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Energy Tax Incentives: Measuring Value Across Different Types of Energy Resources

Updated March 19, 2015

Congressional Research Service
https://crsreports.congress.gov
R41953

CRS REPORT
Prepared for Members and
Committees of Congress

Summary

The U.S. tax code supports the energy sector by providing a number of targeted tax incentives, or tax incentives only available for the energy industry. As Congress evaluates the tax code and contemplates tax reform, there has been interest in understanding how energy tax benefits are distributed across different domestic energy resources. For example, what percentage of energy-related tax benefits support fossil fuels (or support renewables)? How much domestic energy is produced using fossil fuels (or produced using renewables)? And how do these figures compare?

In 2013, the value of federal tax-related support for the energy sector was estimated to be $23.3 billion. Of this, $4.8 billion (20.4%) can be attributed to tax incentives supporting fossil fuels. Tax-related support for renewables was an estimated $13.4 billion in 2013 (or 57.4% of total tax-related support for energy).

While the cost of tax incentives for renewables has exceeded the cost of incentives for fossil fuels in recent years, the majority of energy produced in the United States continues to be derived from fossil fuels. In 2013, fossil fuels accounted for 78.5% of U.S. primary energy production. The remaining primary energy production is attributable to nuclear electric and renewable energy resources, with shares of 10.1% and 11.4%, respectively.

The balance of energy-related tax incentives has changed over time, and it is projected to continue to change, under current law, in coming years. Factors that have contributed to recent changes in the balance of energy-related tax incentives include

- *The expiration of tax-related support for renewables fuels*. Tax-related support for renewable fuels declined substantially after the tax credits for alcohol fuels was allowed to expire at the end of 2011. Other fuels-related incentives also expired at the end of 2014 (although these may be extended as part of the "tax extenders").
- *The Section 1603 grants in lieu of tax credits program*. A major source of tax-related support for renewables in recent years has been the Section 1603 grant program. This program is not available for projects beginning construction after the end of 2011. While outlays for this program increased through 2013, as qualified property was placed in service, outlays for Section 1603 grants have begun to decline.
- *Expired tax incentives for renewables and energy efficiency*. Several other incentives for renewables and energy efficiency have expired (again, these may be extended as part of the tax extenders). Since tax-related support for fossil fuels is expected to remain roughly constant under current law, the expiration of renewables- and efficiency-related incentives means the share of tax incentives for these sectors is expected to decline in future years, under current law.

While subsidy per unit of production or subsidy relative to production level calculations may be one starting point for evaluating energy tax policy, a complete policy analysis might consider why the level of federal financial support differs across various energy technologies. Tax incentives for energy may support various environmental or economic objectives. For example, tax incentives designed to reduce reliance on imported petroleum may be consistent with energy security goals. Tax incentives that promote renewable energy resources may be consistent with certain environmental objectives.

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Since the 1970s, policymakers have increasingly used the tax code to promote energy policy goals. Long-term energy policy goals include providing a secure supply of energy, providing energy at a low cost, and ensuring that energy production and consumption is consistent with environmental objectives.[1] A range of federal policies, including various research and development programs, mandates, and direct financial support such as tax incentives or loan guarantees, promote various energy policy objectives. This report focuses tax incentives that support the production of or investment in various energy resources.[2]

Through the mid-2000s, the majority of revenue losses associated with energy tax incentives have resulted from provisions benefitting fossil fuels. At present, the balance has shifted, such that the bulk of federal revenue losses associated with energy tax provisions are from incentives for renewable energy production and investment.[3] While costs associated with energy tax policy have shifted towards incentives that promote renewable energy, the majority of domestic energy produced continues to be from fossil energy resources. This has raised questions regarding the value of energy tax incentives relative to production, and the relative subsidization of various energy resources.

This report provides background information that might be useful as Congress continues to evaluate current energy tax policy. Specifically, the report presents a comparison of the cost of tax incentives associated with fossil and renewable energy resources, relative to amount of energy produced using each type of resource. The report also reviews other analyses that compare the cost of energy tax incentives relative to production, across different types of energy technologies.

Although the numbers in this report may be useful for policymakers evaluating the current status of energy tax policy, it is important to understand the limitations of this analysis. This report evaluates energy production relative to the value of current energy tax expenditures. It does not, however, seek to analyze whether the current system of energy tax incentives is economically efficient, effective, or otherwise consistent with broader energy policy objectives.[4] Further, analysis in this report does not include information on federal spending on energy that is not linked to the tax code.[5]

Tax Incentives Relative to Energy Production

The following sections estimate the value of tax incentives relative to the level of energy produced using fossil and renewable energy resources. Before proceeding with the analysis, some limitations are outlined. The analysis itself requires quantification of energy production and energy tax incentives. Once data on energy production and energy tax incentives have been

[1] For background on energy policy goals broadly, see CRS Report R42756, *Energy Policy: 114th Congress Issues*, by Brent D. Yacobucci.

[2] Tax incentives related to efficiency and conservation are noted to provide a complete picture of the portfolio of energy-related tax incentives, but are not included in the discussion tying tax incentives to the various forms of energy they support.

[3] For historical revenue losses associated with energy tax incentives, see CRS Report R41227, *Energy Tax Policy: Historical Perspectives on and Current Status of Energy Tax Expenditures*, by Molly F. Sherlock.

[4] For a discussion of an economic framework for evaluating energy tax incentives, see CRS Report R43206, *Energy Tax Policy: Issues in the 114th Congress*, by Molly F. Sherlock and Jeffrey M. Stupak and U.S. Congress, Joint Committee on Taxation, "Present Law And Analysis of Energy-Related Tax Expenditures," committee print, 113th Cong., September 16, 2014, JCX-100-14.

[5] This report does present data from the Energy Information Administration on total targeted federal financial support for energy. For a comprehensive review of federal financial support for energy, see U.S. Energy Information Administration, *Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2010*, Washington, DC, July 2011, http://www.eia.gov.

presented, the value of energy tax incentives can be evaluated relative to current levels of energy production.

Limitations of the Analysis

The analysis below provides a broad comparison of the relative tax support for fossil fuels as compared to the relative support for renewables. Various data limitations prevent a precise analysis of the amount of subsidy per unit of production across different energy resources. Limitations associated with this type of analysis include the following:

- **Current-year tax incentives may not directly support current-year production**

  Many of the tax incentives available for energy resources are designed to encourage investment, rather than production. For example, the expensing of intangible drilling costs (IDCs) for oil and gas provides an incentive to invest in capital equipment and exploration. Although the ability to expense IDCs does not directly support current production of crude oil and natural gas, such subsidies are expected to increase long-run supply.

- **Differing levels of federal financial support may or may not reflect policy rationales**

  Various policy rationales may exist for federal interventions in energy markets. Interventions may be designed to achieve various economic, social, or other policy objectives. Although analysis of federal financial support per unit of energy production may help inform the policy debate, it does not directly consider why various energy sources may receive different levels of federal financial support.

- **Tax expenditures are estimates**

  The tax expenditure data provided by the Joint Committee on Taxation (JCT) are estimates of federal revenue loss associated with a specific provision.[6] These estimates do not provide information on actual federal revenue losses, nor do these estimates reflect the amount of revenue that would be raised should the provision be eliminated.[7]

- **Tax expenditure data are not specific to energy source**

  Many tax incentives are available to a variety of energy resources. For example, the tax expenditure associated with the expensing of IDCs does not distinguish between revenue losses associated with natural gas versus those associated with oil. The tax expenditure for five-year accelerated depreciation also does not specify how much of the benefit accrues to various eligible technologies, such as wind and solar.

- **A number of tax provisions that support energy are not energy specific**

  The U.S. energy sector benefits from a number of tax provisions that are not targeted at energy. For example, the production activities deduction (§ 199) benefits all domestic manufacturers.[8] For the purposes of the § 199 deduction, oil

[6] These caveats also apply to the annual tax expenditure estimates provided by the Treasury Department.

[7] Data on the actual revenue losses associated with various provisions are generally not publicly available.

[8] For more information, see CRS Report R41988, *The Section 199 Production Activities Deduction: Background and*

and gas extraction is considered a domestic manufacturing activity.[9] Certain energy-related activities may also benefit from other tax incentives that are available to non-energy industries, such as the ability to issue tax-exempt debt,[10] the ability to structure as a master limited partnership,[11] or tax incentives designed to promote other activities, such as research and development.

Energy Production

The Energy Information Administration (EIA) provides annual data on U.S. primary energy production. EIA defines primary energy as energy that exists in a naturally occurring form, before being converted into an end-use product. For example, coal is considered primary energy, which can be converted to synthetic gas and later electricity.[12]

This report relies on 2013 data on U.S. primary energy production (see **Table 1** and **Figure 1**).[13] Coal and natural gas are the two largest primary energy production sources, representing 24.4% and 30.5% respectively of primary energy production in 2013. Crude oil constituted 19.3% of primary energy production.[14] Taken together, fossil energy sources were used for 78.5% of 2013 primary energy production.

