalline.
(d) Represents a leading thin-film company's targeted implied levelized cost of energy in 2012.
(e) Represents the average of the hourly wholesale prices between 12 noon and 6pm at a normalized natural gas price.

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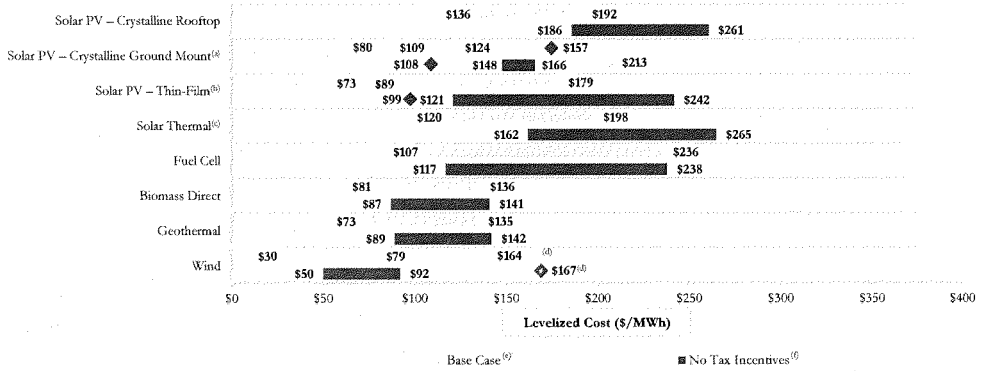
Levelized Cost of Energy – Sensitivity to U.S. Federal Tax Subsidies

U.S. federal tax subsidies remain an important component of the economics of Alternative Energy generation technologies (and government incentives are important in all regions); future cost reductions in technologies such as solar PV, solar thermal and fuel cells have the potential to enable these technologies to approach "grid parity" without tax subsidies and wind currently reaches "grid parity" under certain conditions (albeit such observation does not take into account issues such as dispatch characteristics, the cost of incremental transmission and back-up generation/system reliability costs or other factors)



Source: Lazard estimates.

Note: Assumes 2010 dollars, 60% debt at 8.0% interest rate and 40% common equity at 12% cost, 20-year economic life and 40% tax rate. Assumes natural gas price of $5.50 per MMBtu.

(a) Low end represents single-axis tracking crystalline. High end represents fixed installation. Diamonds represent estimated implied levelized cost of energy in 2012, assuming a total system cost of $2.50 per watt for single-axis tracking crystalline and a leading concentrating photovoltaic company's targeted levelized cost of energy, assuming a total system cost of approximately $4.00 per watt.

(b) Diamonds represent a leading thin-film company's targeted implied levelized cost of energy in 2012, assuming a total system cost of $2.00 per watt.

(c) Represents both solar tower and solar trough, each with 3 hour storage capability.

(d) Represents midpoint of off-shore wind's levelized cost of energy, assuming a range of total system cost of $3.10 – $5.00 per watt.

(e) Reflects production tax credit, investment tax credit, and accelerated asset depreciation, as applicable.

(f) Illustrates levelized cost of energy in the absence of U.S. federal tax incentives such as investment tax credits, production tax credits and assuming 20-year tax life for conventional technologies and 5-year MACRS for renewables technologies.

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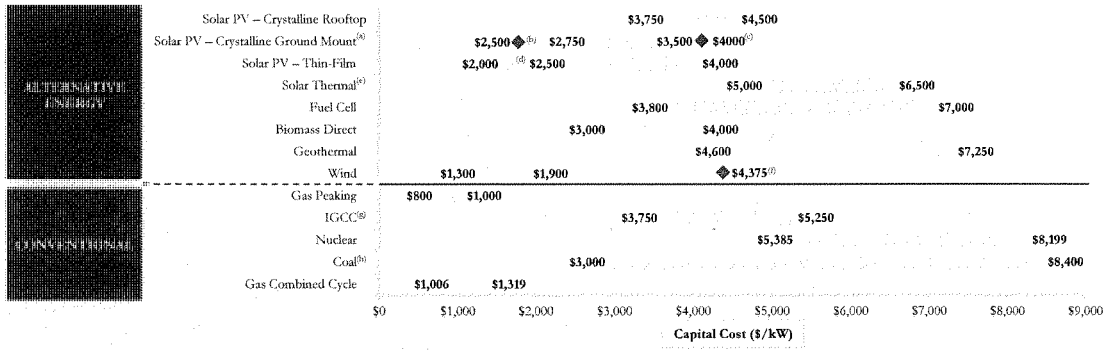
Capital Cost Comparison

While capital costs for a number of Alternative Energy generation technologies (e.g., solar PV, solar thermal) are currently in excess of conventional generation technologies (e.g., gas, coal), declining costs for many Alternative Energy generation technologies, coupled with rising long-term construction and uncertain long-term fuel costs for conventional generation technologies, are working to close formerly wide gaps in electricity costs. This assessment, however, does not take into account issues such as dispatch characteristics, capacity factors, fuel and other costs needed to compare generation technologies



Source: Lazard estimates.

(a) Low end represents single-axis tracking crystalline. High end represents fixed installation.
(b) Represents estimated implied levelized cost of energy in 2012, assuming a total system cost of $2.50 per watt for single-axis tracking crystalline.
(c) Represents a leading concentrating photovoltaic company's total system cost of approximately $4.00 per watt.
(d) Based on a leading thin-film company's guidance of 2012 total system cost of $2.00 per watt.
(e) Low end represents solar trough without storage, high end represents solar trough with 3 hour storage capability.
(f) Represents estimated midpoint of off-shore wind's levelized cost of energy, assuming a range of total system cost of $3.10 – $5.00 per watt.
(g) High end incorporates 90% carbon capture and compression.
(h) Based on advanced supercritical pulverized coal. High end incorporates 90% carbon capture and compression.

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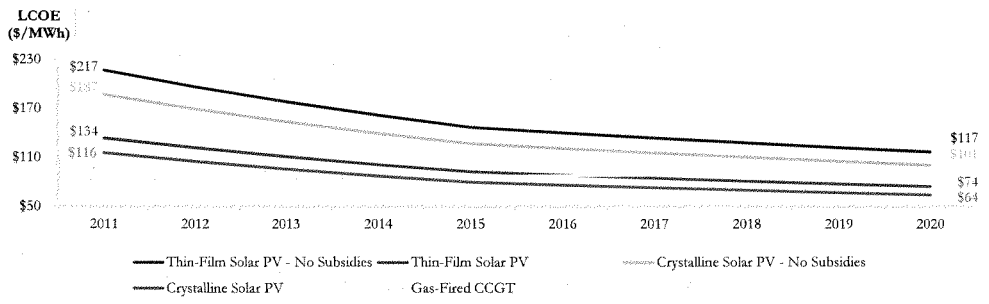
Levelized Cost of Energy – Sensitivity to Capital Costs[a]

An important finding in respect of solar PV technologies is the potential for significant cost reductions over time as manufacturing scale along the entire production value chain increases; by contrast, conventional generation technologies are experiencing capital cost inflation, driven by long-term global demand for conventional generation equipment, where potentially cost-reducing manufacturing improvements for these mature technologies are largely incremental in nature

- **This assessment, however, does not take into account the intermittent nature of solar PV as compared with the dispatchable nature of conventional generation; the key finding in this regard is that solar PV technologies will play an increasingly *complementary* role in generation portfolios**



Source: Lazard estimates.

