PRESENT LAW AND ANALYSIS OF ENERGY-RELATED TAX EXPENDITURES

Scheduled for a Public Hearing
Before the
SUBCOMMITTEE ON ENERGY,
NATURAL RESOURCES, AND INFRASTRUCTURE
OF THE SENATE COMMITTEE ON FINANCE
on March 27, 2012

Prepared by the Staff
of the
JOINT COMMITTEE ON TAXATION

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I. INTRODUCTION AND SUMMARY

The Senate Committee on Finance Subcommittee on Energy, Natural Resources, and Infrastructure has scheduled a public hearing on March 27, 2012, on renewable energy tax incentives.

Since 2004, the Congress has been active in promulgating legislation related to energy production (including oil and gas and renewables) and conservation. Part I of this document,[1] prepared by the staff of the Joint Committee on Taxation, provides tables that summarize current and recently expired energy-related Federal tax incentives.

Part II of this document provides a brief discussion of the economic rationale for certain government intervention in energy markets through the tax code and issues related to the proper design of such tax preferences. These tax expenditures create incentives that have the potential to affect economic decisions and allocate economic resources from other uses to the tax-favored uses. Such tax preferences may produce an allocation of resources that is more efficient for society at large if they are properly designed to overcome negative effects (such as atmospheric pollution, for example) that would otherwise result from a purely market based outcome without any government intervention. Tax expenditures for energy production and conservation have been criticized for lacking well defined objectives, and for lacking coordination among provisions having similar objectives. Some argue that the simultaneous existence of tax preferences for the fossil fuel industry and for renewable energy production represents conflicting government policy. Others have noted that the incentives for renewable energy and conservation are not themselves designed in a coordinated way to produce the most efficient or equitable subsidies for renewable energy and conservation.

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[1] This document may be cited as follows: Joint Committee on Taxation, *Present Law and Analysis of Energy-Related Tax Expenditures* (JCX-28-12), March 23, 2012. This document can also be found on our website at www.jct.gov.

I. CURRENT AND RECENTLY EXPIRED ENERGY-RELATED TAX EXPENDITURES

A. Summary of Credit for Electricity Produced from Certain Renewable Resources

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

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

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

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

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

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C. Summary of Investment Tax Credit Energy Production Incentives

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

		Credit rate or amount	Maximum credit	Expiration
D. Summary of Energy Conservation Credits				

		Credit rate or amount	Maximum credit	Expiration
Personal credits:				
Nonbusiness energy property credits (sec. 25C)	Insulation to international energy conservation code standard	10 %	$500 (overall 25C credit maximum)	December 31, 2011
	Energy efficient windows, doors, skylights, roofs	10 %	$500 ($200 for windows and skylights)	December 31, 2011
	Advanced main air circulating fans	100%	$50	December 31, 2011
	Qualified natural gas, propane, or oil furnace or hot water boilers	100%	$150	December 31, 2011
	Qualified electric heat pump water heaters or natural gas, propane, or oil water heaters	100%	$300	December 31, 2011
	Qualified central air conditioners	100%	$300	December 31, 2011
	Qualified biomass fuel property (wood stoves)	100%	$300	December 31, 2011
Residential energy efficient property credits (sec. 25D)	Residential solar water heating or solar electric property	30 %	None	December 31, 2016
	Residential small wind property	30 %	None	December 31, 2016
	Residential geothermal heat pump property	30 %	None	December 31, 2016
	Residential fuel cell property	30 %	$500 per half kilowatt of capacity	December 31, 2016
Business Credits:				
Manufacturer credit for new energy efficient home (sec. 45L)	Homes 30% more efficient than standard	$1,000 per home	None	December 31, 2011
	Homes 50% more efficient than standard	$2,000 per home	None	December 31, 2011
Manufacturer credit for energy efficient appliances (sec. 45M)	Dishwashers	$25	(1)	December 31, 2011
	Dishwashers (higher efficiency standard)	$50	(1)	December 31, 2011
	Dishwashers (highest efficiency standard)	$75	(1)	December 31, 2011
	Clothes washers	$175	(1)	December 31, 2011
	Clothes washers (higher efficiency standard)	$225	None	December 31, 2011
	Refrigerators	$150	(1)	December 31, 2011
	Refrigerators (higher efficiency standard)	$200	None	December 31, 2011

[1] A given manufacturer may not claim credits in excess of an aggregate of $25 million for taxable years beginning after December 1, 2010, with respect to all credits excepting the $200 credit for refrigerators and the $225 credit for clothes washers.

E. Summary of Alternative Fuel Vehicle Credits

Type of Property	Description of Qualifying Property	Credit Amount and Explanation	Expiration
Fuel cell vehicles (sec. 30B)	Vehicles propelled by chemically combining oxygen with hydrogen and creating electricity	• Base credit of $4,000 for vehicles weighing 8,500 pounds or less • Heavier vehicles can get up to a $40,000 credit, depending on weight • An additional $1,000 to $4,000 credit is available to cars and light trucks to the extent fuel economy exceeds 2002 base fuel economy	December 31, 2014
Plug-in electric-drive motor vehicles (after 2009) (sec. 30D)	Four-wheeled vehicles (excluding low speed vehicles and vehicles weighing 14,000 or more) propelled by a battery with at least 4 kilowatt-hours of electricity that can be charged from an external source.	Base credit of $2,500, plus $417 for each kilowatt-hour of additional battery capacity in excess of 4 kilowatt-hours, up to a maximum credit of $7,500	200,000 vehicle per manufacturer limitation
Electric-drive low-speed, motorcycle, and three-wheeled vehicles (sec. 30)	• Vehicles otherwise qualifying as plug-in electric-drive vehicles but for the fact that they have limited speed or less than four wheels • Two- and three-wheeled vehicles must have a battery capacity of at least 2.5 kilowatt-hours	Credit is 10 percent of cost, up to $2,500.	December 31, 2011
Converted plug-in electric-drive vehicles (sec. 30B)	Used vehicles that have been converted into a plug-in electric drive motor vehicle	Credit is 10 percent of conversion cost up to $4,000.	December 31, 2011
Alternative fuel refueling property (sec. 30C)	Property that dispenses alternative fuels, including ethanol, biodiesel, natural gas, hydrogen, and electricity	30-percent credit up to $30,000 for business property and $1,000 for property installed at a principal residence.	• December 31, 2011, for non-hydrogen refueling property • December 31, 2014, for hydrogen refueling property