The remaining U.S. primary energy production is attributable to nuclear electric and renewable energy resources. Overall, 10.1% of 2013 U.S. primary energy was produced as nuclear electric energy. Renewables (including hydro-electric power) constituted 11.4% of 2013 U.S. primary energy production. Excluding hydro-electric power, renewable energy resources constituted approximately 8.2% of primary energy production in 2013.

Biomass was the largest source of production amongst the renewables in 2013, accounting for 5.6% of overall primary energy production or nearly half of renewable energy production. This was followed by hydro-electric power at 3.1% of primary energy production. The remaining three resources, wind, geothermal, and solar were responsible for 1.9%, 0.3%, and 0.4% of 2013 primary energy production, respectively (see **Table 1** and **Figure 1**).

Table 1. Primary Energy Production by Source

(2013)

Source	Quadrillion Btu[a]	Percent of Total
Fossil Fuels		
Coal	20.0	24.4%

Analysis, by Molly F. Sherlock.

[9] The Emergency Economic Stabilization Act of 2008 (EESA; P.L. 110-343) permanently limited oil and gas extraction to a 6% deduction. Other qualified activities may claim a 9% deduction.

[10] For more information on subsidized debt financing for energy, see CRS Report R41573, *Tax-Favored Financing for Renewable Energy Resources and Energy Efficiency*, by Molly F. Sherlock and Steven Maguire.

[11] For additional background, see CRS Report R41893, *Master Limited Partnerships: A Policy Option for the Renewable Energy Industry*, by Molly F. Sherlock and Mark P. Keightley.

[12] Definitions and data can be found in Energy Information Administration, *Annual Energy Review, 2010*, Washington, DC, October 19, 2011, http://www.eia.gov/totalenergy/data/annual/index.cfm.

[13] 2013 is the most recent year available. These figures are preliminary and may be subject to revision.

[14] The figures for primary energy consumption differ from those for primary energy production. For example, while crude oil was the source for 19.3% of primary energy production in 2013, 35.6% of primary energy consumed was attributed to petroleum. Much of this difference reflects U.S. reliance on imported petroleum.

Source	Quadrillion Btu[a]	Percent of Total
Natural Gas	25.0	30.5%
Crude Oil	15.8	19.3%
Natural Gas Plant Liquids	3.5	4.3%
Nuclear		
Nuclear Electric	8.3	10.1%
Renewable Energy		
Biomass[b]	4.6	5.6%
Hydro-Electric Power	2.6	3.1%
Wind	1.6	1.9%
Solar/PV	0.3	0.4%
Geothermal	0.2	0.3%
Total	81.9	100%

Source: CRS analysis of data from Energy Information Administration, *Monthly Energy Review, 2015*. Data are presented graphically in **Figure 1**.

Notes: Columns may not sum due to rounding.

a. A British thermal unit (Btu) is the amount of heat required to raise the temperature of one pound of water 1 degree Fahrenheit.

b. Within the biomass category, 2.0 quadrillion Btu can be attributed to biofuels. Biofuels constituted 2.4% of total primary energy production in 2013.

Primary energy produced using biomass can be further categorized as biomass being used to produce biofuels (e.g., ethanol) and biomass being used to generate biopower.[15] Of the 4.6 quadrillion Btu of energy produced using biomass, about 2.0 quadrillion Btu, or 43.4%, was used in the production of biofuels.[16,17]

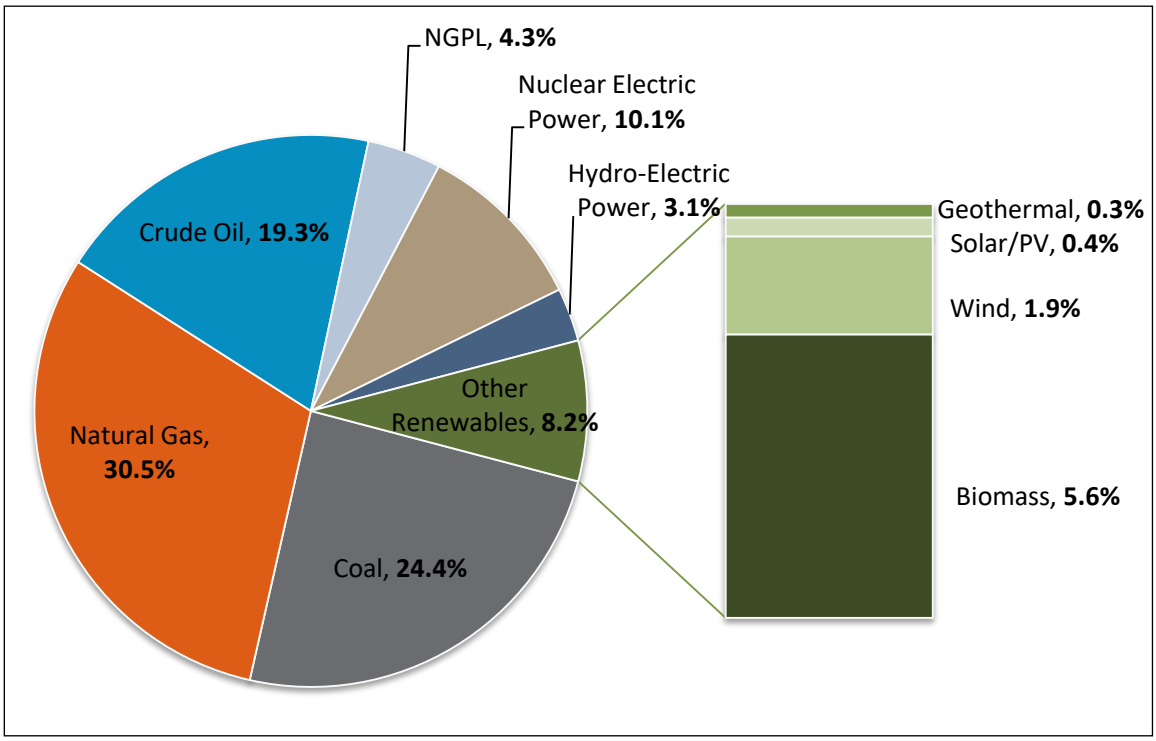
[15] It is unclear whether biopower is carbon neutral. For background on this debate, see CRS Report R41603, *Is Biopower Carbon Neutral?* by Kelsi Bracmort. For more information on biofuels, see CRS Report R41282, *Agriculture-Based Biofuels: Overview and Emerging Issues*, by Mark A. McMinimy.

[16] Biofuels includes wood and wood-derived fuels, biomass waste, and total biomass inputs to the production of fuel ethanol and biodiesel.

[17] A British thermal unit is the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit.

Figure 1. Primary Energy Production by Source

(2013)



Source: CRS graphic using data from the Energy Information Administration, *Monthly Energy Review, 2013*.

Notes: NGPL are Natural Gas Plant Liquids. Percentages may not sum to 100% due to rounding.

Energy Tax Incentives

The tax code supports the energy sector by providing a number of targeted tax incentives, or tax incentives only available for the energy industry. In addition to targeted tax incentives, the energy sector may also benefit from a number of broader tax provisions that are available for energy and non-energy-related taxpayers.[18] These broader tax incentives are not included in the analysis, since tax expenditure estimates do not indicate how much of the revenue loss associated with these generally available provisions is associated with energy-related activities.

Joint Committee on Taxation (JCT) tax expenditure estimates are used to tabulate federal revenue losses associated with energy tax provisions.[19] The tax expenditure estimates provided by the JCT are forecasted revenue losses. These revenue losses are not re-estimated on the basis of actual economic conditions. Thus, revenue losses presented below are projected, as opposed to actual revenue losses.

[18] For example, oil and gas producers currently benefit from the Section 199 domestic production deduction. This incentive is available to all domestic manufacturers, and is not specifically targeted towards the oil and gas sector.

[19] The Congressional Budget and Impoundment Act of 1974 (the Budget Act; P.L. 93-344) defines tax expenditures as "revenue losses attributable to provisions of the federal tax laws which allow a special exclusion, exemption, or deduction from gross income or which provide a special credit, a preferential rate of tax, or a deferral of tax liability." JCT is the official scorekeeper for congressional budget purposes. The Treasury also provides a list of tax expenditures annually.

The JCT advises that individual tax expenditures cannot be simply summed to estimate the aggregate revenue loss from multiple tax provisions. This is because of interaction effects. When the revenue loss associated with a specific tax provision is estimated, the estimate is made assuming that there are no changes in other provisions or in taxpayer behavior. When individual tax expenditures are summed, the interaction effects may lead to different revenue loss estimates. Consequently, aggregate tax expenditure estimates, derived from summing the estimated revenue effects of individual tax expenditure provisions, are unlikely to reflect the actual change in federal receipts associated with removing various tax provisions.[20] Thus, total tax expenditure figures presented below are an estimate of federal revenue losses associated with energy tax provisions, and should not be interpreted as actual federal revenue losses.