Note: Reflects investment tax credit and accelerated asset depreciation, as applicable. Assumes 2010 dollars, 20-year economic life and 40% tax rate. Assumes 30% debt at 8.0% interest rate, 50% tax equity at 8.5% cost and 20% common equity at 12% cost for Alternative Energy generation technologies. Assumes 60% debt at 8.0% interest rate and 40% equity at 12% cost for conventional generation technologies. Assumes natural gas price of $5.50 per MMBtu. Assumes midpoint of analysis conducted earlier.

(a) Assumes capital costs for thin-film and crystalline solar PV decline by 10% annually through 2014 and 5% annually thereafter. Assumes capital costs for gas-fired CCGT increase by 2.5% annually.

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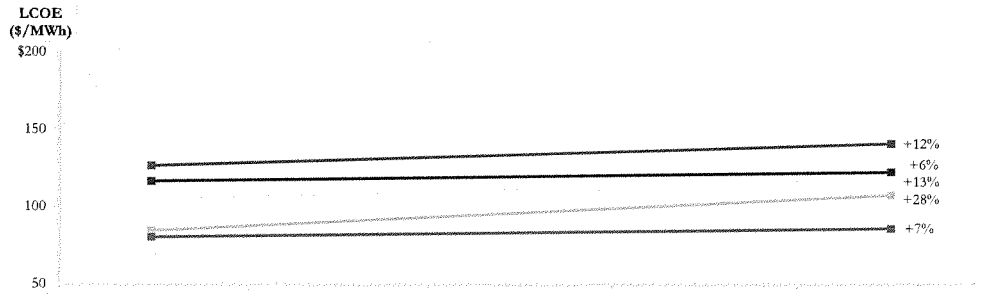
Levelized Cost of Energy – Sensitivity to Cost of Capital

A key issue facing Alternative Energy generation technologies resulting from the potential for intermittently disrupted capital markets is the reduced availability, and increased cost, of capital; these dynamics have a greater relative impact on Alternative Energy generation technologies, whose costs reflect essentially only return on, and of, the capital investment required to build them



After-Tax IRR/WACC	6.2%	6.9%	7.7%	8.4%	9.2%
Cost of Equity	10.0%	11.0%	12.0%	13.0%	14.0%
Cost of Debt	6.0%	7.0%	8.0%	9.0%	10.0%
	Crystalline Solar PV	Thin-Film Solar PV	Nuclear [a]	Coal [b]	CCGT

Source: Lazard estimates.

Note: Reflects production tax credit, investment tax credit and accelerated asset depreciation, as applicable. Assumes 2010 dollars, 20-year economic life, 40% tax rate and 5-40 year tax life. Assumes 30% debt at the stated interest rate, 20% common equity at the stated cost and 50% tax equity at 8.5% cost for Alternative Energy generation technologies. Assumes 60% debt at the stated interest rate and 40% equity at the stated cost for conventional generation technologies. Assumes coal price of $2.50 per MMBtu and natural gas price of $5.50 per MMBtu.

(a) Does not reflect decommissioning costs or potential economic impact of federal loan guarantees or other subsidies.

(b) Based on advanced supercritical pulverized coal.

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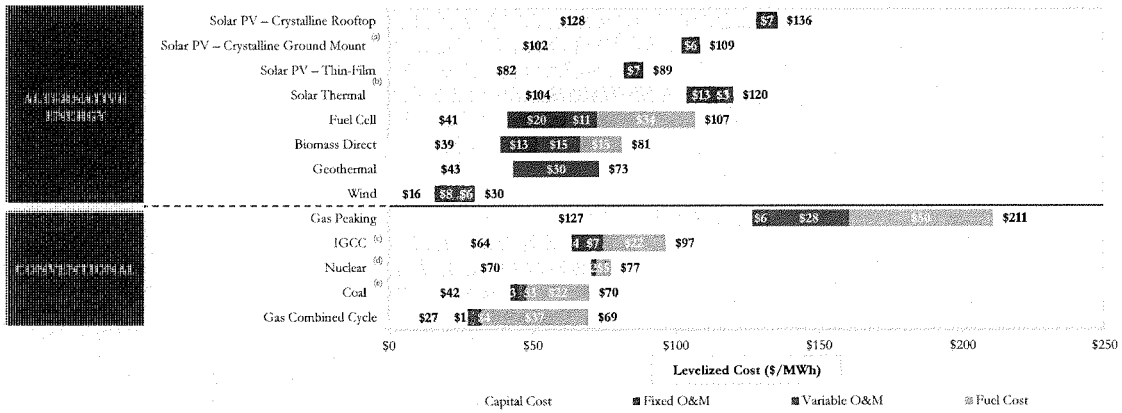
Levelized Cost of Energy Components – Low End

Certain Alternative Energy generation technologies are already cost-competitive with conventional generation technologies; a key factor regarding the long-term competitiveness of currently more expensive Alternative Energy technologies is the ability of technological development and increased production volumes to materially lower the capital costs of certain Alternative Energy technologies, and their levelized cost of energy, over time (e.g., as is anticipated with solar PV technologies)



Source: Lazard estimates.

Note: Reflects production tax credit, investment tax credit and accelerated asset depreciation, as applicable. Assumes 2010 dollars, 20-40-year economic life, 40% tax rate and 5-40 year tax life. Assumes 30% debt at 8.0% interest rate, 50% tax equity at 8.5% cost and 20% common equity at 12% cost for Alternative Energy generation technologies. Assumes 60% debt at 8.0% interest rate and 40% equity at 12% cost for conventional generation technologies. Assumes coal price of $2.50 per MMBtu and natural gas price of $5.50 per MMBtu.

(a) Low end represents single-axis tracking crystalline. High end represents fixed installation.

(b) Represents both solar tower and solar trough, each with 3 hour storage capability.

(c) Incorporates no carbon capture and compression.

(d) Does not reflect decommissioning costs or potential economic impact of federal loan guarantees or other subsidies.

(e) Based on advanced supercritical pulverized coal. Incorporates no carbon capture and compression.

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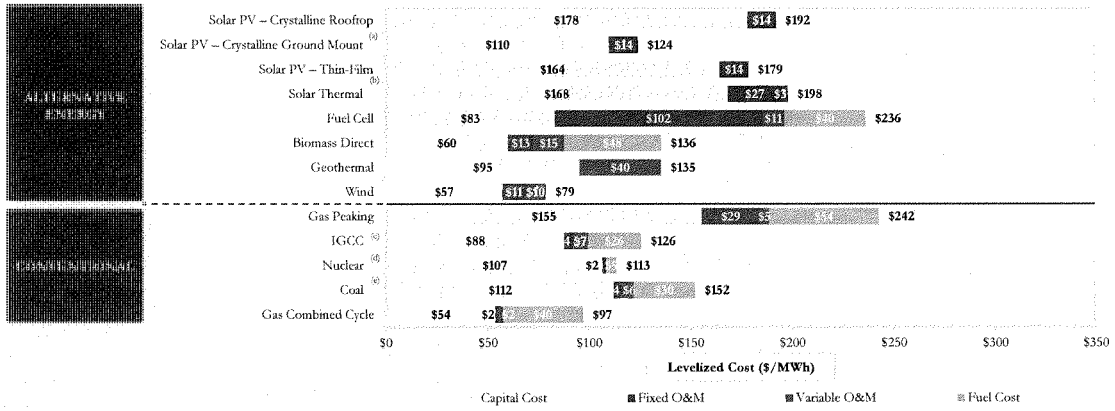
Levelized Cost of Energy Components – High End

Certain Alternative Energy generation technologies are already cost-competitive with conventional generation technologies; a key factor regarding the long-term competitiveness of currently more expensive Alternative Energy technologies is the ability of technological development and increased production volumes to materially lower the capital costs of certain Alternative Energy technologies, and their levelized cost of energy, over time (e.g., as is anticipated with solar PV technologies)



Source: Lazard estimates.