Eligible Activity	Description of Provision	Expiration
Five-year cost recovery for certain energy property (secs. 168(e)(3)(B)(vi) and 48(a)(3)(A)(ii) and (vii))	• A five-year Modified Accelerated Cost Recovery System ("MACRS") recovery period is generally provided for equipment using solar and wind energy to generate electricity, to heat or cool (or provide hot water for use in) a structure, or to provide solar process heat; equipment using solar energy to illuminate the inside of a structure using fiber-optic distributed sunlight; equipment used to produce, distribute, or use energy derived from a geothermal deposit; and qualified fuel cell property. • A five-year MACRS recovery period is provided for certain biomass property, including (i) a boiler, the primary fuel for which will be an alternate substance; (ii) a burner (including necessary on-site equipment to bring the alternate substance to the burner) for a combustor other than a boiler if the primary fuel for such burner will be an alternate substance; (iii) equipment for converting an alternate substance into a qualified fuel; and (iv) certain pollution control equipment.	For five-year recovery period for certain solar equipment - December 31, 2016
Special allowance for cellulosic biofuel plant property (sec. 168(l))	An additional first-year depreciation deduction equal to 50 percent of the adjusted basis of qualified cellulosic biofuel plant property.	December 31, 2012
Pollution control facilities (secs. 169 and 291)	A taxpayer may elect to recover the cost of a certified pollution control facility over a period of 60 months (84 months in the case of certain atmospheric pollution control facilities used in connection with a power plant or other property that is primarily coal-fired). A corporation taxpayer must reduce the amount of basis otherwise eligible for the 60-month recovery by 20 percent.	None
Energy efficient commercial buildings deduction (sec. 179D)	A taxpayer may take an additional deduction of $1.80 per square foot of commercial building property that exceeds certain energy efficiency standards.	December 31, 2013

G. Summary of Fossil Fuel Capital Cost Recovery Provisions		
Eligible Activity	**Description of Provision**	**Expiration**
Geological & geophysical expenditures (sec. 167(h))	• Geological and geophysical ("G&G") expenditures incurred by independent producers and smaller integrated oil companies in connection with domestic oil and gas exploration may be amortized over 24 months. • G&G expenditures incurred by major integrated oil companies are amortized over seven years.	None
Alaska natural gas pipeline (secs. 168(e)(3)(C)(iii) and 168(i)(16)(B))	A seven-year MACRS recovery period and a class life of 22 years is provided for any natural gas pipeline system located in the State of Alaska that has a capacity of more than 500 billion Btu of natural gas per day and either is placed in service after December 31, 2013 or the taxpayer elects to treat the system as placed in service on January 1, 2014 (to the extent the system was placed in service before January 1, 2014).	None
Natural gas gathering lines (sec. 168(e)(3)(C)(iv))	A seven-year MACRS recovery period and 14-year class life is provided for natural gas gathering pipelines placed in service after April 11, 2005.	None
Election to expense 50 percent of qualified property used in refining liquid fuels (sec. 179C)	Taxpayers may elect to expense 50 percent of the cost of qualified refinery property used for processing liquid fuel from crude oil or qualified fuels; the remaining 50 percent is recovered under otherwise applicable rules.	December 31, 2013
Deduction for tertiary injectants (sec. 193)	Taxpayers engaged in petroleum extraction activities may generally deduct qualified tertiary injectant expenses paid or incurred while applying a tertiary recovery method.	None
Election to expense intangible drilling costs (secs. 263(c) and 291)	Taxpayers may elect to currently deduct intangible drilling costs (IDCs) paid or incurred with respect to the development of an oil or gas property located in the United States. For an integrated oil company that has elected to expense IDCs, 30 percent of the IDCs on productive wells must be capitalized and amortized over a 60-month period.	None

Summary of Fossil Fuel Capital Cost Recovery Provisions (cont'd)		
Eligible Activity	**Description of Provision**	**Expiration**
Depletion (secs. 611-613A and 291)	• Depletion is available to any person having an economic interest in a producing oil and gas property. There are generally two types of depletion--cost and percentage depletion. Cost depletion is limited to the taxpayer's basis in the property, whereas percentage depletion is not limited by the basis, but is subject to limitations based on net income derived from the property and taxable income. • Percentage depletion for producing oil and gas property (15 percent rate) is available only to independent producers and royalty owners. For marginal properties, the taxable income limitation is suspended for taxable years ending before January 1, 2012. • Percentage depletion is also available for coal and lignite (10 percent rate) and oil shale (15 percent rate). The percentage depletion deduction for coal and lignite is generally reduced for corporations by an amount equal to 20 percent of the percentage depletion that exceeds the adjusted basis of the property.	Suspension of taxable income limitation for marginal properties expires December 31, 2011
Capital gains treatment of certain coal royalties (sec. 631(c))	• In the case of the disposal of coal (including lignite) mined in the United States, held for more than one year prior to disposal, by the owner in a form under which the owner retains an economic interest in such coal, the excess of the amount realized from the sale over the adjusted depletable basis of the coal (plus certain disallowed deductions) is treated as the sale of property used in the owner's trade or business (*i.e.*, the sale of section 1231 property). • If the owner's net section 1231 gains, including royalties from eligible coal disposals, exceed its section 1231 losses, the royalties are treated as capital gains.	None

