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Renewable Energy Tax Incentives and Green Jobs: One Page Summary of Testimony

Statement of Molly Sherlock, Specialist in Public Finance, Congressional Research Service

Before

House Energy and Commerce Committee, Subcommittee on Oversight and Investigations

June 19, 2012

The Subcommittee requested that this testimony discuss two issues related to renewable energy tax incentives: 1) the cost of these provisions; and 2) the potential for these policies to create jobs. As background, this testimony briefly summarizes tax incentives that support renewable electricity.

The primary tax incentives for renewable electricity have historically been the renewable energy investment tax credit (ITC) and the production tax credit (PTC). Two new tax-related provisions for renewable energy were introduced as part of the American Recovery and Reinvestment Act of 2009 (ARRA; P.L. 111-5). Under ARRA, renewable energy investors were eligible to receive a one-time grant from the U.S. Treasury (the "Section 1603" grant program) in lieu of either the ITC or PTC. The PTC is scheduled to expire at the end of 2012 for wind, and at the end of 2013 for other eligible technologies. The Recovery Act also provided $2.3 billion in advanced energy manufacturing tax credits, all of which were allocated in 2010. As of the end of 2011, the Section 1603 grant option is not available for new projects.

The Joint Committee on Taxation (JCT) has estimated that the ITC, PTC, and the Section 1603 grant program will cost nearly $29 billion over the 2011 to 2015 budget window. Of this total cost, the Section 1603 grant program comprises the majority of foregone revenue, at an estimated $17.2 billion, while the PTC and ITC cost $9.1 billion and $2.5 billion, respectively. As the PTC is scheduled to expire and the Section 1603 grant program is closed to new projects, extending either would result in additional revenue losses.

Studies that examine jobs in the renewable energy industry tend to highlight jobs supported, rather than jobs created. Further, such jobs estimates do not generally account for potential job losses in competing industries. An estimate of the number of jobs created by the Section 1603 grant program can be provided by referring to estimates of the installed capacity that was actually motivated by the grant, as opposed to grant recipients for projects that would have moved forward without the grant. However, there may be substantial uncertainty surrounding these types of job creation estimates.

While job creation may be one of the policy objectives of renewable energy tax incentives, such policies are often designed to achieve other policy objectives in addition to job creation.

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Mr. Chairman and Members of the Subcommittee, I am Molly Sherlock, a Specialist in Public Finance in the Congressional Research Service of the Library of Congress. In this role, I research and evaluate the economics of federal tax policy, including energy tax policy. Thank you for the opportunity to provide testimony on these issues. I should note that CRS takes no position on legislation.

I have been invited here today to discuss tax provisions that support renewable electricity. Specifically, I have been asked to address two issues related to renewable energy tax incentives: 1) the cost of these provisions; and 2) the potential for these policies to create jobs. Before addressing these issues, I will briefly summarize the renewable energy tax incentives that are currently available, as well as those that have recently expired.

Tax Incentives for Renewable Electricity

Tax incentives for renewable energy were first introduced in the late 1970s.[1] Over the past three decades, various provisions in the tax code have been used to support renewable energy. Renewable energy tax incentives that are currently available, as well as those that were introduced as part of the American Recovery and Reinvestment Act of 2009 (P.L. 111-5), are reviewed below.

[1] This testimony addresses tax incentives for renewable electricity. Since the late 1970s, Congress has enacted various tax and non-tax incentives that support renewable transportation fuels, such as ethanol, biodiesel, and cellulosic biofuels. The incentives for renewable fuels are beyond the scope of this testimony.

Investment Tax Credit

The investment tax credit (ITC) for renewable energy was first enacted 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 been modified and extended several times.[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 and geothermal that will remain available after the 30% rate expires at the end of 2016.

Production Tax Credit

Since being enacted 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.[5] Under current law, the PTC for wind-produced electricity will expire at the end of 2012. Since the PTC is based on electricity produced during the first 10 years a qualifying renewable energy facility is in operation, under current law, tax credits may be claimed until 2022.

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.[6] The PTC expiration date for qualifying technologies other than wind is the end of 2013.