Note: Reflects production tax credit, investment tax credit and accelerated asset depreciation, as applicable. Assumes 2010 dollars, 20-40-year economic life, 40% tax rate and 4–20 year tax life. Assumes 30% debt at 8.0% interest rate, 50% tax equity at 8.5% cost and 20% common equity at 12% cost for Alternative Energy generation technologies. Assumes 60% debt at 8.0% interest rate and 40% equity at 12% cost for conventional generation technologies. Assumes coal price of $2.50 per MMBtu and natural gas price of $5.50 per MMBtu.

(a) Low end represents single-axis tracking crystalline. High end represents fixed installation.

(b) Low end represents solar tower, high end represents solar trough, each with 3 hour storage capability.

(c) Incorporates 90% carbon capture and compression.

(d) Does not reflect decommissioning costs or potential economic impact of federal loan guarantees or other subsidies.

(e) Based on advanced supercritical pulverized coal. Incorporates 90% carbon capture and compression.

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Energy Resources: Matrix of Applications

While the levelized cost of energy for Alternative Energy generation technologies is becoming increasingly competitive with conventional generation technologies, direct comparisons must take into account issues such as location (e.g., central station vs. customer-located) and dispatch characteristics (e.g., baseload and/or dispatchable intermediate load vs. peaking or intermittent technologies)

		LEVELIZED COST OF ENERGY	CARBON NEUTRAL/ REC POTENTIAL	STATE OF TECHNOLOGY	LOCATION			DISPATCH			
					CUSTOMER LOCATED	CENTRAL STATION	GEOGRAPHY	INTERMITTENT	PEAKING	LOAD-FOLLOWING	BASE-LOAD
ALTERNATIVE ENERGY	FUEL CELL	$107-236	?[a]	Emerging/ Commercial	✓		Universal				✓
	SOLAR PV	$89-192	✓	Commercial/ Evolving	✓	✓	Universal[b]	✓	✓		
	SOLAR THERMAL	$120-198	✓	Emerging		✓	Southwest	✓	✓	✓	
	BIOMASS DIRECT	$81-136	✓	Mature		✓	Universal			✓	✓
	GEOTHERMAL	$73-135	✓	Mature		✓	Varies				✓
	ONSHORE WIND	$30-79	✓	Mature		✓	Varies	✓			
CONVENTIONAL	GAS PEAKING	$211-242	✗	Mature	✓	✓	Universal		✓		
	IGCC	$97-126	✗[c]	Emerging[d]		✓	Co-located or rural				✓
	NUCLEAR	$77-113	✓	Mature/ Emerging		✓	Co-located or rural				✓
	COAL	$70-152	✗[c]	Mature[d]		✓	Co-located or rural				✓
	GAS COMBINED CYCLE	$69-97	✗	Mature	✓	✓	Universal			✓	✓

Source: Lazard estimates.

(a) Qualification for RPS requirements varies by location.
(b) LCOE study capacity factor assumes Southwest location.
(c) Could be considered carbon neutral technology, assuming carbon capture and compression.
(d) Carbon capture and compression technologies are in emerging stage.

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Levelized Cost of Energy – Key Assumptions

		Solar PV			Solar Thermal		
	Units	Thin-Film Utility[b]	Crystalline Ground Mount [c]	Crystalline Rooftop	Trough-No Storage[d]	Trough 3 Hours Storage	Tower[e]
Net Facility Output	MW	10	10	10	250	250	120 - 100
EPC Cost	$/kW	$2,500 - $4,000	$3,500 - $2,750	$3,750 - $4,500	$3,700 - $5,400	$4,600 - $4,700	$5,600 - $6,300
Capital Cost During Construction	$/kW	included	included	included	included	included	included
Other Owner's Costs	$/kW	included	included	included	$1,300 - included	$1,700 - $1,800	included
Total Capital Cost[a]	$/kW	$2,500 - $4,000	$3,500 - $2,750	$3,750 - $4,500	$5,000 - $5,400	$6,300 - $6,500	$5,600 - $6,300
Fixed O&M	$/kW-yr	$15.00 - $25.00	$15.00 - $25.00	$15.00 - $25.00	$34.00 - $66.00	$60.00	$50.00 - $70.00
Variable O&M	$/MWh	—	—	—	—	—	$3.00
Heat Rate	Btu/kWh	—	—	—	—	—	—
Capacity Factor	%	25% - 20%	27% - 20%	23% - 20%	29% - 26%	34% - 30%	43% - 30%
Fuel Price	$/MMBtu	—	—	—	—	—	—
Construction Time	Months	12	12	12	24	24	24
Facility Life	Years	20	20	20	20	20	20
CO_2 Equivalent Emissions	Tons/MWh	—	—	—	—	—	—
Investment Tax Credit	%	30%	30%	30%	30%	30%	30%
Production Tax Credit	$/MWh	—	—	—	—	—	—
Levelized Cost of Energy	$/MWh	$89 - $179	$109 - $124	$136 - $192	$146 - $191	$167 - $198	$120 - $198

Source: Lazard estimates.

Note: Reflects production tax credit, investment tax credit and accelerated asset depreciation, as applicable. Assumes 2010 dollars, 20-40-year economic life, 40% tax rate and 5-40 year tax life. Assumes 2.5% annual escalation for production tax credit, O&M costs and fuel prices. Assumes 30% debt at 8.0% interest rate, 50% tax equity at 8.5% cost and 20% common equity at 12% cost for Alternative Energy generation technologies. Assumes 60% debt at 8.0% interest rate and 40% equity at 12% cost for conventional generation technologies. Assumes coal price of $2.50 per MMBtu and natural gas price of $5.50 per MMBtu.

(a) Includes capitalized financing costs during construction for generation types with over 24 months construction time.

(b) An illustrative manufacturer of Thin-Film PV would be FirstSolar.

(c) Left side represents single-axis tracking crystalline; right side represents fixed installation. An illustrative manufacturer of high-efficiency Crystalline PV would be SunPower.

(d) Left side represents wet-cooled; right side represents dry-cooled. Illustrative manufacturers/developers of Trough Solar Thermal would be Abengoa Solar, Flagsol, Solar Millennium and Siemens.

(e) Represents a range of solar thermal tower estimates. Illustrative manufacturers/developers of Solar Thermal Tower would be BrightSource Energy, eSolar and SolarReserve.