Table 2 provides information on revenue losses and outlays associated with energy-related tax provisions between 2010 and 2014.[21] In 2010, the tax code provided an estimated $20.0 billion in support for the energy sector. In 2011, the estimated amount was $22.7 billion. In 2012, the estimated amount was $24.2 billion. Between 2011 and 2012, the cost of excise tax credits for alcohol fuels fell, as the primary tax incentives for ethanol were allowed to expire. Increased outlays for Section 1603 grants, however, served to partially offset this decline. In 2013, the tax code provided an estimated $23.3 billion in support for the energy sector. More than a third of the 2013 total, $8.1 billion, was due to the Section 1603 grants in lieu of tax credits for renewables.[22] In 2014, the estimated amount of tax-related financial support for the energy sector was $16.7 billion.[23]

The two largest energy-related provisions, in terms of federal revenue loss, over the 2010 through 2014 period, expired at the end of 2011.[24] Between 2010 and 2014, the Section 1603 grants in lieu of tax credits program cost $24.0 billion. Over the same time period, excise tax credits for alcohol fuels cost $15.8 billion.[25] The expiration of a number of energy-related tax incentives means that, under current law, a substantial shift in balance of energy tax incentives across different types of energy resources is projected to occur (see the section "Energy Tax Incentive Trends" below).

[20] U.S. Congress, Senate Committee on the Budget, *Tax Expenditures: Compendium of Background Material on Individual Provisions*, committee print, prepared by Congressional Research Service, S. Prt. 113-32, December 2014, [henceforth referenced as the "2014 Tax Expenditure Compendium"].

[21] Energy-related tax provisions are those listed under the "Energy" budget function in the Joint Committee on Taxation's annual tax expenditure list. The special tax rate for nuclear decommissioning reserve funds is also included, although this tax expenditure is listed under the "Natural Resources and Environment" budget function. Although technically not tax expenditures, the cost associated with excise tax credits and outlays under the Section 1603 grants in lieu of tax credits program are also included in **Table 2**.

[22] The Section 1603 grant program was created as part of the American Recovery and Reinvestment Act of 2009 (P.L. 111-5) and has since been allowed to expire. The program provided cash grant incentives for renewable energy projects. For more information related to the Section 1603 grants program 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

[23] Recall that a number of energy-related provisions expired at the end of 2013. JCT tax expenditure estimates are based on current law, and when the estimates were made, these provisions were expired. Most expired energy-related provisions were later retroactively extended for 2014 as part of the Tax Increase Prevention Act of 2014 (P.L. 113-295). The cost of this extension, however, is not reflected in **Table 2**.

[24] The Section 1603 grants in lieu of tax credits program is only available for projects that were under construction prior to the end of 2011. Since grants are paid out when eligible property is placed in service, outlays under this program will continue for a number of years.

[25] Most of the revenue loss here can be attributed to the Volumetric Ethanol Excise Tax Credit (VEETC).

Table 2. Estimated Revenue Cost of Energy Tax Provisions: FY2010 through FY2014

($ billions)

Provision	2010	2011	2012	2013	2014
Fossil Fuels					
Credits for Investments in Clean Coal Facilities	0.2	0.2	0.2	0.2	0.2
Expensing of Exploration and Development Costs for Oil and Gas	0.7	0.8	0.7	0.9	1.1
Percentage Depletion for Oil and Gas	0.5	0.9	1.1	1.1	1.0
Amortization of Geological and Geophysical Costs for Oil and Gas Exploration	0.1	0.1	0.1	0.1	0.1
Amortization of Air Pollution Control Facilities	0.1	0.2	0.4	0.4	0.4
15-year Depreciation for Natural Gas Distribution Lines	0.1	0.1	0.1	0.1	0.2
Election to Expense 50% of Qualified Refinery Costs	0.7	0.8	0.4	0.4	0.0
Exceptions for Publicly Traded Partnerships with Qualified Income from Energy-Related Activities	0.5	0.2	1.1	1.2	1.1
Alternative Fuel Credit[a]	0.0	0.2	0.3	0.4	0.4
Subtotal, Fossil Fuels	*2.9*	*3.5*	*4.4*	*4.8*	*4.5*
Renewables					
Credit for Clean Renewable Energy Bonds (CREBs)	0.1	(i)	(i)	(i)	(i)
Investment Tax Credit (ITC)	(i)	0.5	0.5	0.5	0.6
Production Tax Credit (PTC)	1.4	1.4	1.6	1.7	1.5
Residential Energy Efficient Property Credit	0.2	0.2	0.8	0.9	1.1
Credit for Investment in Advanced Energy Property	0.5	0.7	0.3	0.3	0.3
Section 1603 Grants in Lieu of Tax Credits[a]	4.2	3.5	5.1	8.1	3.2
5-Year Depreciation for Certain Energy Property (solar, wind, etc.)	0.3	0.3	0.3	0.3	0.3
Subtotal, Renewables	6.7	6.6	8.6	11.8	7.0
Renewable Fuels					
Credits for Alcohol Fuels	0.1	0.2	0.1	(i)	0.0
Ethanol Excise Tax Incentives[a]	5.7	6.5	3.5	0.0	0.0
Bio-diesel Tax Credits[a]	0.5	0.8	0.8	1.6	1.8
Subtotal, Renewable Fuels	*6.3*	*7.5*	*4.4*	*1.6*	*1.8*
Efficiency & Conservation					
Energy Efficiency Improvements to Existing Homes	1.7	1.5	2.9	3.0	0.6
Credit for Production of Energy Efficient Appliances	0.2	0.2	0.2	0.2	0.0
Energy Efficient Commercial Building Deduction	0.2	0.2	0.2	0.2	0.0
10-Year Depreciation for Smart Electric Distribution Property	(i)	0.1	0.1	0.1	0.2
Subtotal, Efficiency & Conservation	*2.1*	*2.0*	*3.4*	*3.5*	*0.8*

Provision	2010	2011	2012	2013	2014
Alternative Technology Vehicles					
Credits for Alternative Technology Vehicles	0.8	0.0	0.0	0.0	0.0
Credit for Plug-in Electric Vehicles	0.0	0.1	0.2	0.4	0.2
Subtotal, Alternative Technology Vehicles	*0.8*	*0.1*	*0.2*	*0.4*	*0.2*
Nuclear					
Special Tax Rate for Nuclear Decommissioning Reserve Funds	0.9	0.9	1.0	1.1	0.2
Subtotal, Nuclear	*0.9*	*0.9*	*1.0*	*1.1*	*0.2*
Other					
Special Rule to Implement Electric Transmission Restructuring	0.0	1.8	1.8	-0.2	1.8
Excess of Percentage over Cost Depletion, Fuels: Other Fuels	0.2	0.2	0.2	0.2	0.2
15-year Depreciation for Electric Transmission Property	0.1	0.1	0.2	0.2	0.2
Subtotal, Other	*0.3*	*2.1*	*2.2*	*0.2*	*2.2*
Total	**20.0**	**22.7**	**24.2**	**23.3**	**16.7**

Sources: Joint Committee on Taxation and the Department of the Treasury.

Notes: (i) indicates a positive estimated revenue loss of less than $50 million. An n.a. indicates that the provision was not listed in the 2010 tax expenditure tables. Provisions with a revenue score of less than $50 million during all years are omitted from the table.

a. The figures reported for the Section 1603 grants in lieu of tax credits and the excise tax credits for alcohol fuels, biodiesel and alternative fuels are outlays as reported in the President's budget.

b. The JCT tax expenditure list includes the special tax rate for nuclear decommissioning reserve funds in the "National Resources and Environment" budget function. Other tax expenditures for nuclear were either classified as *de minimis* (the advanced nuclear power production tax credit) or non-quantifiable (accelerated deductions for nuclear decommissioning costs) in the 2014 tax expenditure publication.

In 2014, tax incentives for renewables (including renewable electricity and renewable fuels) constituted an estimated 52.8% of the estimated total revenue loss associated with energy tax provisions.[26] Revenue losses associated with fossil-fuels-related tax incentives were an estimated $4.5 billion, or 26.8% of the estimated cost of energy tax incentives.

Fossil Fuels versus Renewables: Relative Production and Tax Incentive Levels

Table 3 provides a side-by-side comparison of fossil fuel and renewable production, along with the cost of tax incentives supporting the two types of energy resources. During 2013, 78.5% of U.S. primary energy production could be attributed to fossil fuel sources. Of the federal tax support targeted to energy in 2013, an estimated 20.4% of the value of tax incentives went towards supporting fossil fuels. During 2013, an estimated 11.4% of U.S. primary source energy

[26] The remainder of the analysis uses data from 2013, as this is the most recent year for which primary source energy production data are available.

was produced using renewable resources. Of the federal tax support targeted to energy in 2013, an estimated 57.4% went towards supporting renewables.