H. Summary of Fossil Fuel Capital Gains Treatment		
Eligible Activity	**Description of Provision**	**Expiration**
Capital gains treatment of certain coal royalties (sec. 631(c))	• In the case of the disposal of coal (including lignite) mined in the United States, held for more than one year prior to disposal, by the owner in a form under which the owner retains an economic interest in such coal, the excess of the amount realized from the sale over the adjusted depletable basis of the coal (plus certain disallowed deductions) is treated as from the sale of property used in the owner's trade or business (*i.e.*, the sale of section 1231 property). • If the owner's net section 1231 gains, including royalties from eligible coal disposals, exceed its section 1231 losses, the royalties are treated as capital gains.	None

I. Summary of Energy Credits Related to Fossil Fuels

Eligible Activity	Description	Credit Amount	Expiration
Enhanced oil recovery (EOR) credit (sec. 43)	• Credit for expenses associated with an EOR project • An EOR project is generally a project that involves the use of one or more tertiary recovery methods to increase the amount of recoverable domestic crude oil	• 15 percent of enhanced oil recovery costs • Currently phased-out	None
Marginal wells credit (sec. 45I)	Production credit for marginal wells or wells that have an average daily production of not more than 25 barrels per day	• $3-per-barrel credit (adjusted for inflation from 2004) for the production of crude oil from marginal wells • $0.50-per-1,000-cubic-feet credit (adjusted for inflation from 2004) for the production of natural gas from a marginal wells • Currently phased-out	None
Indian coal credit (sec. 45)	Production credit for coal produced at facilities placed in service before 2009 that produce coal from reserves that on June 14, 2005 were owned by (or held in trust on behalf of) an Indian tribe	• $1.50-per-ton production credit (adjusted for inflation from 2005) for 2006 and 2007 • $2-per-ton credit (adjust for inflation from 2005) for 2008 through 2012	December 31, 2012
Refined coal credit (used to produce steam) (sec. 45)	Production credit for refined coal, defined as a synthetic fuel produced from coal (including lignite) or high-carbon fly ash that when burned emits 20 percent less nitrogen oxide and 40 percent less sulfur dioxide or mercury compared to feedstock coal available in 2003	• $4.375-per-ton production credit (adjusted for inflation from 1992; $6.326 for 2011) • Credit is available during the 10-year period from the date the facility was placed in service	December 31, 2011

	Summary of Energy Credits Related to Fossil Fuels (cont'd)		
Eligible Activity	**Description**	**Credit Amount**	**Expiration**
Advanced coal project credit (sec. 48A)	• Investment credit for projects that use integrated gasification combined cycle (IGCC) or other advanced coal-based electricity generation technologies • Credits are allocated by the Secretary • First round allocations are capped at $800 million for IGCC projects and $500 million for other projects • Second round allocations are capped at $1.25 billion • Second round projects must generally sequester 65 percent of total CO_2 emissions (70 percent in the case of reallocated credits)	• 20 percent for first round IGCC projects • 15 percent for other first round projects • 30 percent for second round projects	None (other than the credit allocation limitation)
Gasification credit (sec. 48B)	• Investment credit for qualified projects that use gasification technology • Qualified projects convert coal, petroleum residue, biomass, or other materials recovered for their energy content into a synthesis gas for direct use or subsequent chemical or physical conversion • Credits are allocated by the Secretary • First round allocations are capped at $350 million • Second round allocations are capped at $250 million • First round projects are generally limited to industrial applications; second round projects include projects designed to produce motor fuels • Second round projects must generally sequester 65 percent of total CO_2 emissions	• 20 percent for first round • 30 percent for second round	None (other than the credit allocation limitation)

	J. Summary of Energy-Related Bond Provisions
Type of Bond	**Description**
New Clean Renewable Energy Bonds ("New CREBs") (sec. 54C)	• Tax credit bond • New CREBs may be issued to finance "qualified renewable energy facilities." Qualified renewable energy facilities are facilities that: (1) qualify for the tax credit under section 45 (other than Indian coal and refined coal production facilities). • Credit rate is 70 percent of the rate that permits issuance of bonds without discount and interest cost to the issuer. • Qualified issuers include electrical cooperatives, clean renewable energy bond lenders, public power providers, State and local governments (including Indian tribes), and not-for-profit electric utilities which have a loan or loan guarantee under the Rural Electrification Act. • Volume limited ($2.4. billion) all of which has been allocated by the Secretary of the Treasury
Qualified Energy Conservation Tax Credit Bonds ("QECs") (sec. 54D)	• Tax credit bond • Bond issuance must be used for "qualified conservation purposes." • Credit rate is 70 percent of the rate that permits issuance of bonds without discount and interest cost to the issuer. • Volume limited ($3.2 billion) and allocated by the Secretary of the Treasury generally in proportion to State population
Tax-exempt bonds for certain public energy-related projects (sec. 103)	• Tax-exempt bond • May be used for financing government-owned and operated electrical and gas powered generation, transmission and distribution facilities • Not subject to any volume caps
Tax-exempt bonds for certain private energy-related projects (secs. 141, and 142)	• Tax-exempt bond • May be used for financing certain exempt facilities including privately owned and/or operated utility facilities (local district heating and cooling facilities, certain private electric and gas facilities, and hydroelectric dam enhancements); qualified green building and sustainable design projects • Generally subject to private activity volume cap
Safe harbor from arbitrage rules for prepaid natural gas (sec. 148)	• Allows tax-exempt bonds to be used to finance prepaid natural gas contracts without application of the otherwise applicable arbitrage rules

	K. Summary of Other Energy Provisions		
Eligible Activity	**Description**	**Credit Amount**	**Expiration**
Energy research credit (sec. 41)	• Credit for payments made to energy research consortia for qualified energy research • Includes research related to fossil fuels as well as to renewable energy technologies	20 percent of qualified expenses	December 31, 2011
Advanced nuclear power production credit (sec. 45J)	• Credit for production of nuclear power from new facilities that use modern designs and have received an allocation from the Secretary • Secretary may allocate up 6,000 megawatts of credit-eligible capacity.	1.8 cents per kilowatt-hour for the eight-year period starting when the facility was placed in service	Qualified facilities must have been placed in service by December 31, 2020
Carbon dioxide sequestration credit (sec. 45Q)	• Credit for the sequestration of industrial source carbon dioxide produced at qualified U.S. facilities • Qualified facilities must capture at least 500,000 metric tons of CO_2 per year.	• $10 for CO_2 used as a tertiary injectant and then permanently sequestered (adjusted for inflation: $10.19 for 2011; 2012 adjustment expected in April) • $20 for CO_2 permanently sequestered without being first used as a tertiary injectant (adjusted for inflation: $20.37 for 2011; 2012 adjustment expected in April)	End of the year in which the Secretary determines that 75 million tons of CO_2 have been captured and sequestered