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Levelized Cost of Energy – Key Assumptions (cont'd)

	Units	IGCC[b]	Gas Combined Cycle	Gas Peaking[c]	Coal[d]	Nuclear[e]
Net Facility Output	MW	580	550	152 - 34	600	1,100
EPC Cost	$/kW	$3,054 - $4,193	$743 - $1,004	$580 - $700	$2,027 - $6,067	$3,750 - $5,250
Capital Cost During Construction	$/kW	$696 - $1,057	$107 - $145	included	$487 - $1,602	$1,035 - $1,449
Other Owner's Costs	$/kW	included	$156 - $170	$220 - $300	$486 - $731	$600 - $1,500
Total Capital Cost[a]	$/kW	$3,750 - $5,250	$1,006 - $1,319	$800 - $1,000	$3,000 - $8,400	$5,385 - $8,199
Fixed O&M	$/kW-yr	$26.40 - $28.20	$6.20 - $5.50	$5.00 - $25.00	$20.40 - $31.60	$12.80
Variable O&M	$/MWh	$6.80 - $7.30	$3.50 - $2.00	$28.00 - $4.70	$3.00 - $5.90	—
Heat Rate	Btu/kWh	8,800 - 10,520	6,800 - 7,220	9,100 - 9,800	8,750 - 12,000	10,450
Capacity Factor	%	75%	70% - 40%	10%	93%	90%
Fuel Price	$/MMBtu	$2.50	$5.50	$5.50	$2.50	$0.50
Construction Time	Months	57 - 63	36	25	60 - 66	69
Facility Life	Years	40	20	20	40	40
CO_2 Equivalent Emissions	Tons/MWh	0.74 - 0.89	0.40 - 0.42	0.63 - 0.60	0.95 - 1.27	—
Investment Tax Credit	%	—	—	—	—	—
Production Tax Credit	$/MWh	—	—	—	—	—
Levelized Cost of Energy	$/MWh	$97 - $126	$69 - $97	$211 - $242	$70 - $152	$77 - $113

Source: Lazard estimates.

Note: Reflects production tax credit, investment tax credit and accelerated asset depreciation, as applicable. Assumes 2010 dollars, 20-40-year economic life, 40% tax rate and 5-40 year tax life. Assumes 2.5% annual escalation for production tax credit, O&M costs and fuel prices. Assumes 30% debt at 8.0% interest rate, 50% tax equity at 8.5% cost and 20% common equity at 12% cost for Alternative Energy generation technologies. Assumes 60% debt at 8.0% interest rate and 40% equity at 12% cost for conventional generation technologies. Assumes coal price of $2.50 per MMBtu and natural gas price of $5.50 per MMBtu.

(a) Includes capitalized financing costs during construction for generation types with over 24 months construction time.

(b) High end incorporates 90% carbon capture and compression.

(c) Low end represents assumptions regarding GE 7FA. High end represents assumptions regarding GE LM6000PC.

(d) Based on advanced supercritical pulverized coal. High end incorporates 90% carbon capture and compression.

(e) Does not reflect decommissioning costs or potential economic impact of federal loan guarantees or other subsidies.

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Levelized Cost of Energy – Key Assumptions (cont'd)

	Units	Fuel Cell[a]	Biomass Direct	Wind	Off-Shore Wind	Geothermal
Net Facility Output	MW	2.4	35	100	210	30
EPC Cost	$/kW	$3,000 - $7,000	$2,641 - $3,522	$1,000 - $1,500	$2,500 - $4,120	$4,050 - $6,383
Capital Cost During Construction	$/kW	included	$359 - $478	included	included	$550 - $867
Other Owner's Costs	$/kW	$800 - included	included	$300 - $400	$600 - $880	included
Total Capital Cost[b]	$/kW	$3,800 - $7,000	$3,000 - $4,000	$1,300 - $1,900	$3,100 - $5,000	$4,600 - $7,250
Fixed O&M	$/kW-yr	$169 - $850	$95.00	$30.00 - $30.00	$60.00 - $100.00	—
Variable O&M	$/MWh	$10.83	$15.00	—	$13.00 - $18.00	$30.00 - $40.00
Heat Rate	Btu/kWh	6,239 - 7,260	14,500	—	—	—
Capacity Factor	%	95%	85%	41% - 30%	45% - 32%	90% - 80%
Fuel Price	$/MMBtu	$5.50	$1.00 - $3.30	—	—	—
Construction Time	Months	3	36	12	12	36
Facility Life	Years	20	20	20	20	20
CO_2 Equivalent Emissions	Tons/MWh	0.26 - 0.42	—	—	—	—
Investment Tax Credit	%	30%	—	—	—	—
Production Tax Credit	$/MWh	—	$10	$20	$20	$20
Levelized Cost of Energy	$/MWh	$107 - $236	$81 - $136	$30 - $79	$94 - $235	$73 - $135

Source: Lazard estimates.

Note: Reflects production tax credit, investment tax credit and accelerated asset depreciation, as applicable. Assumes 2010 dollars, 20-40-year economic life, 40% tax rate and 5-40 year tax life. Assumes 2.5% annual escalation for production tax credit, O&M costs and fuel prices. Assumes 30% debt at 8.0% interest rate, 50% tax equity at 8.5% cost and 20% common equity at 12% cost for Alternative Energy generation technologies. Assumes 60% debt at 8.0% interest rate and 40% equity at 12% cost for conventional generation technologies. Assumes coal price of $2.50 per MMBtu and natural gas price of $5.50 per MMBtu.

(a) Low end incorporates illustrative economic and efficiency benefits of combined heat and power ("CHP") applications.

(b) Includes capitalized financing costs during construction for generation types with over 24 months construction time.

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Summary Considerations

Lazard has conducted this study comparing the levelized cost of energy for various conventional and Alternative Energy generation technologies in order to understand which Alternative Energy generation technologies may be cost-competitive with conventional generation technologies, either now or in the future, and under various operating assumptions, as well as to understand which technologies are best suited for various applications based on locational requirements, dispatch characteristics and other factors. We find that Alternative Energy technologies are complementary to conventional generation technologies, and believe that their use will be increasingly prevalent for a variety of reasons, including government subsidies, RPS requirements, and continuously improving economics as underlying technologies improve and production volumes increase.

In this study, Lazard's approach was to determine the levelized cost of energy, on a $/MWh basis, that would provide an after-tax IRR to equity holders equal to an assumed cost of equity capital. Certain assumptions (e.g., required debt and equity returns, capital structure, and economic life) were identical for all technologies, in order to isolate the effects of key differentiated inputs such as investment costs, capacity factors, operating costs, fuel costs (where relevant) and U.S. federal tax incentives on the levelized cost of energy. These inputs were developed with a leading consulting and engineering firm to the Power & Energy Industry, augmented with Lazard's commercial knowledge where relevant.

Lazard has not manipulated capital costs or capital structure for various technologies, as the goal of the study was to compare the current state of various generation technologies, rather than the benefits of financial engineering. The results contained in this study would be altered by different assumptions regarding capital structure (e.g., increased use of leverage) or capital costs (e.g., a willingness to accept lower returns than those assumed herein).

Key sensitivities examined included fuel costs and tax subsidies. Other factors would also have a potentially significant effect on the results contained herein, but have not been examined in the scope of this current analysis. These additional factors, among others, could include scale benefits or detriments, the value of Renewable Energy Credits ("RECs") or carbon emissions offsets, the impact of transmission costs, second-order system costs to support intermittent generation (e.g., backup generation, voltage regulation, etc.), and the economic life of the various assets examined.