Table 3. Comparing Energy Production and Energy Tax Incentives: Fossil Fuels and Renewables

(2013)

	Production		Tax Incentives	
	Quadrillion Btu	% of Total	Tax Incentives	% of Total
Fossil Fuels	64.3	78.5%	$4.8	20.4%
Renewables[a]	9.3	11.4%	$13.4	57.4%
Renewables (excluding hydro-electric)	*6.7*	8.2%	*$13.4*	57.4%
Renewables (excluding biofuels and related tax incentives)	*7.3*	8.9%	*$11.8*	50.5%
Renewables (excluding hydro-electric and biofuels and related tax incentives)	*4.7*	5.7%	*$11. 8*	50.5%
Nuclear	*8.3*	10.1%	*$1.10*	4.7%

Source: Calculated using data presented in **Table 1** and **Table 2** above.

a. The value of total tax incentives for renewables excluding hydro-electric power is less than the total value of tax incentives when those available for hydro-power are included. However, the difference is small. JCT estimates that in 2013, the tax expenditures for qualified hydropower under the PTC are less than $50 million.

b. Renewables tax incentives include targeted tax incentives designed to support renewable electricity and renewable fuels.

Energy generated using hydro-electric power technologies might be excluded from the renewables category, as most existing hydro-generating capacity was established in the past (84% of 2010 hydro-electric generating capacity was installed before 1980; 99% was installed before 1996).[27] Thus, there is no current federal tax benefit for most electricity currently generated using hydropower. Further, with many of the best hydro sites already developed, there is limited potential for growth in conventional hydropower capacity. There is, however, potential for development of additional electricity-generating capacity through smaller hydro projects that could substantially increase U.S. hydro-electric generation capacity.[28] Excluding hydro from the renewables category, non-hydro renewables accounted for 8.2% of 2013 primary energy production.

During 2013, certain tax expenditures for renewable energy did, however, benefit taxpayers developing and operating hydro-electric power facilities. Specifically, development of hydro-electric facilities has been supported with clean renewable energy bonds (CREBs).[29] Additionally,

[27] Energy Information Administration, *Hydropower has a Long History in the United States*, July 8, 2011, available at http://www.eia.gov/todayinenergy/detail.cfm?id=2130.

[28] See CRS Report R42579, *Hydropower: Federal and Nonfederal Investment*, by Kelsi Bracmort, Charles V. Stern, and Adam Vann.

[29] For additional information on which technologies have benefitted from CREBs, see CRS Report R41573, *Tax-Favored Financing for Renewable Energy Resources and Energy Efficiency*, by Molly F. Sherlock and Steven

certain hydro-electric installations may be eligible for the renewable energy production tax credit (PTC) or the Section 1603 grants in lieu of tax credits program.[30] Given that hydro is supported by 2013 tax expenditures, one could also argue that hydro should not be excluded from the renewables category.

It may also be instructive to consider incentives that generally support renewable electricity separately from those that support biofuels.[31] Of the estimated $23.3 billion in energy tax provisions in 2013, an estimated $1.6 billion, or 6.9%, went toward supporting biofuels. Excluding tax incentives for biofuels, 50.5% of energy-related tax incentives in 2013 were attributable to renewables. In other words, excluding biofuels from the analysis reduces the share of tax incentives attributable to renewables from 57.4% to 50.5%. Excluding biofuels from the analysis has a smaller impact on renewables' share of primary energy production. When biofuels are excluded, the share of primary energy produced in 2013 attributable to renewables falls by 2.5 percentage points, from 11.4% to 8.9%.[32]

In 2013, 10.1% of primary energy produced was from nuclear resources. The one tax benefit for nuclear with a positive tax expenditure in 2013 was the special tax rate for nuclear decommissioning reserve funds. At $1.1 billion in 2013, this was 4.7% of the value of all tax expenditures for energy included in the analysis. Like many other energy-related tax expenditures, the special tax rate for nuclear decommissioning reserve funds is not directly related to current energy production. Instead, this provision reduces the cost of investing in nuclear energy by taxing income from nuclear decommissioning reserve funds at a preferred rate (a flat rate of 20%).

Energy Tax Incentive Trends

Over time, there have been substantial shifts in the proportion of energy-related tax expenditures benefitting different types of energy resources (see **Figure 2**).[33] From the 1980s through 2011, most of the tax-related federal financial support for renewable energy was for renewable fuels, mainly alcohol fuels (i.e., ethanol).[34] Starting in 2008, the federal government incurred outlays associated with excise tax credits for biodiesel and renewable diesel. The tax credits for alcohol fuels (including ethanol) expired at the end of 2011, while the tax credits for biodiesel and renewable diesel expired at the end of 2014. Thus, after 2014, under current law, there are no

Maguire.

[30] In 2014, 22 Section 1603 grants totaling $408.4 million were awarded to hydropower projects. As of January 2015, a total of $515.3 million in Section 1603 grants has been paid out to qualifying hydropower facilities. A complete list of Section 1603 grant recipients is available from the Department of Treasury, at http://www.treasury.gov/initiatives/recovery/Pages/1603.aspx.

[31] In the past, a large proportion of renewables-related tax support has been for biofuels, and opposed to other forms of renewables.

[32] The data in **Table 3** can be used to provide an estimate of federal tax support per million Btu produced using fossil fuel and renewable energy resources. Such analysis, however, does not directly link the amount of federal financial support given directly to energy produced, as many federal tax incentives for energy reward investments rather than production. In other words, current federal financial incentives do not directly support current energy production. From this perspective, evaluating the current value of federal financial support per Btu of energy production is methodologically flawed. Nonetheless, this type of analysis has been used in the past. For example, see the 2007 EIA study discussed in greater detail below.

[33] For more information on historical trends, see CRS Report R41227, *Energy Tax Policy: Historical Perspectives on and Current Status of Energy Tax Expenditures*, by Molly F. Sherlock.

[34] The dramatic increase in JCT's estimated revenue losses in 2009 for renewable fuels was due to "black liquor."

projected costs associated with tax incentives for renewable fuels. Expired tax incentives may be extended, however, as part of the "tax extenders."[35]

Beginning in the mid-2000s, the cost of energy tax incentives for renewables began to increase. From 2009 onwards, the increased costs associated with incentives for renewable electricity are largely attributable to the Section 1603 grants in lieu of tax credit program.[36] The Section 1603 grant option is not available for projects that began construction after December 31, 2011. However, since grants are paid out when construction is completed and eligible property is placed in service, outlays under the Section 1603 program are expected to continue through 2017.

Revenue losses for tax incentives supporting energy efficiency are also projected to decline through 2018. Most of the increase in revenue losses for efficiency-related provisions between 2008 and 2014 was associated with tax incentives for homeowners investing in certain energy-efficient property.[37] The primary tax incentive for energy efficiency improvements to existing homes expired at the end of 2014.[38] Extension of expired tax incentives for energy efficiency would increase the cost of energy efficiency-related tax incentives.

As was noted above, much of the projected cost of energy-related tax incentives in the out years is associated with expired or expiring provisions. Costs for certain provisions may extend beyond expiration for a number of reasons. In the case of the Section 1603 grant program, since outlays occur when property is placed in service, costs for this program will continue to be incurred long past its 2011 expiration date. Another example is the renewable energy production tax credit (PTC). The PTC is available for the first 10 years of production from a qualified facility. Thus, property placed in service in 2012 may claim production tax credits through 2022. Even with the expiration of the PTC for wind at the end of 2014, wind energy facilities that were under construction before December 31, 2014, may receive production credits for 10 years after it is placed in service. Revenue losses associated with tax provisions can also extend beyond a provision's expiration when taxpayers are allowed to carry forward unused tax credits, using credits to offset liability in future tax years.

[35] For more information, see CRS Report R43898, *Tax Provisions that Expired in 2014 ("Tax Extenders")*, by Molly F. Sherlock.