Summary of Other Energy Provisions (cont'd)			
Eligible Activity	**Description**	**Credit Amount**	**Expiration**
Advanced energy project credit (sec. 48C)	• Investment credit for qualified projects that re-equip, expand, or establish a manufacturing facility for the production of specified energy related products • Credits are allocated by the Secretary and are capped at $2.3 billion.	30 percent	None (other than the credit allocation limitation)
Energy conservation subsidies provided by public utilities (sec. 136)	• Energy conservation subsidies provided by public utilities are excluded from gross income	N/A	None
Deferral of gains from the sale of electric transmission property (sec. 451(i))	• A taxpayer may elect to recognize gain ratably over an eight year period for gains on disposition of certain electric transmission property.	N/A	December 31, 2011
Passive loss rules for working interests in oil and gas property (sec. 469)	• Passive activity loss rules not applicable to working interest in any oil or gas property that taxpayer holds directly or indirectly through an entity that does not limit the taxpayer's liability • Losses and credits from such interests, in general, may offset income from other activities of taxpayer	N/A	None
Reduced rate of tax for alcohol from natural gas ("partially exempt methanol or ethanol") (sec. 4041(m))	• Taxed at 9.15 cents per gallon (alcohols other than ethanol) • Taxed at 11.3 cents per gallon (ethanol)	N/A	After March 31, 2012, the rates of tax are 2.15 cents per gallon for alcohols other than ethanol and 4.3 cents per gallon for ethanol.

| Summary of Other Energy Provisions (cont'd)			
Eligible Activity	**Description**	**Credit Amount**	**Expiration**
Reduced tax for diesel-water fuel emulsion (sec. 4081(a)(2)(D), 4081(c) and 6427(m))	• Diesel fuel tax rate of 24.3 cents per gallon is reduced to 19.7 cents per gallon for diesel-water fuel emulsions to reflect the reduced Btu content per gallon resulting from the water • Refund of the difference between the two rates is available to the extent tax-paid diesel is used to produce a qualifying emulsion diesel fuel.	N/A	None
Certain publicly traded partnerships treated as corporations (secs. 7704 and 851)	• General rule that a publicly traded partnership is taxed as a corporation is not applicable if 90 percent of gross income is interest, dividends, real property rents, or certain other types of qualifying income • Other types of qualifying income includes income and gains from certain activities with respect to natural resources	N/A	None

II. DATA AND ANALYSIS

A. Overview of Domestic Oil, Natural Gas, Coal
and Renewable Energy Production

<u>Oil and natural gas production</u>

Despite having less than two percent of the world's oil reserves,[2] the United States remains one of the largest oil producers in the world.

Figure 1.−Crude Oil Production in Selected Countries
(millions of barrels per day)
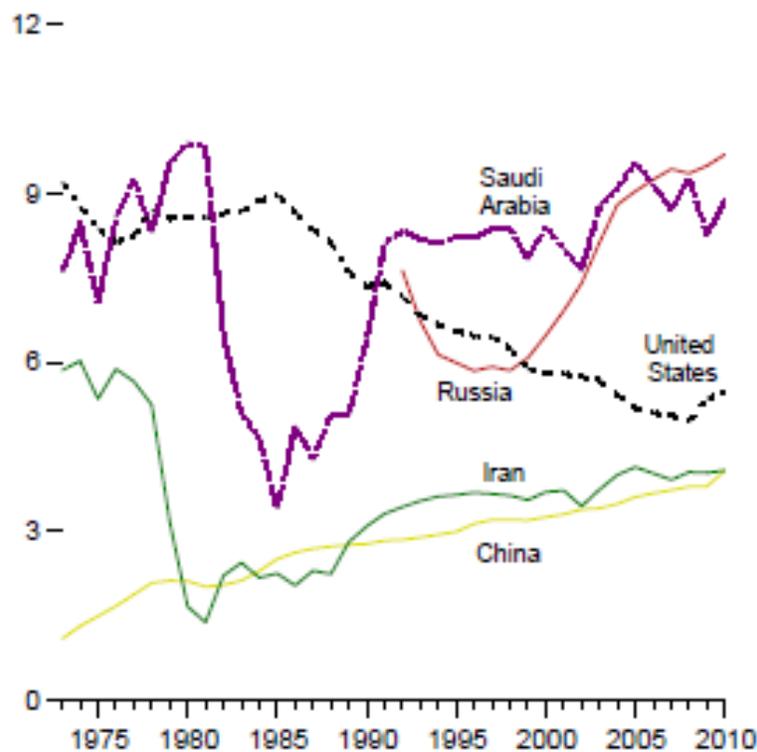
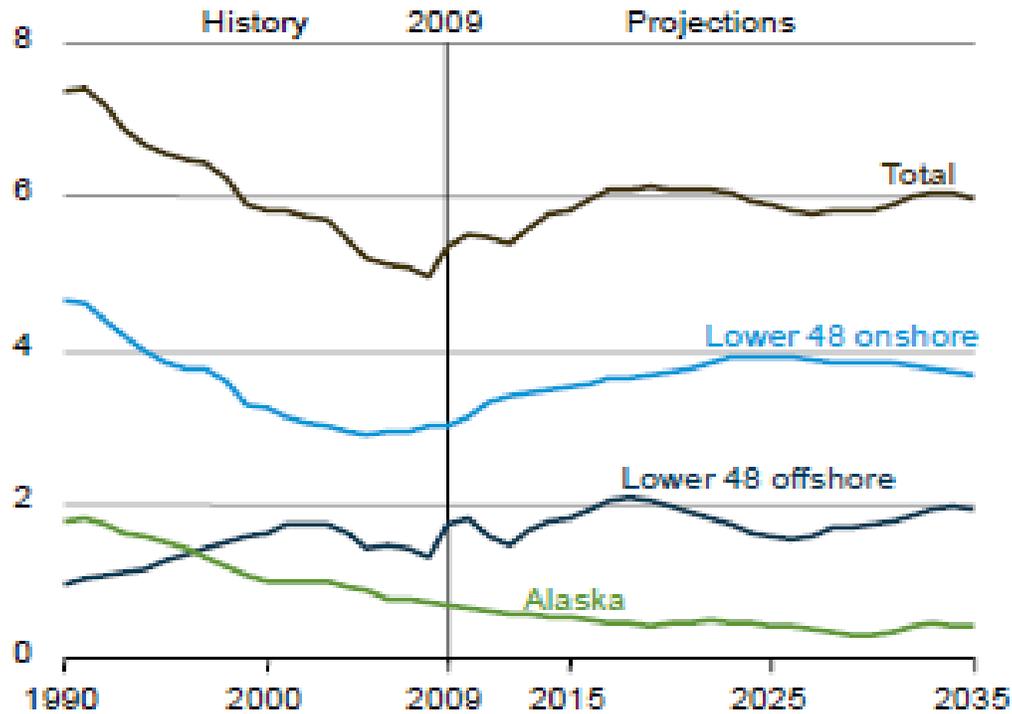Source: Energy Information Administration, *Monthly Energy Review*, February 2012, p. 150, Figure 11.1a.