Other Tax 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.[7]

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

[6] 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.

[7] 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. The depreciation period for other energy property also varies by property type, but is generally in the 15 to 20 year range.

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[8] and those producing electricity using renewable energy resources may qualify for the Internal Revenue Code (IRC) Section 199 domestic production activities deduction.[9]

Tax Provisions 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.[10] 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 advanced energy technology manufacturing tax credit. Many of the beneficiaries of this program were in the renewable energy sector.

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.[11] This provision—commonly referred to as the "Section 1603 grant"—was intended to compensate for weak tax-equity markets.[12] Initially, the Section 1603 grant program was made available for property either placed-in-service or under construction in 2009 and 2010. The 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, but grants are still being paid out to qualifying projects as these projects come online.[13]

The advanced energy manufacturing tax credit (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.[14]

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[8] 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.

[9] 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.

[10] 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.

[11] 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.

[12] 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 fully realize the value of renewable energy tax benefits.

[13] 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.

[14] Section 1302 of ARRA.

In January 2010, all of the $2.3 billion available for advanced energy manufacturing tax credits were awarded to 183 projects.[15] 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.[16]

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.[17] Manufacturers of solar photovoltaics (PV) and wind turbines and related equipment were among the largest recipients.

The Cost of Renewable Energy Tax Incentives

The Joint Committee on Taxation (JCT) projected that the renewable energy ITC cost $0.5 billion in 2011 (see **Table 1**). Over the 2011 to 2015 budget window, projected foregone revenue from claims of the ITC is $2.5 billion. Prior to 2011, JCT estimates of annual revenue loss from the renewable energy ITC were less than $100 million.[18] The majority of the foregone revenue for the ITC (roughly 90%) is attributable to investments in solar energy property. Recent increases in solar investment have led to increases in the revenue cost of tax credits for solar. Federal incentives, including tax credits, as well as market factors, such as the reduced price for solar panels, have been cited as reasons for recent increases in solar investment.[19]

The JCT has estimated that the renewable energy PTC resulted in $1.4 billion of forgone revenue in 2011 (see **Table 1**). Over the 2011 to 2015 budget window, the JCT estimates that the renewable energy PTC will cost $9.1 billion.[20] 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.

Five-year accelerated depreciation for renewable energy investments is scored as a tax expenditure by the JCT. In 2011, an estimated $0.3 billion in federal revenue was foregone due to this provision (see **Table 1**). Over the 2011 to 2015 budget window, the JCT estimates that five-year accelerated depreciation for renewables will cost $1.1 billion.

In January 2010, all $2.3 billion in advanced energy manufacturing tax credits were awarded to 183 projects. The actual cost of the advanced energy manufacturing tax credit program will likely be less than the $2.3 billion in tax credits awarded. 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.[21] Over the 2011 to 2015 budget

[15] 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.

[16] 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.

[17] 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.

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

[19] See Solar Energy Industries Association and GTM Research, *U.S. Solar Market Insight Report Q1 2012*, June 2012, http://www.seia.org/.

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

[21] 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 (continued...)

window, the JCT estimates that foregone revenues associated with claims of the advanced energy manufacturing tax credit will be $1.4 billion (see **Table 1**).

In 2011, $4.7 billion in grants was paid out under the Section 1603 grants in lieu of tax credits program (see **Table 1**). As of March 15, 2012, more than $11.0 billion had been paid out under the Section 1603 grant program that was enacted in 2009.[22,23] Through the end of 2017, it has been estimated that another $11.5 billion will be paid out in Section 1603 grants,[24] bringing the total estimated cost of the program to nearly $22.6 billion.