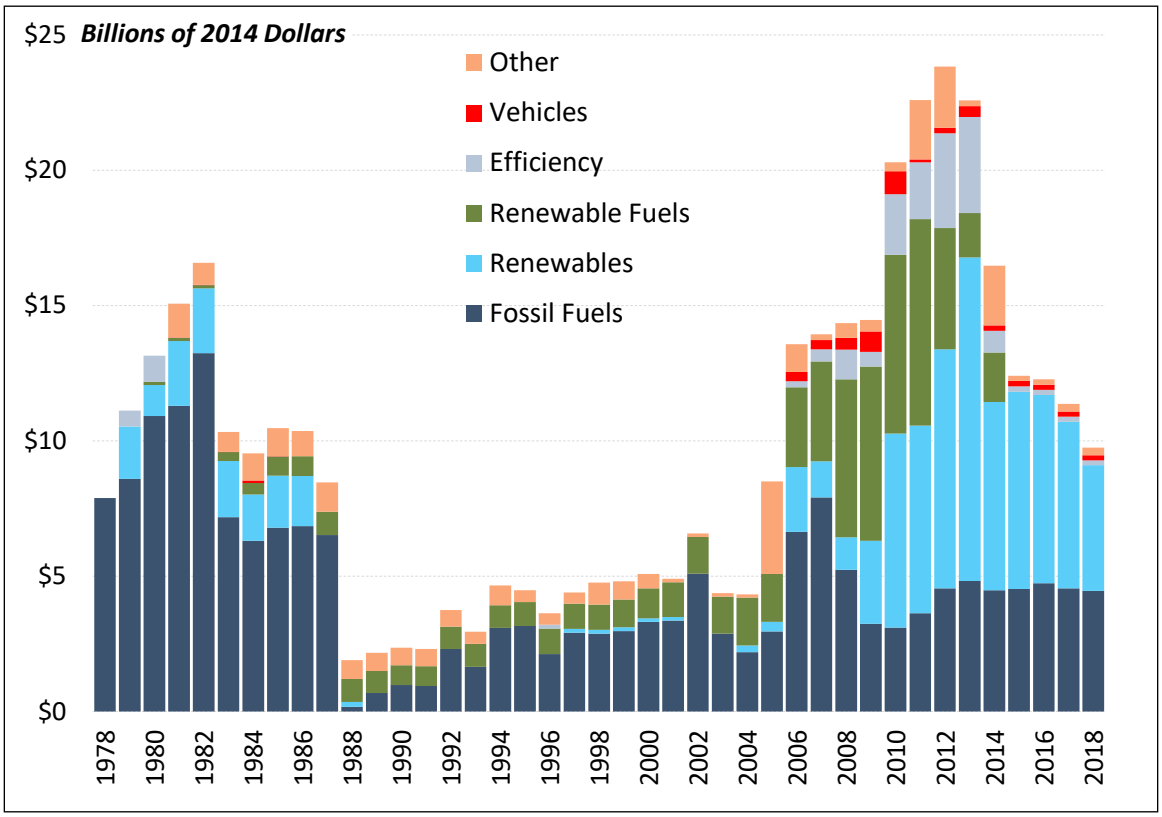
[36] For additional background, see CRS Report R41635, *ARRA Section 1603 Grants in Lieu of Tax Credits for Renewable Energy: Overview, Analysis, and Policy Options*, by Phillip Brown and Molly F. Sherlock.

[37] For more information, see CRS Report R42089, *Residential Energy Tax Credits: Overview and Analysis*, by Margot L. Crandall-Hollick and Molly F. Sherlock.

[38] The nonbusiness energy property credit (Internal Revenue Code (IRC) § 25C) expired at the end of 2014.

Figure 2. Projected Annual Cost of Energy-Related Tax Incentives

(FY1978 – FY2018)



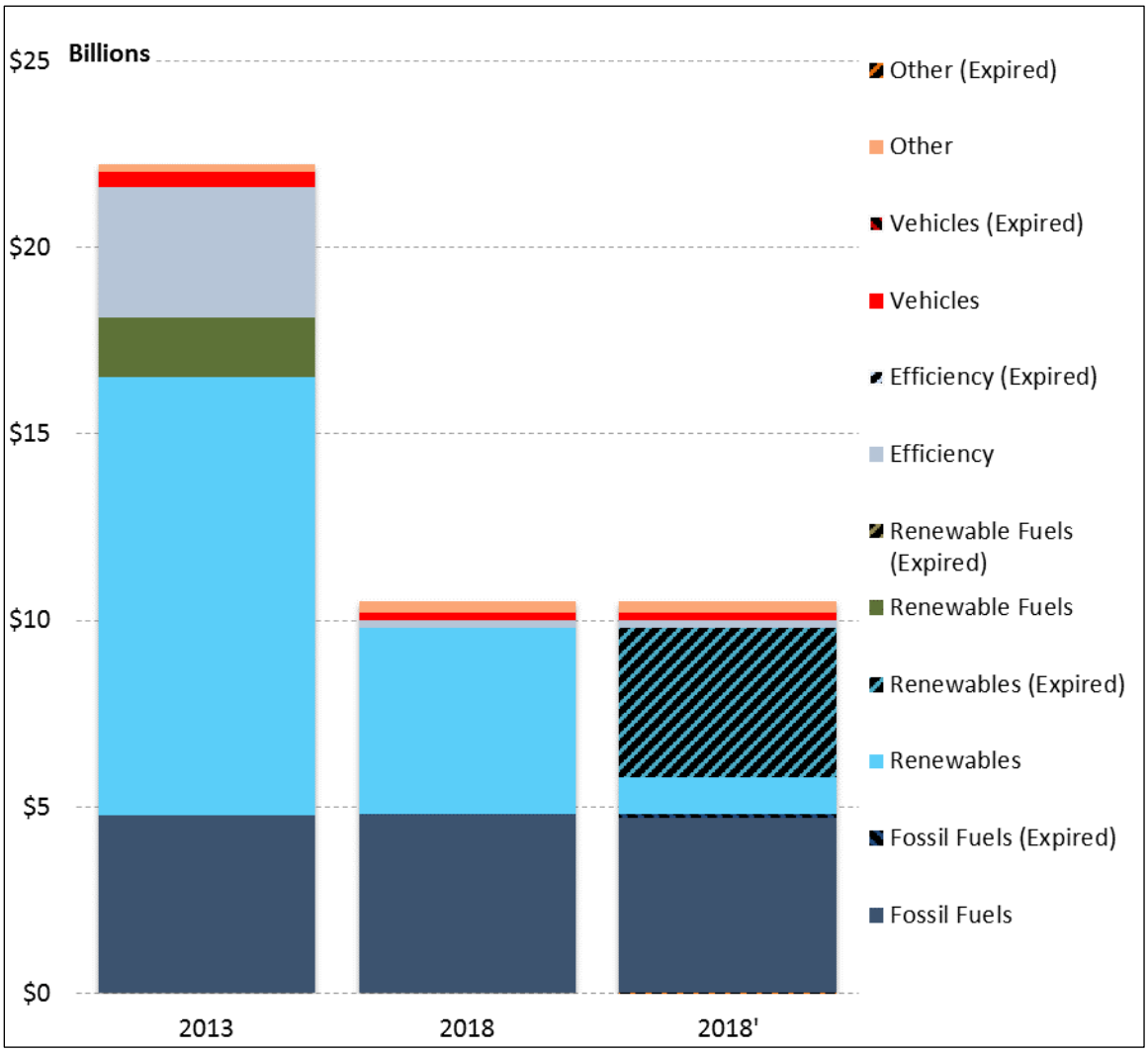
Source: CRS using data from the Joint Committee on Taxation and Office of Management and Budget.

Notes: Annual cost estimates are the sum of individual tax expenditure provisions and do not reflect possible interaction effects. The estimates also do not reflect the revenue that could be raised should specific provisions be eliminated. For all years, tax expenditure estimates are projections, not actual revenue losses. The figure does not include energy-related tax expenditure provisions that cannot be attributed to a specific fuel or technology. The figure does include outlays associated with excise tax credits for alcohol fuels (e.g., ethanol), other biofuels and alternative fuels, and outlays for grants paid out under the Section 1603 program.

Accounting for expired provisions has additional implications for trends in tax-related support for different types of energy resources. Between 2013 and 2018, the cost of tax-related provisions that support renewable energy (both renewables and renewable fuels) is projected to decline from $13.4 billion to $5.0 billion (see **Figure 3**). The majority of the $5.0 billion cost in 2018 is associated with the PTC for wind, which expired at the end of 2014. Thus, in 2018, these incentives will no longer be available for new investments in renewable electricity. Of the $5.0 billion projected cost for renewable electricity provisions in 2018, $4.0 billion is from expired incentives while $1.0 billion is from incentives available for new projects in 2018. Extension of certain tax incentives for renewable energy, such as the production tax credit, would change this analysis.

Figure 3. Projected Cost of Energy Tax Provisions: FY2013 and FY2018

(changes associated with expiring provisions)



Source: CRS using data from the Joint Committee on Taxation and Office of Management and Budget.

Notes: Annual cost estimates are the sum of individual tax expenditure provisions and do not reflect possible interaction effects. The estimates also do not reflect the revenue that could be raised should specific provisions be eliminated. For all years, tax expenditure estimates are projections, not actual revenue losses. The figure does not include energy-related tax expenditure provisions that cannot be attributed to a specific fuel or technology. The figure does include outlays associated with excise tax credits for alcohol fuels (e.g., ethanol), other biofuels and alternative fuels, and outlays for grants paid out under the Section 1603 program.