Until the middle of the last decade, domestic oil production had been declining steadily since in the mid-1980s. Production has increased over the past several years, and this rise is predicted to continue over the next 25 years.[3] Rising oil prices, growing shale resources

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[2] Energy Information Administration, *International Energy Outlook 2011*, September 2011, Table 5.

[3] Energy Information Administration, *Annual Energy Outlook 2011*, April 2011, p. 82.

available through horizontal drilling and hydraulic fracturing, and increased application of carbon dioxide-enhanced oil recovery are expected to drive the increased production.[4]

Figure 2.−Projected Domestic Crude Oil Production by Source, 1990-2035
(millions of barrels per day)

Source: Energy Information Administration, *Annual Energy Outlook 2011*, April 2011, Figure 95, p.82.

Because the remaining domestic oil reserves generally require more costly secondary or tertiary recovery techniques, domestic crude oil production is highly sensitive to world crude oil prices.[5]

The United States has a slightly larger share of the world's natural gas reserves compared to oil reserves but it still amounts to four percent of the global total.[6] Like oil, however, domestic production of natural gas is expected to increase, with most of the increase attributable

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[4] *Ibid.*

[5] *Ibid.*

[6] Energy Information Administration, *International Energy Outlook 2011,* September 2011, Table 7.

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to onshore unconventional production (such as natural gas produced from tight sand and shale formations).[7]

The oil and gas industry continues to be a large employer in the United States. For 2011, the domestic oil and gas extraction sector employed a seasonally adjusted average of 174,300 workers.[8]

Coal production

As with oil, the United States is one of the biggest producers of coal in the world.[9] Unlike with oil, however, and as illustrated below, the United States has by a substantial margin the world's largest coal reserves.

Figure 3.−Estimated World Coal Reserves by Country
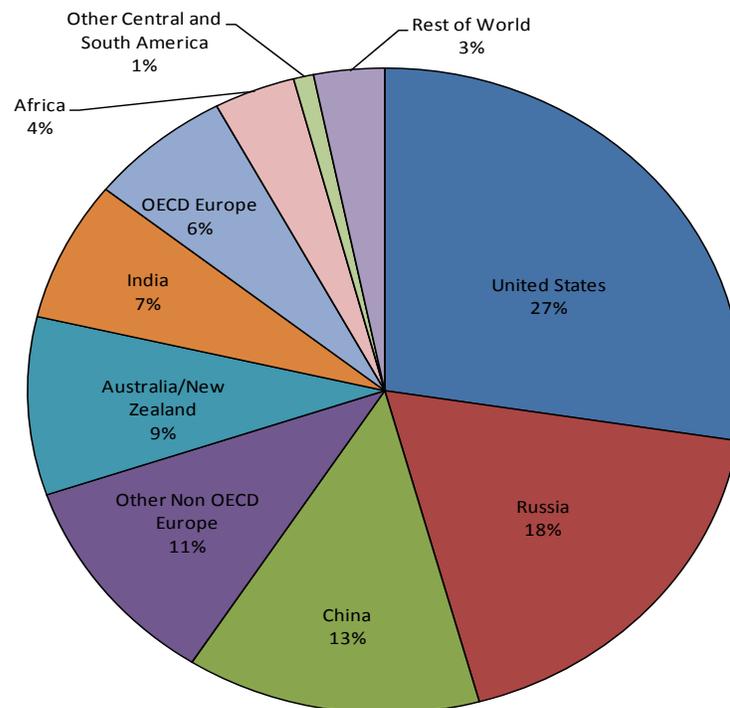
Source: Generated using data from the Energy Information Administration, *International Energy Outlook 2011*, September 2011, Table 10.

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[7] Energy Information Administration, *Annual Energy Outlook 2011*, April 2011, p. 79.

[8] Bureau of Labor Statistics, *Monthly Labor Review*, vol. 135, no. 2, February 2012, Table 12, p. 62.

[9] The United States is the world's second largest producer of coal after China. Energy Information Administration, *International Energy Outlook 2011*, September 2011, Table 8.