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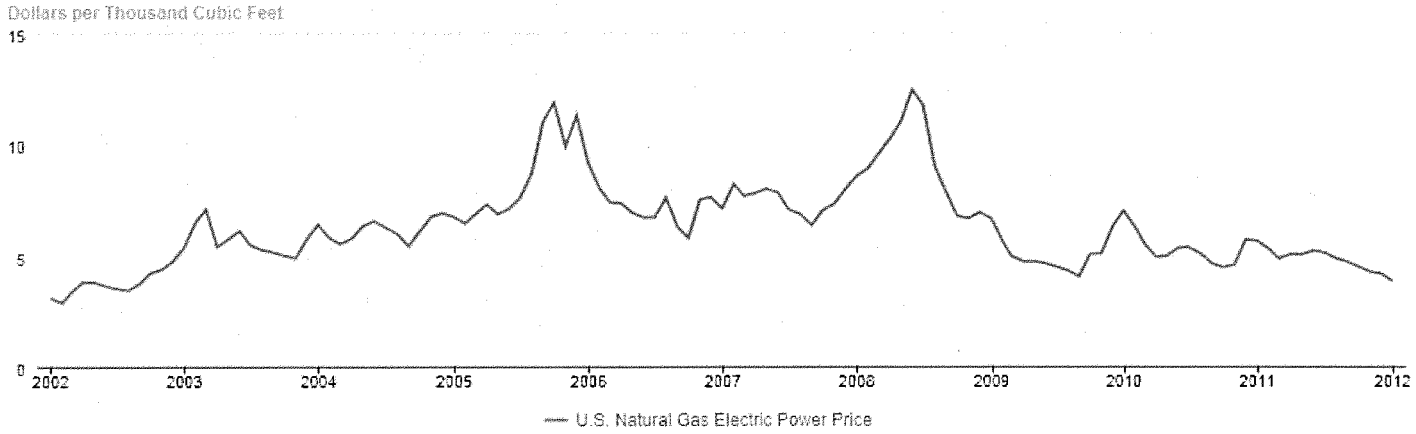
U.S. Natural Gas Electric Power Price



cia Source: U.S. Energy Information Administration

QUESTIONS FOR THE RECORD
U.S. House Committee on Science, Space, and Technology
Subcommittees on Investigations & Oversight and Energy & Environment Joint Hearing

"Impact of Tax Policies on the Commercial Application of Renewable Energy Technology"

Thursday, April 19, 2012

Mr. Terry Royer
CEO
Winergy Drive Systems

Questions submitted by Dr. Andy Harris, Chairman, Subcommittee on Energy & Environment

1. In your testimony, you state that "In just the last six years, 38,094MW of wind have been constructed under a consistent PTC." Of that figure, what percentage of MWs installed were claimed under the PTC as opposed to Section 1603?

As you know, the Section 1603 program was created in early 2009 as an alternative to enable companies to monetize the PTC. Since the creation of the Section 1603 program through 2011, about 14,400 MW of the wind energy capacity installed utilized Section 1603 and about 7,500 MW used the PTC. Prior to 2009, before the Section 1603 program was in place, it could be assumed that virtually all of those installed megawatts were claimed under the PTC. Therefore, of the 38,000 MW of wind capacity installed since 2005, approximately 62% of those installed megawatts were claimed under the PTC.

2. By the end of 2008 the wind industry touted 85,000 direct and indirect jobs in the United States including manufacturing jobs. By 2010, this number dropped to 75,000 despite 14,000 MW of wind being installed in 2009 and 2010. Please explain the decline in employment during a period of intense installation?

While, overall, this time period was one of robust wind energy capacity growth, there was a very large drop in wind energy capacity additions from 2009 to 2010. Like virtually every other industry, the economic crisis negatively affected wind energy capacity growth during that time. That is why annual capacity installations dropped from 10,000 MW in 2009 to 5,214 MW in 2010. As a result, the wind industry's joh numbers decreased.

Questions submitted by Dr. Paul Broun, Chairman, Subcommittee on Investigations & Oversight

1. I understand that some 30 states plus the District of Columbia have enacted renewable portfolio standards (RPS) and that 8 more states have established "voluntary goals" for the use of renewable energy. Why won't meeting these standards drive solar and wind industry demand?

The issue here is that this patchwork of state standards will not drive new manufacturing growth in the wind industry. In order to sustain and build upon the manufacturing base you need a national production tax credit. Any one of those state standards could be changed at any time and if you are a manufacturer located in that state or region it could create uncertainty for a company in the absence of an underlying national policy. If you are a company looking to invest in the U.S., those state standards will not be enough of a policy support for you to locate your company or factory here.

2. What percentage of the small commercial solar systems your company installs and leases are manufactured overseas versus those manufactured in the U.S.? What is the typical price differential?

Since we are not a solar manufacturer or developer I cannot comment on this question.

Questions submitted by the Honorable Randy Neugebauer (R-TX)

1. What is your best estimate for the year in which the wind industry, on a massive scale, will be truly cost competitive with coal and natural gas without subsidies?

It is vitally important that Congress enact a near term extension of the PTC to stop the loss of American jobs. The wind industry would be receptive to working with Congress on a longer-term phase down of the PTC in the context of a broader legislative re-assessment of tax and/or energy policy.

An immediate full extension of the PTC remains critical to the U.S. industry, and is our top priority. This immediate extension is needed to save 37,000 U.S. wind manufacturing jobs that will otherwise be lost in the next year. It would stop what would otherwise be felt as a crushing tax increase on wind energy.

However, the wind industry is committed to discussing options after the PTC is extended this year. We have been clear that we do not need the PTC forever. We understand the significant financial challenges that Congress is facing, as well as a great need for our industry to have predictability. Unfortunately, without having a better understanding of our nation's overall energy and tax policy direction and the market conditions that would be created, even providing an estimate to answer your question is not possible.

2. Could you please describe the technical improvements to the actual turbine designs and power distribution that are expected to reduce costs and increase efficiency within that timeframe?

Increases in productivity are expected to come from improved designs, larger turbines on taller towers, and more effective maintenance and service procedures. For example, new materials and designs will extend the life of gearboxes. Advanced materials enable blades to be longer, thus capturing more "fuel" (wind). New materials used in wind turbine towers will enable turbines to be installed on taller towers to expose turbines to stronger winds. Further, investments in the long distance transmission of electricity will enable

broader use of low-cost electricity from wind turbines in the best wind resource areas in the U.S. Additionally the price of Wind Turbines have fallen from 2008 to 2010 as a result of improved technologies.

3. Could you also please describe a couple specific examples of recent improvements to turbine design or power distribution that have helped reduce the cost of wind energy production?

Examples of the improvements cited above have already been implemented in the wind industry. Between 2006 and 2011 the average hub height of turbines installed in the U.S. increased by nearly 25%. During that same time, the rotor diameter increased by an average of nearly 20%, resulting in the more recently installed turbines producing over 24% more electricity. New high voltage transmission lines installed from good wind resource areas to load centers within California, Texas, Oklahoma and the Midwest have enabled low cost electricity from new wind projects to supply a broader base of customers.