For fossil fuels, the cost of energy-related tax provisions was roughly $5.2 billion in 2013 (see **Figure 3**). This cost is projected to be $4.8 billion in 2018. Most of the tax incentives that support fossil fuels are permanent features of the tax code, and thus are not scheduled to expire. This explains why the projected cost of tax provisions that support fossil fuels is expected to remain relatively steady over the next few years.

Subsidies Relative to Production: The Energy Information Administration (EIA) Studies

Other studies have examined federal financial support (e.g., "subsidies") across various energy resources. Some of this research is similar to what has been presented thus far, in that it examines federal financial support relative to energy produced across different energy sources. Using an alternative approach, other research has compared the subsidization of different energy resources using effective tax rates (see **Appendix B** for an overview of effective tax rate studies).[39]

In recent years, the Energy Information Administration (EIA) has released studies providing analysis of energy and electricity production subsidies.[40] In this work, the EIA defines subsidies to include spending and tax expenditure provisions. On the spending side, the EIA includes direct expenditures that result in payments to energy producers or consumers as well as energy-related federal research and development (R&D) funding. The EIA analysis also includes certain energy-related federal loan guarantees and federal electricity support programs in their tabulation of federal energy subsidies.[41] On the tax side, the EIA study includes tax expenditures. The analysis presented earlier focuses exclusively on energy subsidies provided through the tax code, and does not examine spending-side energy subsidies. In contrast to the EIA studies, the earlier analysis includes Section 1603 grants in lieu of tax credits as a tax-related provision. EIA lists the Section 1603 grants in lieu of tax credits as a direct expenditure.

To estimate energy subsidies per unit of electricity production across different energy resources, the EIA employs the following methodology. First, the EIA defines electricity production that is supported by federal subsidies. Next, the analysis examines all energy subsidies, categorizing these subsidies into those that support electricity production and those that support other uses of energy. The analysis then allocates electricity-related energy subsidies by fuel type. Using this information on electricity production and federal subsidies, the EIA is able determine the share of electricity or energy attributable to a specific fuel, relative to the share of federal financial support received by that fuel. The results of EIA's analyses covering 2013, 2010, and 2007 are summarized in **Table 4**, **Table 5**, and **Table 6** respectively.

Coal continues to be the largest fuel source for electricity and receives a relatively small share of federal financial support. In 2013, 39.0% of generation was from coal, while coal received 6.0%

[39] One drawback associated with the effective tax rate analysis presented in **Appendix B** is that it relies on tax parameters that were in place prior to the enactment of the American Recovery and Reinvestment Act of 2009 (ARRA; P.L. 111-5). ARRA contained a number of energy-related provisions, and substantially changed the nature of federal financial support for renewables. For additional information, see CRS Report R40412, *Energy Provisions in the American Recovery and Reinvestment Act of 2009 (P.L. 111-5)*, coordinated by Fred Sissine, 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, and CRS Report R40999, *Energy Tax Policy: Issues in the 111th Congress*, by Molly F. Sherlock and Donald J. Marples.

[40] The three EIA reports covered in this report are (1) Energy Information Administration, *Federal Financial Interventions and Subsidies in Energy Markets 2007*, Report #:SR/CNEAF/2008-01, Washington, DC, April 2008, http://www.eia.gov/analysis/requests/2008/subsidy2/pdf/subsidy08.pdf, and (2) Energy Information Administration, *Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2010*, Washington, DC, July 2011, http://www.eia.gov/analysis/requests/subsidy/archive/2010/pdf/subsidy.pdf, and (3) Energy Information Administration, *Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2013*, Washington, DC, March 2015, http://www.eia.gov/analysis/requests/subsidy/pdf/subsidy.pdf.

[41] Since no loans were executed in FY2013, the discussion of loans and loan guarantees in EIA's March 2015 report is limited.

of federal financial incentives. In 2010, 44.9% of generation was from coal, while coal received 10.0% of the total federal financial support for electricity production. In 2007, 47.6% of generation was from coal, while 12.7% of total federal financial support for electricity was provided to coal.[42]

Table 4. Subsidies to Electricity Production by Fuel Type, 2013

(dollar values in millions)

	Production		Federal Financial Incentives		
Fuel Type	**FY2013 Net Generation (billion kWh)**	**% of Total**	**Tax Subsidies**	**Other Subsidies[a]**	**% of Total**
Coal	1,586	39.0%	642	258	6.0%
Natural Gas and Petroleum Liquids	1,141	28.0%	662	28	4.0%
Nuclear	789	19.4%	1,109	552	10.0%
Renewables	532	13.1%	3,373	8,306	72.0%
Biomass	60	1.5%	*9*	*109*	1.0%
Geothermal	17	0.4%	*22*	*223*	2.0%
Hydropower	269	6.6%	*17*	*375*	2.0%
Solar (utility)	*9*	0.2%	*1,712*	*2,682*	27.0%
Solar (distributed)	*10*	0.2%			
Wind	*168*	4.1%	*1,614*	*4,323*	37.0%
Transmission and Distribution	-i-	-i-	211	973	7.0%
Total	**4,068**	**100%**	**5,996**	**10,117**	**100%**

Source: Energy Information Administration (EIA), Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2013.

Notes: An "-i-" indicates that the value was found as "not meaningful" by the EIA. Columns may not sum due to rounding. Subsidy estimates for solar, disaggregated by utility and distribution, are not available from EIA for federal financial incentives.

a. Other subsidies include direct expenditures, research and development expenditures, federal electricity support, and loan guarantees.

b. The EIA includes the Section 1603 grants in lieu of tax credits in their direct expenditures category. The analysis above includes Section 1603 grants as tax-related federal financial support, since eligibility for

[42] In 2007, refined coal received a large share of federal financial support for electricity (32%) relative to the share of electricity produced using refined coal (1.8%). During 2007, synthetic (refined) coal was able to claim the tax credit for unconventional fuels under § 29 of the IRC. In response to concerns surrounding abuse, this credit was allowed to expire as scheduled at the end of 2007. Following expiration of this incentive, the 59 plants that had been producing synthetic coal ceased production. See Energy Information Administration (EIA), Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2010, p. 11.

Section 1603 grants is tied to the tax code. In 2013, $8.1 billion in Section 1603 grants in lieu of tax credits were awarded to renewable energy projects.

The shares of electricity produced using natural gas and petroleum liquids has been trending up in recent years, increasing from 22.5% in 2007, to 25.0% in 2010, to 28.0% in 2013. The share of federal financial support for electricity produced using natural gas and petroleum liquids was 3.4% in 2007, 5.5% in 2010, and 4.0% in 2013.

The share of electricity produced using nuclear has remained stable between 2007 and 2013, ranging between 19.4% and 19.6%. Between 2010 and 2013, the estimated share of federal financial support decreased substantially. The share of federal financial assistance for electricity going to nuclear decreased from 21.0% to 10.0% between 2010 and 2013. There were subsidy costs for nuclear loan guarantees in 2010, but not in 2013, which explains this decline.[43]

Table 5. Subsidies to Electricity Production by Fuel Type, 2010

(dollar values in millions)

	Production		Federal Financial Incentives		
Fuel Type	**FY2010 Net Generation (billion kWh)**	**% of Total**	**Tax Subsidies**	**Other Subsidies[a]**	**% of Total**
Coal	1,851	44.9%	486	703	10.0%
Natural Gas and Petroleum Liquids	1,030	25.0%	583	72	5.5%
Nuclear	807	19.6%	908	1,591	21.0%
Renewables	425	10.3%	1,347[b]	5,212[b]	55.3%
Biomass	*57*	*1.4%*	*54*	*61*	*1.0%*
Geothermal	*16*	*0.4%*	*1*	*199*	*1.7%*
Hydropower	*257*	*6.2%*	*17*	*198*	*1.8%*
Solar	*1*	*0.0%*	*99*	*869*	*8.2%*
Wind	*95*	*2.3%*	*1,178*	*3,808*	*42.0%*
Transmission and Distribution	-i-	-i-	58	924	8.2%
Total	**4,091**	**100%**	**3,382**	**8,502**	**100%**

Source: Energy Information Administration (EIA), Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2010.

Notes: An "-i-" indicates that the value was found as "not meaningful" by the EIA. Columns may not sum due to rounding.

a. Other subsidies include direct expenditures, research and development expenditures, federal electricity support, and loan guarantees.

b. The EIA includes the Section 1603 grants in lieu of tax credits in their direct expenditures category. The analysis above includes Section 1603 grants as tax-related federal financial support, since eligibility for Section 1603 grants is tied to the tax code. In 2010, $4.25 billion in Section 1603 grants in lieu of tax credits were awarded to renewable energy projects.

[43] For background, see CRS Report RL33558, *Nuclear Energy Policy*, by Mark Holt and CRS Report R42152, *Loan Guarantees for Clean Energy Technologies: Goals, Concerns, and Policy Options*, by Phillip Brown.