Domestic coal production is projected to fall somewhat through 2014 due to low natural gas prices and increased generation from renewable and nuclear sources, and then to grow at an annual average rate of 1.1 percent through 2035.[10]

The coal mining sector continues to be a major source of employment in the United States. For 2011, the coal mining sector employed a seasonally adjusted average of 86,200 workers.[11]

Renewable energy production

In recent years there has been increased interest in, and adoption of, tax subsidies for conservation of energy and for development of renewable sources of energy. In part as a result of these subsidies, renewable energy production has grown significantly in recent years. For example, net power generation from wind energy has more than quadrupled in the past five years, from 26.6 terawatts in 2006 to 119.7 terawatts in 2011.[12] However, as illustrated in Figure 4 below, the United States continues to rely primarily on fossil fuel sources for energy. In 2010, 83.1 percent of U.S. energy consumption came from fossil fuels, 8.6 percent from nuclear electric power, and 8.3 percent from renewable sources of energy (including 2.6 percent from conventional hydroelectric power).

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[10] Energy Information Administration, *Annual Energy Outlook 2011*, April 2011, p. 85.

[11] Bureau of Labor Statistics, *Monthly Labor Review*, vol. 135, no. 2, February 2012, p. 62, Table 12.

[12] Energy Information Administration, *Electric Power Monthly*, February 2012, p. 22, Table 1.1.A.

Figure 4.−Energy Consumption by Source for 2010 (Quadrillion Btu)[13]
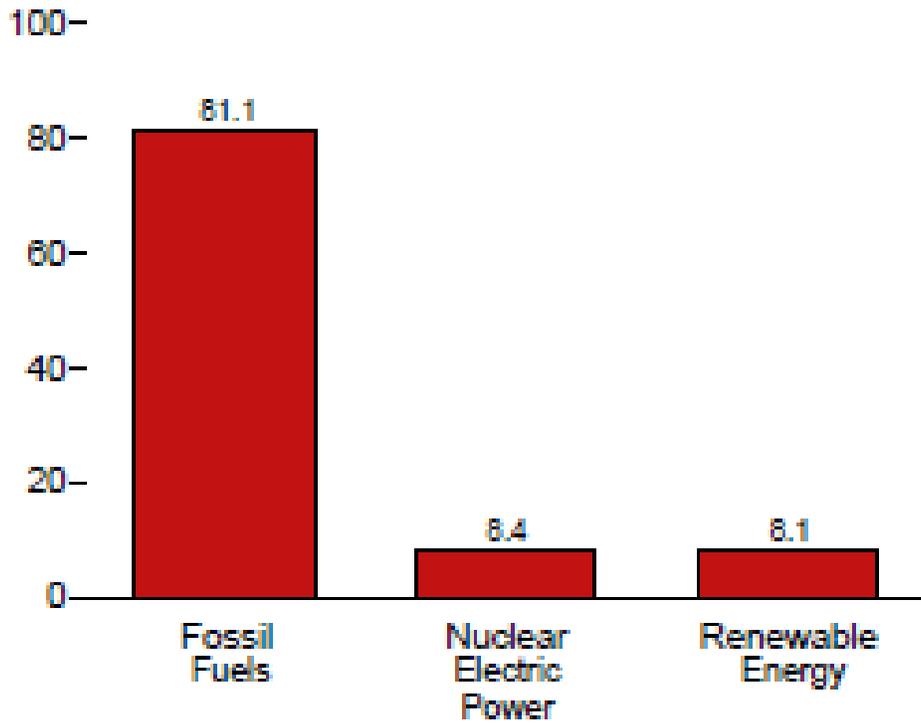
The renewable electricity sector is not a major source of employment in the United States.[14]

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[13] A British thermal unit ("Btu") is the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit.

[14] The Bureau of Labor Statistics has recently attempted to quantify "Green Goods and Services" jobs ("GGS jobs"). Bureau of Labor Statistics, *News Release: Employment in Green Goods and Services - 2010*, March 22, 2012. The Bureau estimates that for 2010 there were 3,700 private sector GGS jobs in hydroelectric power generation, 2,200 in wind power, 1,100 in biomass power, 600 in geothermal power, and 400 in solar power.

B. Economic Analysis of Energy Tax Expenditures

1. General economic rationale for certain tax expenditure intervention in energy markets

A common economic rationale for government intervention in certain markets (including many aspects of energy markets) is that often there exist "externalities" in the consumption or production of certain goods. The externalities lead to "market failures," wherein either too little or too much of certain economic activity occurs relative to what is the socially optimal level of activity. An externality exists when, in the consumption or production of a good, there is a difference between the cost (or benefit) to an individual from consumption or production and the cost (or benefit) to society as a whole. When the society-wide, or "social," costs of consumption exceed the private costs of consumption, a negative externality exists. When the social benefits from consumption or production exceed private benefits, a positive externality exists. When negative externalities exist, there is overconsumption of the good that causes the negative externality relative to what would be socially optimal. When positive externalities exist, there is underconsumption of the good that produces the positive externality.

The reason for the overconsumption or underconsumption is that private actors in general do not take into account the effect of their consumption on others, but only weigh their personal costs and benefits in their decisions. Thus, they consume goods up to the point where the marginal benefit to them of more consumption is equal to the marginal cost (generally, the price) that they face. But from a social perspective, consumption should occur up to the point where the marginal social cost (generally, the price to the consumer plus any external costs imposed on others) is equal to the marginal social benefit (the benefit received by the consumer, plus any social benefit from the individual consumption). Absent some intervention, only when there are no externalities do private actions lead to the socially optimal level of consumption or production, because only in this case are private costs and benefits equal to social costs and benefits.