Table 1. Projected Cost of Renewable Energy Tax Incentives

billions of dollars

	2011	2012	2013	2014	2015	2011 - 2015
Renewable Energy Investment Tax Credit (ITC)	0.5	0.5	0.5	0.5	0.5	2.5
Renewable Energy Production Tax Credit (PTC)						
Wind	1.1	1.3	1.4	1.5	1.5	6.8
Open-Loop Biomass	0.3	0.3	0.3	0.3	0.2	1.7
Other Eligible Technologies	(ii)	(ii)	(ii)	(ii)	(ii)	0.6
5-Year Cost Recovery for Renewable Energy Property	0.3	0.3	0.2	0.2	0.1	1.1
Advanced Energy Manufacturing Tax Credit	0.7	0.4	0.2	0.1	(i)	1.4
Section 1603 Grants in Lieu of Tax Credits[a]	4.7	4.1	3.9	3.2	1.2	17.2

Source: Joint Committee on Taxation and Department of Treasury

Notes: An (i) indicates a positive revenue loss of less than $50 million. An (ii) indicates that the revenue cost was listed as less than $50 million per year for each eligible technology (other than wind and open-loop biomass). Additional information on the estimated annual cost is not available. Columns and row may not sum due to rounding and due to limited information for provisions with annual revenue cost of less than $50 million.

a. The cost of the Section 1603 grants in lieu of tax credits represents an outlay, whereas the cost of tax incentives indicates foregone revenue.

As noted above, a primary purpose of the Section 1603 grant program was to compensate for perceived weakness in tax equity markets. By providing taxpayers investing in renewable energy with a grant, the demand for tax equity to monetize tax credits would be reduced.[25]

(...continued)

billion due to advanced energy manufacturing tax credit awards.

[22] 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.

[23] 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.

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

[25] When taxpayers investing in renewable energy project have insufficient tax liability to offset credits, taxpayers may turn to tax-

(continued...)

In practice, the Section 1603 grant is often more valuable than the underlying tax credits. Grants are received as a one-time payout from the Treasury when renewable energy property is placed in service. Thus, taxpayers investing in renewable energy do not need to have taxable income in the current year to benefit from the incentive, nor is there a need to turn to tax-equity markets for taxpayers with limited tax liability. Further, investors in projects that believe the PTC over ten years will be more valuable than the one-time grant can elect to receive the PTC.[26] Finally, since the incentive is of greater value than the underlying tax credits, additional marginal projects that would not have been financially viable with the tax credit option might have become economically feasible given the grant.[27] While the grant as an incentive is of greater value to investors, it is also more expensive from the government's perspective.

The Obama Administration supports extending the PTC and the Section 1603 grant program. 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, as proposed by the Administration, would cost an estimated $5.7 billion over the 2012 to 2022 budget window.[28] Extending the PTC alone for one year, through 2013 for wind and 2014 for other eligible technologies, would cost an estimated $4.1 billion over the 10-year budget window.[29]

Renewable Energy Tax Incentives and Jobs

Since 2009, generation of electricity using wind and solar resources has increased. Between 2009 and 2011, net electricity generation using wind increased by more than 60%.[30] Net electricity generation using solar more than doubled over that same time period.[31] Electricity generated using wind and solar resources remains a small share of overall electricity generation, but increased from 2.8% to 3.8% between 2009 and 2011.

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equity markets, developing partnerships that provide cash in exchange for tax credits. Requiring renewable energy investors to monetize tax benefits in tax equity markets reduces the value of the incentive that flows directly to project developers.

[26] Mark Bolinger, Ryan Wiser, and Naim Darghouth, "Preliminary Evaluation of the Section 1603 Treasury Grant Program for Renewable Power Projects in the United States," *Energy Policy*, vol. 38, no. 11 (November 2010), pp. 6804-6819.

[27] One estimate suggests that between 20% and 25% of the wind capacity installed in 2009 was directly motivated by the Section 1603 grant. This research also found that more than 60% of wind power projects that elected the grant in 2009 were likely to have moved forward without the grant option. See Mark Bolinger, Ryan Wiser, and Naim Darghouth, *Preliminary Evaluation of the Impact of the Section 1603 Treasury Grant Program on Renewable Energy Deployment in 2009*, Ernest Orlando Lawrence Berkeley National Laboratory, LBNL-3188E, April 2010.

[28] 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.

[29] 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.