Both the share of electricity produced using renewables and the share of federal financial support for electricity supporting renewables increased between 2007 and 2013. In 2007, 8.8% of electricity generated came from renewable resource. By 2010, this share had increased to 10.3%, and by 2013, to 13.1%. In 2007, 14.9% of federal financial support for electricity went to renewables. In 2010, this figure was 55.3%. In 2013, 72.0% of federal financial support for electricity supported renewables. The increase in the share of federal financial support for renewables is largely due to the Section 1603 grants in lieu of tax credits program. Taxpayers that otherwise would have been eligible for the production tax credit (PTC), and would have received this tax credit over 10 years, may now choose to claim one-time lump sum grants. Investment tax credit (ITC)-eligible taxpayers, including solar, may also claim Section 1603 grants.[44]

Table 6. Subsidies to Electricity Production by Fuel Type, 2007

(dollar values in millions)

	Production		Federal Financial Incentives		
Fuel Type	**FY2007 Net Generation (billion kWh)**	**% of Total**	**Tax Subsidies**	**Other Subsidies[a]**	**% of Total**
Coal	1,946	47.6%	264	590	12.7%
Refined Coal	72	1.8%	2,156		32.0%
Natural Gas and Petroleum Liquids	919	22.5%	203	24	3.4%
Nuclear	794	19.4%	199	1,068	18.8%
Renewables	360	8.8%	724	284	14.9%
			Total Subsidy Value[b]		
Biomass	*40*	*1.0%*	*36*		*0.5%*
Geothermal	*15*	*0.4%*	*14*		*0.2%*
Hydropower	*258*	*6.3%*	*174*		*2.6%*
Solar	*1*	*0.0%*	*14*		*0.2%*
Wind	*31*	*0.8%*	*724*		*10.7%*
Landfill Gas	*6*	*0.1%*	*8*		*0.1%*
Municipal Solid Waste	*9*	*0.2%*	*1*		*0.0%*
Transmission and Distribution	-i-		735	500	18.3%
Total	**4,091**	**100%**	**4,281**	**2,466**	**100%**

Source: Energy Information Administration (EIA), Federal Financial Interventions and Subsidies in Energy Markets 2007.

Notes: An "-i-" indicates that the value was found as "not meaningful" by the EIA. Columns may not sum due to rounding.

a. Other subsidies include direct expenditures, research and development expenditures, and federal electricity support.

[44] For additional information on the Section 1603 grants in lieu of tax credits program, 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.

b. The EIA did not distinguish between tax subsidies and other subsidies for specific renewable technologies.

The EIA studies also evaluate subsidies and support for energy that is not related to electricity production. EIA estimates that in 2013, $5.2 billion of the $29.3 billion in total energy-related subsidies supported fuels used outside the electric-power sector. Non-electricity-related energy subsidies support fuels in the transportation sector, as well as primary end-use consumption or energy in the residential, commercial, and industrial sectors. **Table 7**, **Table 8**, and **Table 9** summarize EIA's findings on energy subsidies relative to energy production for energy not related to electricity production.

Table 7. Energy Subsidies Not Related to Electricity Production, 2013

(dollar values in millions)

	Production		Federal Financial Incentives	
Fuel Type	**Fuel Production Not Used For Electricity (quadrillion Btu)**	**% Total**	**Total Subsidies[a]**	**% Total**
Coal	3.50	8.0%	185	3.5%
Natural Gas and Petroleum Liquids	35.75	81.7%	1,657	31.8%
Biomass / Biofuels	4.15	9.5%	2,328	44.7%
Geothermal	0.06	0.1%	100	1.9%
Solar	0.22	0.5%	935	18%
Hydropower	0.03	0,1%	3	0.1%
Other Renewables	0.03	0.1%	0	0.0%
Total	**43.74**	**100%**	**5,206**	**100%**

Source: CRS and Energy Information Administration (EIA), Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2013.

Notes: Columns may not sum due to rounding.

a. The data as presented by EIA does not distinguish between tax and non-tax subsidies for energy not related to electricity production.

Most of the fuel production that is used outside of the electricity sector is natural gas and petroleum liquids (81.7% in 2013). The share of federal financial support for energy not related to electricity production going to natural gas and petroleum liquids fell increased between 2010 and 2013, from 20.7% to 31.8%. The overall value of these subsidies fell, however, from $2.2 billion to $1.7 billion. Overall, federal financial incentives for energy not related to electricity production declined between 2010 and 2013, from $10.4 billion to $5.2 billion.

Table 8. Energy Subsidies Not Related to Electricity Production, 2010

(dollar values in millions)

	Production		Federal Financial Incentives	
Fuel Type	**Fuel Production Not Used For Electricity (quadrillion Btu)**	**% Total**	**Total Subsidies[a]**	**% Total**
Coal	2.94	8.3%	169	1.6%
Natural Gas and Petroleum Liquids	28.55	80.3%	2,165	20.7%
Biomass / Biofuels	3.87	10.9%	7,646	73.2%
Geothermal	0.06	0.2%	73	0.7%
Solar	0.10	0.3%	169	1.6%
Other Renewables	0.02	0.0%	226	2.2%
Total	**35.54**	**100%**	**10,448**	**100%**

Source: CRS and Energy Information Administration (EIA), Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2010.

Notes: Columns may not sum due to rounding.

a. The data as presented by EIA does not distinguish between tax and non-tax subsidies for energy not related to electricity production.

Much of the decrease in federal financial incentives for non-electricity fuels between 2010 and 2013 can be explained by the expiration of certain incentives for biofuels (specifically, ethanol). Federal financial support for non-electricity biomass and biofuels was $7.6 billion (73.2% of federal financial support for non-electricity fuels) in 2010 and $2.3 billion (44.7% of federal financial support for non-electricity fuels) in 2013. Over this same time period, the share of non-electricity fuels produced from biomass or biofuels increased from 3.87 quadrillion Btu to 4.15 quadrillion Btu, with the share of non-electricity energy production attributable to biomass or biofuels declining more than a percentage point, from 10.9% to 9.5%, over the same time period.

Although the results of the EIA study are not directly comparable to the analysis of federal tax support across different energy resources presented above, similar patterns emerge. Most federal financial support for energy, through the tax code or otherwise, supports renewables. The majority of energy produced comes from fossil fuels. Despite recent reductions in incentives for biofuels, a large share of federal financial incentives for fuels not related to electricity production continued to go to biofuels in 2013. However, this type of analysis does not indicate whether the distribution of federal financial support across various energy resources is consistent with energy policy goals. Energy policy may be designed to be consistent with certain national security, environmental, or economic objectives that might require that the distribution of federal financial support for energy not be aligned with the distribution of energy production across various energy resources.

Table 9. Energy Subsidies Not Related to Electricity Production, 2007

(dollar values in millions)

	Consumption		Federal Financial Incentives	
Fuel Type	**Fuel Consumption Not Used for Electricity (quadrillion Btu)**	**% Total**	**Total Subsidies[a]**	**% Total**
Coal	1.93	3.2%	78	1.3%
Refined Coal	0.16	0.3%	214	3.4%
Natural Gas and Petroleum Liquids	55.78	91.5%	1,921	30.8%
Ethanol / Biofuels	0.57	0.9%	3,249	52.1%
Geothermal	0.04	0.1%	1	0.0%
Solar	0.07	0.1%	184	3.0%
Other Renewables	2.50	4.1%	360	5.8%
Hydrogen	-ii-		230	3.7%
Total (Fuel Specific)	**60.95**	**100%**	**6,237**	**100%**

Source: Energy Information Administration (EIA), Federal Financial Interventions and Subsidies in Energy Markets 2007.

Notes: An "-ii-" indicates positive fuel consumption of less than 500 trillion Btu. Columns may not sum due to rounding.

a. The data as presented by EIA does not distinguish between tax and non-tax subsidies for energy not related to electricity production.

Concluding Remarks

The majority of energy produced in the United States continues to come from fossil energy sources. In recent years, the majority of energy tax incentives have served to benefit renewable energy resources. The data presented in this report illustrate that, relative to production levels, federal financial support for renewable energy exceeds support for fossil sources of energy. However, since the primary tax provisions supporting renewables have expired, tax-related support for renewables has fallen in recent years, and is projected to continue to decline.

Variation in the amount of federal financial support relative to energy produced across energy resources may be consistent with various environmental or economic objectives. For example, tax incentives designed to reduce reliance on imported petroleum may be consistent with energy security goals. Tax incentives that promote renewable energy resources may be consistent with certain environmental objectives. Energy tax incentives can also be used to support emerging technologies and encourage commercialization of high-risk innovations. While subsidy per unit of production or subsidy relative to production level calculations may provide a starting point for evaluating energy tax policy, a complete policy analysis might consider why the level of federal financial support might differ across various energy technologies.