QUESTIONS FOR THE RECORD
U.S. House Committee on Science, Space, and Technology
Subcommittees on Investigations & Oversight and Energy & Environment Joint Hearing

"Impact of Tax Policies on the Commercial Application of Renewable Energy Technology"

Thursday, April 19, 2012

Dr. Benjamin Zycher
Visiting Scholar
American Enterprise Institute

Questions submitted by the Honorable Randy Neugebauer (R-TX)

1. Is it a fair assessment to say that subsidizing inefficient technologies that would not otherwise survive on the market removes a critical market signal that would spur faster innovation without those subsidies? Do you believe that false market signals derived from tax subsidies can convince the market (and a business or industry) that an inefficient technology is "good enough" and that drastic improvements in efficiency and reductions in cost are not necessary for the product to survive, thus slowing the development of more economically viable technologies?

Answer: It is reasonable to predict that such subsidies have a dual effect: first, to shift resources generally, and research and development investment in particular, toward inefficient technologies and thus away from other technologies more likely to be efficient prospectively. Second: Because such subsidies have the effect of making inefficient technologies artificially "competitive," they hinder investment in more-efficient technologies, which prospectively face greater obstacles in terms of expected competitive pressures because of the subsidies. Accordingly, the subsidies can be predicted to yield less innovation in technologies more likely to prove efficient. I think that this formulation is a bit more rigorous than the "faster" approach stated in the question, as the time profile of investment behavior is a somewhat different parameter. I would argue that the "good enough" constraint also should be restated similarly: Efficient investment and technologies face greater competitive difficulties in the face of subsidies for other technologies, and so can be predicted to receive less research and development support in the capital market. But the general approach---the effect of subsidies on market competition for research and development investment---underlying Mr. Neugebauer's questions is correct.

2. The nonpartisan Congressional Budget Office recently issued a report titled *Federal Financial Support for the Development and Production of Fuels and Energy Technologies.*[1] The CBO Director's Blog introducing the report stated that tax incentives "are generally an inefficient way to reduce environmental and other external costs of energy," and that "[t]hey

[1]Terry Dinan and Philip Webre, *Federal Financial Support for the Development and Production of Fuels and Energy Technologies*, Congressional Budget Office, Issue Brief, March 2012, (http://www.cbo.gov/sites/default/files/cbofiles/attachments/03-06-FuelsandEnergy_Brief.pdf).

often reward businesses for investments and actions they intended to take anyway."[2] How can the government guarantee that taxpayer money is actually incentivizing the private sector rather than just lining the coffers of preferred companies?

Answer: It certainly is the case that tax incentives may subsidize investments that otherwise would have been made, although most analyses would predict that tax incentives structured properly would increase the amount of such investment, so that not all of the subsidies would prove to be "inframarginal." In this sense, taxes on polluting activities often are cited as more efficient alternatives to such tax incentives, and to both cap-and-trade and regulatory approaches as well. At the same time, taxes, cap-and-trade programs, and regulatory mandates tend to hide the costs of such pollution-reduction efforts from government, so that such policies may yield incentives for government to impose constraints on industrial and other activities that are too stringent in an economic sense, that is, that lead to incremental costs of environmental protection greater than the incremental benefits. A tax incentive approach has some real drawbacks, as do all such policy tools, but it does offer the large benefit of forcing government officials and agencies to confront the costs of their environmental policies, at least in terms of tax revenues and/or budget dollars available for other uses. The current EPA regulatory effort in the context of carbon dioxide emission---whatever our assumptions about the purportedly adverse effects of such emissions---is good example of policymaking in which officials largely are not confronted with the economic costs of new constraints.

[2]How Much Does the Federal Government Support the Development and Production of Fuels and Energy Technologies? March 3, 2012 (http://www.cbo.gov/publication/43040).

QUESTIONS FOR THE RECORD
U.S. House Committee on Science, Space, and Technology
Subcommittees on Investigations & Oversight and Energy & Environment Joint Hearing

"Impact of Tax Policies on the Commercial Application of Renewable Energy Technology"

Thursday, April 19, 2012

Dr. Margo Thorning
Senior Vice President and Chief Economist
American Council for Capital Formation

Questions submitted by Dr. Paul Broun, Chairman. Subcommittee on Investigations & Oversight

1. Are other countries maintaining or reducing subsidies for renewable energy?
   Answer: Several European countries, including Germany, the U.K. Spain, Italy and Australia have recently announced reductions or elimination of subsidies for wind, solar and biomass energy programs see [1] http://www.euractiv.com/energy/germany-announces-30-cuts-solar-subsidies-news-511104, http://www.guardian.co.uk/environment/2011/oct/20/renewable-energy-subsidies-slashed

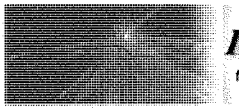
2. We all recognize that it will take all forms of energy, conventional and alternative to meet our country's energy needs. That said, have those who promote the subsidy and use of alternatives assessed the costs of infrastructure upgrades required to deliver the energy associated with the alternative fuels? For example, grid costs for transmitting alternative energy and, switching to plug in electric vehicles, retail fueling infrastructure for ethanol fuel blends that exceed standards set by tank and pump manufacturers?
   Answer: The cost of the infrastructure upgrades needed to support the expansion of alternative c vehicles and renewable energy has not been given adequate attention by policymakers. These costs are likely to add significantly to overall costs of owning and operating alternative vehicles and to generating electricity from renewable sources. For example, home installation for recharging unit costs $900-$2,100 per vehicle. In addition, workplace and retail recharging stations will be needed; bureaucratic and technological as well as cost issues may hinder deployment. Finally, the U.S. electricity infrastructure will need upgrading if there were a large surge in EV purchases. Similarly, the cost of increasing the ratio of biofuel to gasoline or diesel beyond the current level will entail substantial costs. Private estimate suggest that ethanol fueling upgrades – tanks and pumps- would cost on average $250,000 to $300,000 or $ 29.5 to $ 35.4 billion
   Natural gas fueling – compressed NG tanks, piping and retail fueling would cost $450,000 to $500,000 per site or a total of $ 53 billion to $ 59 billion

3. Dr. Sherlock's testimony states, "Ideally, energy tax policy should be designed to allow markets to choose which technologies best meet energy policy objectives." If America's energy policy objective were to provide the cheapest form of energy, what would such an energy tax policy look like?
   Answer: Putting all investments on an equal footing would be the most efficient way to induce the most efficient, lowest cost sources of energy. Over the years, many economic analyses have estimated that if the U.S. switched to a consumed income tax in which all investment was expensed, investment and economic growth would be enhanced. Expensing would increase cash flow which is very important to certain segments of the energy industry, especially for natural gas and independent oil exploration and development firms. As policymakers consider options for reforming the tax code they need to weigh carefully the impact of changes such as repealing accelerated depreciation that would raise the cost of capital for new investment and negatively impact the development of the U.S. energy industry(see my testimony before the House Committee on Ways and Means at http://accf.org/wp-content/uploads/2012/02/media_636.pdf

Questions submitted by the Honorable Randy Neugebauer (R-TX)

1. Is it a fair assessment to say that subsidizing inefficient technologies that would not otherwise survive on the market removes a critical market signal that would spur faster innovation without those subsidies?
   Answer: Subsidies reduce the signals provided by markets and result in a less efficient allocation of scarce resources. Innovation may in fact be stifled as investment funds are shifted into the subsidized industries such as solar panel, battery manufacturing or cellulosic ethanol. This diversion of scarce resources may "crowd out" new technologies and innovations.