[30] In 2009, 73.9 million megawatt hours of electricity were generated using wind. By 2011, that figure was 119.7 million megawatt hours. Data on annual electricity production can be found in Energy Information Administration (EIA), *Electric Power Monthly*, May 29, 2012. Available at: http://www.eia.gov/electricity/monthly/.

[31] In 2009, 0.9 million megawatt hours of electricity were generated using solar. By 2011, that figure was 1.8 million megawatt hours.

While both the solar and wind industries are supported by renewable energy tax incentives, identifying the number of jobs that were created as a result of specific tax incentives is challenging. Most renewable energy jobs studies look at jobs within a particular industry or jobs that were supported by, rather than created by, certain incentives.

Methodology for Jobs Studies

When interpreting the results of jobs studies, it is helpful to understand what types of jobs were included in the analysis. *Direct employment* includes "jobs created in the design, manufacturing, delivery, construction/installation, projects management and operation and maintenance of the different components of the technology, or power plant, under consideration."[32] *Indirect employment* measures jobs created at various stages in the supply chain, such as the manufacture of raw materials. Indirect jobs may also include related service jobs in the banking or legal sectors, for example. Finally, *induced employment* refers to general economic activity resulting from spending by direct and indirect employees (e.g., spending on food and housing).

Oftentimes, jobs studies are based on models. Input-output (I-O) models are widely used to estimate employment in various industrial sectors. I-O models are intended to model the entire economy and the various interactions between different industries. Within specific industries, I-O models can be calibrated using data on individual projects such as nameplate capacity, location, year of construction, and project cost. Depending on the sophistication of the specific model, I-O models can be designed to estimate net job creation economy-wide resulting from added activity in a certain industry.[33] That is, if growth in the wind sector leads to loss of coal-sector jobs, the net job creation when coal-related job losses are considered would be less than the gross job creation in the wind industry.

Jobs and the Recovery Act's Section 1603 Grant Program

In April 2012, the National Renewable Energy Laboratory (NREL) released a report providing analysis of jobs supported by the Section 1603 grant program.[34] In looking at supported jobs, NREL does not attempt to estimate how many jobs were created by the Section 1603 grant program.[35] Instead, the report estimates the number of direct, indirect, and induced jobs that were supported by wind and solar projects that received the Section 1603 grants from 2009 through November 11, 2011. During this period, $9.7 billion in grants was paid out to 24,711 projects.

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[32] Max Wei, Shana Patadia, and Daniel M. Kammen, "Putting Renewables and Energy Efficiency to Work: How Many Jobs Can the Clean Energy Industry Generate in the U.S.?," *Energy Policy*, vol. 38, no. 2 (2010), pp. 920-921.

[33] Max Wei, Shana Patadia, and Daniel M. Kammen, "Putting Renewables and Energy Efficiency to Work: How Many Jobs Can the Clean Energy Industry Generate in the U.S.?," *Energy Policy*, vol. 38, no. 2 (2010), pp. 919-931 provides additional details on the use of I-O models in clean energy job creation studies.

[34] Daniel Steinberg, Gian Porro, and Marshall Goldberg, *Preliminary Analysis of the Jobs and Economic Impacts of Renewable Energy Projects Supported by the §1603 Treasury Grant Program*, National Renewable Energy Laboratory, NREL/TP-6A20-52739, Golden, CO, April 2012.

[35] Page 3 of the NREL report states:

> In this analysis, no attempt was made to estimate the number of projects or amount of capacity that would have been built without a §1603 grant, which would be necessary in order to quantify the portion of the total jobs and associated economic impacts attributable to the §1603 program; thus, we report the estimated number of jobs, earnings, and economic output supported by total investment (§1603 investment and non-§1603 investment) in the projects examined. 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 the authors make no attempt to estimate that portion in this analysis.

NREL used an I-O model to estimate jobs supported by the Section 1603 grant program.[36] The specific model used in the NREL study is able to estimate supply-chain impacts within the industry, and therefore estimate indirect employment associated with projects that received Section 1603 grants. The model used in the NREL study, however, does not account for job displacement or reduced economic activity in other industrial sectors. Thus, the jobs estimates provided in the NREL study are gross estimates, and do not include potential job losses in other industries that might have resulted as economic resources were redirected to wind and solar.