Tax preferences that encourage investment in specific areas increase economic efficiency only when market-based pricing signals have led to a lower level of investment in a good than is socially optimal. In general, this can occur in a market-based economy when private investors do not capture the full value of an investment−that is, when there are positive externalities to the investment that accrue to third parties who did not bear any of the costs of the investments. For example, if an individual or corporation can borrow funds at 10 percent and make an investment that will return 15 percent, they generally make that investment. However, if the return were 15 percent, but only eight percent of that return went to the investor, and seven percent to society at large, the investment generally does not take place, even though the social return (the sum of the return to the investor and other parties) would indicate that the investment should be made. In such a situation, it may be desirable to subsidize the return to the investor through tax credits or other mechanisms so that the investor's return is sufficient to cause the socially desirable investment to be made. In this example, a credit that raises the return to the investor to at least 10 percent would be necessary. Even if the cost of the credit were paid through general tax increases for others, society as a whole would presumably be better off because of the seven percent return to society from the investment. In this situation, the credit would only need to raise the return to the investor by two percent for the investor to break even. Thus, even if the rest of society bears the full cost of a credit that raises the investor return from eight percent to

ten percent, they would enjoy a five-percent net return to the investment (seven percent less two percent).

Pollution is an example of a negative externality, because the costs of pollution are borne by society as a whole rather than solely by the polluters themselves. In the case of pollution, there are various ways the government could intervene in markets to limit pollution to more economically efficient levels. One approach is to control pollution directly through regulation of polluters, such as by requiring coal burning electric utilities to install scrubbers to limit their emissions of various pollutants.

Other more market oriented approaches to achieving socially optimal levels of pollution control are also possible. One such approach is to set a tax on the polluting activity that is equal to the social cost of the pollution. Thus, if burning a gallon of gasoline results in pollution that represents a cost to society as a whole of $1, it would be economically efficient to tax gasoline at $1 per gallon. By so doing, the externality is said to be internalized, because now the private polluter faces a private cost equal to the full social cost, and the socially optimal amount of consumption takes place. An alternative market-based approach to control pollution is to employ a system of payments, for example, tax credits, to essentially pay polluters to reduce pollution. If the payments can be set in such a way as to yield the right amount of reduction (that is, without paying any more or less than the reduction is valued), the socially desirable level of pollution will result. The difference between these two approaches is who pays for the pollution reduction. Under the tax approach, polluters and those who buy goods and services from polluters bear the social costs of their pollution. The alternative approach suggests that the pollution reduction costs should be borne more broadly by those who receive the benefit of the reduction.

In the case of a positive externality, the tax policy that maximizes economic efficiency is to provide a tax preference (*i.e.*, a negative tax) for the consumption or production that produces the positive externality. By the same logic as above, the externality becomes internalized, and the private benefits from consumption become equal to the social benefits, leading to the socially optimal level of consumption or production. An example where such a positive externality is thought to exist is in basic scientific research, as the social payoffs to such research are not fully captured by private parties that undertake, and incur the cost of, such research. As a result, a socially sub-optimal level of such research is undertaken. The provision of a subsidy for such research can correct this market inefficiency and lead to socially optimal levels of research.

Some have argued that decreasing the dependence of the United States on foreign source energy is desirable for geopolitical and national defense reasons, and that these reasons constitute an externality that provides a rationale for subsidizing domestic fossil fuel production as well as subsidizing conservation and renewable energy production. In recent years there has been increasing focus in the tax code on energy conservation and renewable energy production incentives. The remainder of the discussion herein focuses on some considerations in the design of these incentives.

2. Issues in the design and efficacy of tax expenditures for energy conservation and renewable energy production

<u>In general</u>

Economists generally agree that the most efficient means of addressing pollution would be through a direct tax on the pollution-causing activities, rather than through the indirect approach of targeted tax credits for certain technologies. By the direct tax approach, the establishment of the economically efficient prices on pollutants, through taxes, would result in the socially optimal level of pollution. To achieve this result, the tax would be set to equal the cost to society of the incremental pollution. The imposition of a direct tax on the pollution-causing activity would indirectly lead to the adoption of the types of technologies favored in the tax code, but only if these technologies were in fact the most efficient technologies.

A tax on the pollution causing activity is technologically neutral−a tax does not favor any particular technology that individuals might choose to utilize, or favor any particular behavioral modification that individuals may choose to make, in their pollution reducing responses to the tax. Rather, individuals would choose the most cost effective and economically efficient means of altering their behavior in response to the tax. For example, the optimal behavioral responses to a broad based tax on fossil fuels may lead to installation of greater amounts of home insulation, but may also lead to individuals turning down the thermostat or switching off unnecessary lighting. It would be difficult or impractical to design tax subsidies to directly incentivize the turning down of thermostats, the switching off of lights, or other similar forms of optimizing behavior.

Nonetheless, many provisions of current law provide targeted tax credits for investment in, or expenditures on, certain assets that reduce, directly or indirectly, the consumption of conventional fuels and the attendant negative externalities. The design of these tax benefits is directly relevant to how close these tax benefits come, individually and collectively, to achieving their intended objectives in a cost effective and efficient manner. Ideally, their design would be coordinated to try to mimic the more economically efficient outcome that a broad based tax would provide.

The most important consideration in the efficient design of targeted subsidies is to determine what activities to subsidize and how much to subsidize them (*i.e.*, what a credit rate should be, for example). In setting the policy parameters, the government is implicitly setting the price it will pay for the energy production or conservation that is produced or conserved in the manner specified by the tax provision. To be technologically neutral and economically efficient, the government should set policy parameters so that the implicit price it pays for the same objective, say fossil fuel displacement (typically measured in millions of British thermal units,[15] or "MMBtu"), is the same under each tax provision that has the same purpose. If it sets its policies in this manner, then only the most cost effective production of such fossil fuel MMBtu displacement will be subsidized.

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

While the government's policy parameters indicate the price it is willing to pay for fossil fuel MMBtu displacement at the margin, in practice it is difficult to know how much overall incremental fossil fuel displacement (and pollution reduction) the government is buying in the aggregate with a given conservation or renewables production credit. The reason is that the government subsidy typically applies to "inframarginal" activity, or activity that would have occurred even in the absence of the credit (as oppose to activity that only occurs because of the subsidy). The government incurs an expense in subsidizing such inframarginal activity in order to induce others at the margin to engage in the tax-favored activity they otherwise would not have undertaken.