2. Do you believe that false market signals derived from tax subsidies can convince the market (and a business or industry) that an inefficient technology is "good enough" and that drastic improvements in efficiency and reductions in cost are not necessary for the product to survive, thus slowing the development of more economically viable technologies?
   Answer: Yes, for example the U.S. solar panel industry may be an example of the phenomenon. Subsidized U.S. manufacturers of solar panels and wind turbines were blindsided by the lower cost, more efficient panels and turbines produced by our competitors. Had the U.S. subsidies not been in place, it is likely that our companies would have worked harder to stay "ahead of the curve" on new, cost effective technology.



Industrial Wind Action Group

facts, analysis, exposure of wind energy's real impacts

May 29, 2012

The Honorable Paul Broun, MD, Chairman
Subcommittee on Investigations and Oversight
Committee on Science, Space, & Technology
2321 Rayburn House Office Building
Washington, DC 20515-6301

The Honorable Andy Harris, M.D., Chairman
Subcommittee on Energy and Environment
Committee on Science, Space, & Technology
2321 Rayburn House Office Building
Washington, DC 20515-6301

Re: April 19 Hearing Titled, Impact of Tax Policies on the Commercial Application of Renewable Energy Technology

Dear Chairman Broun and Chairman Harris:

Thank you very much for permitting me to testify at the above mentioned hearing. I am grateful for your attention to the important matters considered at the hearing and pray my submissions will help inform the debate surrounding tax policy relative to renewable energy development.

In response to your letter of May 14, I've prepared the following:

1) A list of my suggested edits to the transcript;
2) A list of typographical corrections to my testimony dated April 19, 2012;
3) Responses to questions submitted to me by Committee members following the hearing.

If you should have any questions, or if I can be of further service, please do not hesitate to contact me by phone at 603-838-6588 or e-mail at llinowes@windaction.org.

Sincerely,

Lisa Linowes
for the Industrial Wind Action Group

Linowes - Recommended Transcript amendments:

1) Line 1826: Should read - "Quick point about 1603, there is a claim that 1603..."
2) Line 1834: Should read - "...that Section 1603 funding in all of my cases exceeded..."
3) Line 2240: Should read - "The organization is not paid to present anyone else's views."

Linowes - Typographical amendments to Testimony:

1) All Pages - Added footer to include the brief description, page number and date.
2) Page 3 - Deleted extra 'is': Any opportunity beyond that is, as DOE correctly states, is "a bonus, but not a necessity."
3) Page 7 - Deleted extra 'a': In a press reports this month, AWEA CEO Denise Bode credited ...
4) Page 11 - Deleted extra 'a': Of the 450+ facilities listed, a less than 75 represent plants dedicated to...
5) Page 13 - Changed reference to '1693' to '1603'.
6) Page 14 - Moved word 'But' to beginning of sentence: "Transponder-only airspace but relies on pilots complying ..." changed to "But transponder-only airspace relies on pilots complying ..."
7) Page 14 - Changed 'documentations' to 'documents': "Despite proposed technical mitigations, documents released ..."

I've attached a .pdf of my amended testimony which also includes the slides I presented at the hearing.

Linowes responses to questions submitted by Dr. Andy Harris, Chairman, Subcommittee on Energy & Environment:

Q1. What are the concerns with offshore wind, especially offshore Maryland?

There are two significant issues facing deployment of offshore wind that, to date, have receive only limited analysis. They are energy costs and the impacts on U.S. Military and air navigation radars. I cover each briefly below. For more information on the radar question, please see my response to Dr. Harris' question 2.

Cost: According to the latest figures from EIA, the cost to build an offshore wind energy facility is nearly $6,000[1] per kilowatt as compared to onshore wind ($2,438/kw) and natural gas ($978/kw combined cycle). Offshore wind is extraordinarily expensive to construct, especially when one considers the project is expected to deliver only 39% of the time with no guarantee its generation will arrive when most needed. With high upfront costs and fewer hours to spread the cost over, long-term (15+ year) power purchase agreements are now a requirement in order to attract investor financing.

In 2011, the Massachusetts Supreme Court upheld the Commonwealth's approval of a purchase contract between National Grid and Cape Wind. In the contract, Grid will purchase half of the project's energy at an initial bundled energy price (energy, capacity, renewable credits) of $186 per megawatt hour (MWh) with a 3.5% escalation factor per year plus a 4% charge paid to National Grid for its effort. The wholesale price assumes the project will be eligible for available federal subsidies including Section 1603, the Production Tax Credit, or other comparable programs in place when the project goes on line. If these subsidies go away, the price is even higher. By the end of the 15-year contract, the project will be cost Massachusetts ratepayers $300 per megawatt hour.

Since Massachusetts is a deregulated state, the burden of paying for Cape Wind would normally be borne by small consumers who purchase their energy from their utility. Large industrial users are free to purchase their energy from competitive suppliers. But a change in state law permitted the National Grid to apply the high cost of Cape Wind to the delivery side of the electricity bill. By spreading the cost too as many ratepayers as possible, the cost to a single ratepayer would be reduced. Even in this scheme, residential customers will pay an addition $1-2 per month to pay for Cape Wind's energy. According to the state's attorney general, the contract for half the energy will cost ratepayers $4 billion in above market costs over the next 15 years - in a state that already pays some of the highest rates in the nation.

There is no indication that the cost of offshore wind will come down in the next 10-15 years especially if prices are locked through power contracts.

[1] Updated Capital Cost Estimates for Electricity Generation Plants, Nov 2010 http://www.eia.gov/oiaf/beck_plantcosts/

Impacts on Radar: The Patuxent River Atlantic Test Ranges (ATR) provides full-service support for testing and evaluating aircraft and for warfighter training missions. Wind turbines along the Maryland, Virginia, and North Carolina coastlines could severely degrade radar tracking systems including fixed and mobile facilities.

As discussed in my response to Dr. Harris' question #2, radar mitigation technology is not mature, fielded, or approved. The entire area used by the ATR should be declared a 'no turbine' zone until such time when mitigations can be proven to work without degrading radar resolution. However, the DoD Siting Clearinghouse (footnote #2) is actively pursuing mitigation plans that will pave the way for thousands of offshore wind turbines along our eastern seaboard.

Q2. You state in your testimony that U.S. Military and air navigation radars have been impaired by wind turbines. Please provide a brief summary of the problems with technical mitigations now used.

Currently, large expenditures of time and funds are being expended in pursuit of technical mitigations to correct for the spinning turbines which interfere with radar operations. While some mitigations portend future promise, the Raytheon Lead DASR-11 engineer (Peter Drake) and the Navy's radar technical subject matter expert (Rich Obrien) have stated that radar mitigation technology does not yet exist.

I have interviewed radar specialists familiar with technical mitigations proposed and implemented at Travis Air Force base, the Naval Air Station in Kingsville, TX (NASK), as well as the Fossil Oregon long-range military radar. In all cases, their concerns reflect the Navy Radar Working Group's published recommendations which state:

(a) radar mitigation technologies, while under study, have not been tested or approved by FAA or DOD,

(b) no schedule for deployment has been developed, and

(3) anticipated relief is two or more years away.