In sum, NREL concluded that the Section 1603 grant program supported between 52,000 and 75,000 direct and indirect jobs per year during the construction phase (see **Table 2**). During the operational phase, NREL estimated that the Section 1603 grant program supported 5,100 to 5,500 direct and indirect jobs per year. These figures represent jobs supported by grants paid through November 10, 2011.

Table 2. Estimates of Jobs Supported and Created by the Section 1603 Grant Program

Average Jobs per Year

	Construction Phase	Operational Phase
Jobs Supported by the Section 1603 Grant (NREL's Results)		
Direct Jobs	9,400	910
Indirect Jobs	43,000 - 66,000	4,200 – 4,600
Induced Jobs	32,000 - 49,000	4,600 – 4,900
Direct + Indirect	52,000 – 75,000	5,100 – 5,500
Total (Direct + Indirect + Induced)	84,000 – 120,000	9,700 – 10,000
Estimate of Jobs Created by the Section 1603 Grant – Illustrative Example		
Direct Jobs	3,666	355
Indirect Jobs	16,770 – 25,740	1,638 – 1,794
Direct + Indirect	20,280 – 29,250	1,989 – 2,145

Source: National Renewable Energy Laboratory (NREL) and CRS calculations based on the methodology presented in Mark Bolinger, Ryan Wiser, and Naim Darghouth, *Preliminary Evaluation of the Impact of the Section 1603 Treasury Grant Program on Renewable Energy Deployment in 2009*, Ernest Orlando Lawrence Berkeley National Laboratory, LBNL-3188E, April 2010.

Notes: Potential jobs created by the Section 1603 grant are calculated as 39% of the estimated jobs supported, as reported in the NREL study. Induced jobs are not included in the potential job creation section as such estimates are less reliable than those presented for direct and indirect jobs. These figures are provided for illustrative purposes, and may vary according to factors described in the text.

One way to estimate the number of jobs created by the Section 1603 grant program would be to use estimates of the installed capacity that was actually dependent on the grant, as opposed to grant recipients for projects that would have moved forward without the grant. One early analysis of the Section 1603 grant program estimated that roughly 25% of the wind capacity installed in 2009 was directly motivated

[36] The model used in the NREL study known as the JEDI model.

by the grant.[37] Of the wind projects that received the grant in 2009, roughly 39% were dependent on the grant. Using this methodology, an estimate of the number of jobs potentially created by the Section 1603 grant program is the number of jobs supported by the Section 1603 grant program multiplied by 39%, or an estimate of the share of projects took place in direct response to the grant option.[38] If further research on the proportion of projects that moved forward because of the Section 1603 grant program becomes available, this figure may be revised.

The potential jobs created by the Section 1603 grant program, as reported in **Table 2**, may understate actual job creation for a couple of reasons. First, the 39% ratio was derived using only wind projects. If solar projects are more likely to be motivated by the Section 1603 grant option, or if solar projects are more labor intensive, the 39% ratio would understate job creation for solar projects.[39] Second, the 39% ratio was based on wind projects completed in 2009. Many of the projects that took place in 2009 had been planned in earlier years, prior to enactment of the Section 1603 grant program at the beginning of 2009. It is likely that a larger proportion of the projects installed in 2010 were directly motivated by the Section 1603 grant, as there was a longer lead time to allow for planning knowing that the grant option would be available. The estimates of jobs created by the Section 1603 grant program remain gross estimates, and still do not account for potential job losses in other industries.[40]

An alternative methodology for estimating the number of jobs created by the Section 1603 grant program is to use an investment elasticity approach. An investment elasticity measures the percentage change in investment divided by the percentage change in the user cost of capital. Empirical evidence suggests relationship between investment and investment tax incentives is inelastic, implying that induced spending is less than the value of the subsidy that is being given.[41] As an illustration, an investment elasticity of -1 would lead to increased investment in renewable energy of 30% (most empirical evidence suggests an investment elasticity of less than 1 in absolute value, making this a generous estimate).[42] Since moving from the PTC or ITC to a grant option provides a marginal subsidy that is less than the total value of the subsidy, this methodology suggests that the job creation estimates in the illustrative example in **Table 2** may overstate actual job creation.