Appendix A. Comparing Energy Production to Energy Tax Incentives: 2009 and 2010[45]

While the proportion of primary energy production attributable to certain energy resources changes slowly over time, there are often substantial changes in the estimated value of energy-related tax incentives for certain types of energy resources from year to year. For example, in 2009, 77.4% of energy-related tax incentives benefitted renewables (**Table A-1**). By 2010, the share of energy-related tax incentives attributable to renewables had declined to 68.1% (see **Table A-2**). The primary reason for this decline is that in 2009, "black liquor" qualified for fuels-related tax incentives.[46] Thus, the tax expenditure estimate for tax credits for alcohol fuels was substantially higher in 2009 ($6.5 billion) than in 2010 ($0.1 billion). Annual changes in the estimated cost of energy-related tax incentives can result in substantial year-to-year changes in the proportion of energy-related tax incentives attributable to various energy resources.

Table A-1. Comparing Energy Production and Energy Tax Incentives: Fossil Fuels and Renewables, 2009

	Production		Tax Incentives	
	Quadrillion Btu	% of Total	Billions of Dollars	% of Total
Fossil Fuels	56.9	77.9%	$2.5	12.6%
Renewables[b]	7.8	10.6%	$15.4	77.4%
Renewables (excluding hydro-electric)	*5.1*	*7.0%*	*$15.4*[b]	*77.4%*[b]
Renewables (excluding biofuels and related tax incentives)	*6.2*	*8.5%*	*$2.9*	*14.6%*
Renewables (excluding hydro-electric and biofuels and related tax incentives)	*3.5*	*4.8%*	*$2.9*[b]	*14.6%*[b]

Source: Calculated using data from the Energy Information Administration, Joint Committee on Taxation, and Treasury. See the main text for a complete discussion.

a. Renewables tax incentives include targeted tax incentives designed to support renewable electricity and renewable fuels.

b. The value of total tax incentives for renewables excluding hydro-electric power is less than the total value of tax incentives when those available for hydro-power are included. However, the difference is small. JCT estimates that in 2009, the tax expenditures for qualified hydropower under the PTC are less than $50 million. During 2009, one award of $4.1 million was paid to a hydropower facility under the Section 1603 grant program. Hydropower has also received less in CREB financing than was awarded to solar and wind technologies. During 2009, the tax expenditure for CREBs was less than $50 million across all technologies.

[45] The analysis in previous versions of this report covering 2009 and 2010 did not include tax expenditures for the special tax rate for nuclear decommissioning reserve funds. Categorization of tax expenditures according to the industry being supported has also been refined for the current 2013 analysis. Thus, the results for 2013 are not directly comparable to these earlier results.

[46] For more information, see CRS Report R41769, *Energy Tax Policy: Issues in the 112th Congress*, by Molly F. Sherlock and Margot L. Crandall-Hollick.

Table A-2. Comparing Energy Production and Energy Tax Incentives: Fossil Fuels and Renewables, 2010

	Production		Tax Incentives	
	Quadrillion Btu	% of Total	Billions of Dollars	% of Total
Fossil Fuels	58.5	78.0%	$2.4	12.6%
Renewables[a]	8.1	10.7%	$13.0	68.1%
Renewables (excluding hydro-electric)	*5.6*	*7.4%*	*$13.0*[a]	*68.1%*[a]
Renewables (excluding biofuels and related tax incentives)	*6.2*	*8.3%*	*$6.7*	*35.1%*
Renewables (excluding hydro-electric and biofuels and related tax incentives)	*3.7*	*4.9%*	*$6.7*[a]	*35.1%*[a]

Source: Calculated using data from the Energy Information Administration, Joint Committee on Taxation, and Treasury. See the main text for a complete discussion.

a. Renewables tax incentives include targeted tax incentives designed to support renewable electricity and renewable fuels.

The value of total tax incentives for renewables excluding hydro-electric power is less than the total value of tax incentives when those available for hydro-power are included. However, the difference is small. JCT estimates that in 2010, the tax expenditures for qualified hydropower under the PTC are less than $50 million. During 2010, two awards totaling $88,000 were paid to hydropower facilities under the Section 1603 grant program. Hydropower has also received less in CREB financing than was awarded to solar and wind technologies. During 2010, the tax expenditure for CREBs was an estimated $0.1 billion across all technologies.

Appendix B. An Alternative Method for Evaluating the Value of Energy Tax Incentives across Technologies: The Effective Tax Rate Approach

Another way to measure the relative subsidization of various energy resources is to use an effective tax rate approach. Effective tax rates, in the context presented below, are used to evaluate how the tax system affects incentives for capital investment. Lower effective tax rates on capital investment can promote investment in certain sectors.

The remainder of this section summarizes the results of a 2010 study analyzing energy-related tax incentives and investment.[47] This study uses the 2007 tax code to evaluate its impact on the inventive to invest in different types of energy capital. As was the case with the EIA study presented earlier, the effective tax rate analysis here does not incorporate energy tax policy changes under ARRA. Nonetheless, this analysis highlights the incentives for investment created by provisions in the tax code related to energy investment and production.

What Is an "Effective" Tax Rate

The effective tax rates measures the impact of the tax system on investment decisions. In the context of this report, an effective tax rate is defined as $\frac{\rho - r}{\rho}$. In this equation, ρ is the real before-tax return on the marginal investment and r is the real return paid to investors after taxes.[48] Assume that investors require an after-tax rate of return of 6% for a given investment. Assume next that a project must have a real before-tax rate of return of 9% to cover taxes, depreciation, and payments to investors. Under these conditions, the effective tax rate would be 33%.[49] Negative effective tax rates indicate that the tax code is actually subsidizing investment to the point where taxpayers are willing to accept a before-tax rate of return that is less than the after-tax rate of return for an investment.

Effective tax rates provide a single measure for the impact of the tax system on capital investments. Thus, there are many provisions in the tax code that can affect effective tax rates. In the energy sector, depreciation rules, investment and production tax incentives, and tax rules specific to the oil and gas sector are all important in the calculation of effective tax rates.

Effective Tax Rates for Energy-Related Capital Investments

Effective tax rates in the energy sector suggest that the tax code provides greater incentives for certain types of energy-related capital investments. In 2007, the tax code created the largest incentive for capital investment in solar thermal energy generation facilities. In 2007, solar benefitted from a 30% investment tax credit as well as five-year accelerated depreciation. The 2007 effective tax rate for capital investments in solar thermal was estimated at -244.7% (see **Table B-1**). Wind, which benefitted from the production tax credit (PTC) as well as five-year accelerated depreciation, was estimated to face an effective tax rate of -163.8%. These effective

[47] 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.

[48] For additional details on the effective tax rate methodology, see Congressional Budget Office, *Taxing Capital Income: Effective Rates and Approaches to Reform*, October 2005.

[49] Using the effective tax rate formula given in the text, the effective tax rate is calculated as (0.09-0.06) / 0.09 = 0.333.

tax rates suggest that the tax code creates strong incentives for direct capital investment in wind and solar energy resources. Overall, the effective tax rates for renewables and nuclear are substantially lower than the effective tax rates for coal and gas. Empirical evidence suggests that energy-related investments may in fact be influenced by tax incentives. Metcalf (2010) finds that investment in wind capacity is "strongly influenced by tax policy."

Table B-1. 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: 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.

Note:

a. The effective tax rate on refining capital reflects the 50% expensing allowance available in 2007 for investments in additional refinery capacity.

Provisions in the tax code may distort investment decisions for other types of energy resources. The effective tax rate for capital investment in nuclear electric generation (-99.5%) also provides strong investment incentives. The Energy Policy Act of 2005 (EPACT05; P.L. 109-58) introduced a production tax credit for new commercial nuclear reactors.[50] Despite these incentives, new nuclear facilities have been slow to develop.[51]

Various tax incentives available to the oil and gas industry also influence effective tax rates on oil and gas investment. Effective tax rates on investments made by non-integrated oil and gas firms

[50] An effective tax rate analysis published by Ernst & Young estimates the effective tax rate for nuclear energy capital to be 26.7%. The difference between this estimate and that provided by Metcalf (2010) stems from the different treatment of the nuclear PTC enacted as part of EPACT05. See Ernst & Young, *International Comparison of Depreciation Rules and Tax Rates for Selected Energy Investments*, May 2, 2007, available at http://www.accf.org/media/dynamic/8/media_82.pdf.

[51] For additional background, see CRS Report RL33558, *Nuclear Energy Policy*, by Mark Holt.

are lower than for integrated firms.[52] The primary reason for this difference is that non-integrated producers are able to fully expense intangible drilling costs (IDCs) and are able to take advantage of percentage depletion. Integrated producers can only expense 70% of IDCs and must claim cost rather than percentage depletion.

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Acknowledgments

The authors would like to thank Jamie Hutchinson for providing graphics support.

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[52] The effective tax rate is also influenced by the price of oil and operating profits in the industry. The figures reported here are those that were presented in Metcalf (2010).