The military and FAA are aware that radar mitigation technology is not mature, fielded, or approved. Despite this position, the DoD Siting Clearinghouse[2] has approved turbine installations conditioned on deployment of these unverified mitigations.

The most recent instance is documented in an agreement signed between the DoD Siting Clearinghouse and the Texas Wind Group (TWG) involving the Riviera 1 wind turbine facility proposed to be sited within 10-15 miles of NASK. In the Memorandum of Agreement signed on March 8, 2012[3] (see footnote link, also attached), the Navy agreed to drop its objection to the project provided the developer agreed to limited curtailment of the project and to pay $500,000 to help offset some of the costs of mitigation.

The primary mitigation involves the suppression of returns from the wind farm region using RAG (range azimuth gate) mapping techniques.

Important: RAG mapping techniques used elsewhere have been shown to degrade radar performance in the region around the wind farm. The extent and nature of the degradation is unknown and site specific but can seriously impair air traffic services including increased aircraft separation commensurate with the loss of radar coverage and changes to aircraft routing, impacting both efficiency and effectiveness.

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[2] The DoD Siting Clearinghouse was established under Section 358 of the 2011 National Defense Authorization Act. H. David Belote serves as the executive director.

[3] Memorandum of Agreement, March 2012 - greenfleet.dodlive.mil/files/2012/04/TWG-MOA.pdf

Degradation can appear as target masking, false target generation, scintillation, and the spontaneous appearance (or disappearance) of aircraft targets.

The $500,000 payment represents a fraction of total mitigation costs if a new (third) DASR-11 radar is required to complete the mitigation. A new radar unit will push the price as high as $15 million.

If the Riviera 1 facility is constructed and the untested, unfielded mitigation degrades radar capability to a point where it is too dangerous for pilots to fly and train safely, the agreement with the wind company prohibits the Navy from taking further action with the developer to protect NASK from the encroachment by the turbines.

The reliance on unproven mitigation techniques by the DoD Clearinghouse is compromising US military preparedness. It is imperative Congress take action before it is too late to stop these developments.

Linowes responses to questions submitted by the Honorable Randy Neugebauer (R-TX):

Q1. What is your best estimate for the year in which the wind industry, on a massive scale, will be truly cost competitive with coal and natural gas without subsidies?

With natural gas selling at record lows and supplies expected to be abundant through this decade, it is unlikely the wind industry will achieve price parity with coal or gas anytime soon, if ever, unless the price of traditional sources of generation are forced up due to government regulation, including a carbon tax. That is not to say that individual wind projects cannot operate without the PTC or Section 1603 provided they're sited in areas with excellent, steady winds and within close proximity to existing transmission. But industry-wide, such sites are rare.

Wind developers are under pressure from investors to secure long-term power purchase agreements with utilities that will ensure their power will be purchased at a fixed price. Most long-term (10+ years) purchase agreements I've read lock in the price for onshore wind at 2-3 times the wholesale price of other, more traditional sources of generation. Offshore wind is even more costly. The industry frequently argues that since wind has no fuel cost, ratepayers are protected from wide price swings. These long-term contracts may have a stabilizing effect on energy prices for wind, they do so at an excessive price to the ratepayers.

What matters to developers and utilities is cost recovery. With capacity factors for onshore wind averaging around 30%, there are fewer hours of operation to recover the cost. In the last decade, more than half of the states adopted RPS policies believing that by introducing resources with no fuel cost they'd ultimately reduce energy prices. This is not true. Rather, these policies merely mandated a market for energy resources that are otherwise non-competitive. Many of these states are now coming to understand the high cost of developing intermittent wind resources.

One final point: wind energy is not being deployed in the US to meet our energy needs. Since wind is an "energy" resource and not a "capacity" resource, both DOE and the American Wind Energy Association have made clear that any capacity value derived from wind "...should be viewed as a bonus, but not a necessity[4]." Thus, even if wind were able to achieve price parity with gas or coal, it would not negate the need to build new reliable generation to meet our energy needs.

While small amounts of wind can be integrated into regional grids, larger amounts require costly accommodations meant to address wind's locational constraints and its intermittency and unpredictability. Operating reserve generators, improved forecasting tools and extensive transmission deployment are needed to deliver and manage wind's variability within a reliable system. Any analysis that evaluates the cost of wind energy must weigh the value of wind's environmental benefit against all other costs.

[4] 20% Wind Power by 2030 - http://www1.eere.energy.gov/windandhydro/pdfs/41869.pdf

Q2. Could you please describe the technical improvements to the actual turbine designs and power distribution that are expected to reduce costs and increase efficiency within that timeframe?

The biggest impediment to wind energy achieving reduced costs is the fuel source itself. As long as wind farms operate at or near 30% capacity factors, there are too few hours of generation per year to spread the large upfront capital costs over. This issue is compounded by two other limitations of wind power:

a) Wind energy typically generates at a time of day and year when the energy is least needed and thus the market price for its energy is low;

b) Wind energy must be sited where the winds are, which is typically long distances from load. The locational constraints are driving the need for costly transmission.

There are two technologies that could enhance wind's value: Forecasting and storage.

Forecasting: Efforts are underway to improve the predictability of wind energy through better forecasting tools. If grid-operators could more precisely anticipate when the wind will blow, how long it will blow, and at what speed/direction, it would help in power dispatch schedules (when to turn down a fossil plant in order to accept wind). Forecasting helps address wind's unpredictability, but it cannot correct for wind's intermittency. Current prediction tools are accurate only about 15% of the time.

Storage: Improved storage technology is the only option that could help increase wind's usefulness as a capacity resource. But large-scale storage is prohibitively expensive and the technology is limited to small quantities of megawatts. Last year, DOE committed a $117 million (Section 1705) loan guarantee to First Wind to erect the Kahuku facility, a 30 megawatt wind project on the island of O'ahu in Hawaii. The funding was for a battery system to help with electricity load stability by flatten out wide swings in winds. The battery is not meant to store nighttime generation for dispatch during peak hours of energy consumption. The industry predicts we are at least 10+ years away any breakthrough that would permit grid-scale storage technology.

Q3. Could you also please describe a couple specific examples of recent improvements to turbine design or power distribution that have helped reduce the cost of wind energy production?

Capacity factors have generally increased for projects in the last 5 years. This increase is driven by a combination of higher hub heights and larger rotor diameters. Increased hub heights (location of a turbine's nacelle) enable turbines to access higher average wind speeds and therefore achieve higher capacity factors.

In addition, turbine manufacturers now provide models that operate in low-wind regimes thus expanding development to sites that were previously considered to have inadequate winds. These improvements have driven wind turbine costs up somewhat, but the increased capacity factors have helped to mitigate the higher costs. There is an upper limit to the size of the turbines before ground transportation becomes a limiting factor. We are likely close to that limit now with turbine blades now exceeding 160-feet in length.

In the last six years, US wind installations have reached over 48,000 megawatts. Turbines are now sited in areas with extreme climate variations such as the tops of mountains. Rather than steady, prevailing winds, turbines must operated in areas where the wind speeds and direction change rapidly. Manufacturing improvements have focused on improving the availability of the equipment in these difficult climates, especially with regard to gearboxes and blades.