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[37] A total of 9,747 megawatts of wind capacity was installed in 2009. Of this, 6,200 megawatts in wind capacity applied for the grant option. By examining the specific financial circumstances for individual projects, it was estimated that roughly 3,766 megawatts of wind power elected the grant without needing the grant, while 2,433 megawatts of wind capacity installations were grant-dependent. See Mark Bolinger, Ryan Wiser, and Naim Darghouth, *Preliminary Evaluation of the Impact of the Section 1603 Treasury Grant Program on Renewable Energy Deployment in 2009*, Ernest Orlando Lawrence Berkeley National Laboratory, LBNL-3188E, April 2010.

[38] This methodology is used in Mark Bolinger, Ryan Wiser, and Naim Darghouth, *Preliminary Evaluation of the Impact of the Section 1603 Treasury Grant Program on Renewable Energy Deployment in 2009*, Ernest Orlando Lawrence Berkeley National Laboratory, LBNL-3188E, April 2010.

[39] In NREL's 2012 study of job creation, solar PV received 13% of total Section 1603 funds and comprised 5% of the generation capacity. Of the jobs direct estimated to have been supported in NREL's 2012 study, 41% were for solar during the construction phase, while 16% were for solar during the operational phase (the NREL 2012 study on job creation looked only at wind and solar).

[40] It is also possible that falling prices for wind turbines and solar panels led to increased installations of renewable electricity capacity in recent years. Falling prices would have made more projects financially viable with tax credits only, but also would have made more marginal projects attractive given the grant option.

[41] For further discussion, see CRS Report R41034, *Business Investment and Employment Tax Incentives to Stimulate the Economy*, by Thomas L. Hungerford and Jane G. Gravelle.

[42] The 30% is derived as follows. A demand function is given as $Q=AP^{-e}$. Demand after the investment subsidy is given as $Q^*=AP^{*-e}$. Assuming an investment subsidy of 30%, P is multiplied by (1 – 0.3). Dividing Q* by Q, and solving for the percentage change in Q (or investment), investment is found to increase by 30% with an investment elasticity of -1.

What Other Metrics Could be Used to Evaluate Renewable Energy Tax Incentives?

While "job creation" may have been one of the policy objectives of the Section 1603 grant program and the advanced energy manufacturing tax credit, job creation was not necessarily the primary policy objective. Congressional intent when enacting the Section 1603 grant program was to provide incentives for energy resources that address the environmental concerns associated with fossil fuels, and to support continued growth in the renewable energy industry during the economic downturn.[43] In contrast to the Section 1603 grant program, the potential for job creation was one of the selection criteria in the advanced energy manufacturing tax credit program. Other selection criteria for the advanced energy manufacturing tax credit included reduced emissions, technological innovation, and time to completion.[44]

To fully evaluate renewable energy tax incentives, it is important to carefully consider the policy's objectives. In the case of renewable energy, tax incentives have been promoted as a tool for addressing environmental concerns, enhancing energy security, and as compensation for the unpriced costs associated with the use of electricity generated using fossil fuels. In this sense, job creation may be an ancillary benefit of supporting growth in the renewable energy sector.

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

[43] The JCT published the following rationale for the Section 1603 grant program:

> The Congress believes that incentives for the production of electricity from renewable resources will help limit the environmental consequences of continued reliance on power generated using fossil fuels. The Congress understands that some investors in renewable energy projects have suffered economic losses that prevent them from benefitting from the renewable energy production credit and the energy credit. The Congress further believes that this situation, combined with current economic conditions, has the potential to jeopardize investment in renewable energy facilities. The Congress there believes that, in the short term, allowing renewable energy developers to elect to receive direct grants in lieu of the renewable electricity production tax credit and the energy credit is necessary for continued growth in this important industry.

See 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, pp. 109-110.

[44] See 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, p. 129.