For example, a credit is provided under present law for the purchase of certain energy efficient furnaces. If the credit is assumed to be $500 and it is further assumed that the typical energy consumption from the efficient furnace as compared to an average furnace results in 1,000 MMBtu less fossil fuel consumption over its lifetime, then the government has set the price of 50 cents for each MMBtu of displaced fossil fuel consumption to encourage the adoption of the more efficient furnace. However, many investments in the energy efficient furnaces might have taken place even in the absence of the credit, and thus the government pays, via the credit, for fossil fuel displacement that would have occurred anyway. If two million furnaces are sold (leading to a billion dollars in credits being claimed), but only 200,000 of these are sold as a direct result of the credit, then only one tenth (200,000 divided by 2 million) of the fossil fuel displacement from the energy efficient furnaces can be said to have occurred because of the credit. Ninety percent of the fossil fuel displacement would have occurred by the 1.8 million more efficient furnaces that would have been purchased in the absence of the credit.

Thus, in this hypothetical example, the true budget cost of the aggregate incremental displaced fossil fuel consumption is 10 times the implicit government price at the margin, or $5, for each MMBtu of displaced fossil fuel consumption.[16] Additionally, individuals who have purchased a more efficient furnace might choose to heat their homes to a greater degree than without the tax credit since it costs less to do so. This behavioral response negates some of the initial fossil fuel displacement from the purchase of the more efficient furnace, and inflates the cost to the government of a given amount of fossil fuel displacement.[17]

While the government can in theory establish an efficient set of subsidies for the activities it chooses to subsidize, in practice it cannot administratively identify and set up programs to subsidize every conceivable energy-saving practice. Additionally, it is not possible to identify meritorious technologies not yet invented. The government must continue to expand the class of credit-eligible activities if it wishes to minimize the economic distortions that come

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[16] This type of budgetary inefficiency can sometimes be tempered by targeting the credit at investment or expenditures above a base amount.

[17] In the conservation literature, this phenomenon of greater energy efficiency leading to behavioral responses that tend to increase the use of the more energy efficient equipment has come to be termed the "rebound effect," and has been estimated to reduce expected energy savings by up to 30 percent in the case of space heating and automobiles (see Frank Gottron, "Energy Efficiency and the Rebound Effect: Does Increasing Efficiency Decrease Demand?," Congressional Research Service report RS20981, July 2001. See also "On the Rebound: The Interaction of Energy Efficiency, Energy Use and Economic Activity," *Energy Policy*, Volume 28, June 2000.)

from favoring certain technologies through tax subsidies over other technologies that prove equally capable of achieving reductions in fossil fuel consumption. Furthermore, the investment in research to develop such new technologies might be constrained by the existence of tax subsidies for current technologies. Investors in such research run the political risk that their newly discovered technologies will not be granted any tax subsidies and may find it difficult to compete with existing subsidized technologies.

Table 1 compares selected tax incentives to illustrate the varying implicit prices that the government is willing to pay per MMBtu of fossil fuel displacement. The differing amounts show that at the margin the government pays more to displace Btus from certain activities over others, which is not economically efficient.[18]

Column 1 in Table 1 lists the statutory credit amount in cents per kilowatt-hour and dollars or cents per gallon. Column 2 converts the statutory credit amounts to express them in terms of dollars per unit of heat energy (in millions of Btus) embedded in the credit-eligible fuel or in the kilowatt-hour of electricity.

Column 3 in Table 1 shows the credit amount per MMBtu of displaced fossil fuel consumption, factoring in the thermal efficiency of power generation being displaced. A renewable fuel, such as ethanol, directly displaces a fossil fuel on a Btu per Btu basis. The fossil fuel heat energy that a kilowatt-hour of renewable electricity displaces, however, depends on the thermal efficiency with which the fossil-fueled electricity generation station being replaced converts the heat energy of the fossil fuel to the heat energy of a kilowatt-hour of electricity. This measure of the generating station's thermal efficiency is known as the "heat rate." According to the Department of Energy, the average annual heat rate factor for fossil-fueled power plants in the United States is 9,760 Btus per kilowatt-hour.[19] Thus, though a kilowatt-hour of electricity has heat energy of 3,412 Btus, as noted at the bottom of Table 1, it requires on average 9,760 Btus of fossil fuel to produce that kilowatt-hour at a domestic fossil-fuel-burning power plant. Thus, a kilowatt-hour of renewable electricity displaces on average 9,760 Btus of fossil fuel feedstock. Factoring in thermal efficiency basically accounts for the fact that the average coal-fired or natural gas-fired power plant is only about 35 percent efficient (3,412 / 9,760). If the objective of the Federal government's renewable energy policy is defined as displacement of fossil fuel energy, then column 3 shows the varying amounts that the government pays to accomplish that objective.

As noted above, it cannot be known from this information alone what the total budget cost is for the aggregate incremental renewable production that occurs as a result of the credits,

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[18] This discussion assumes that the benefits across all types of alternative energy are equivalent and that fossil fuels are being displaced (rather than, for example, nuclear power). In reality, different alternative energy sources might displace different types of fossil fuels, whose negative externalities may vary. Also, the production of certain renewables, such as solar or wind energy, may be more benign than the production of others, such as ethanol. Thus, depending on these other factors, varying credit rates could be economically efficient if there are differences across the renewables in the net benefits from each renewable and the fossil fuel it displaces.

[19] Energy Information Agency, *Monthly Energy Review*, Table A6, p. 178 (August 2011).

due to renewable production that would have occurred in the absence of the credits. If, as an example, half of the wind energy production would have occurred in any event, then the total Federal revenue cost of achieving the incremental wind energy produced is twice that stated in the table, if one assumes that all wind energy produced receives the credit.[20] In other words, the average cost of the subsidy per unit subsidized may be much lower than the cost of the subsidy when expressed in terms of the cost per marginal additional units of the subsidized activity that result from having the subsidy in place.

Table 1.−Comparison of Selected Energy Production Tax Credits			
	(Column 1) Statutory credit amount	(Column 2) Credit amount in dollars per MMBtu of heat energy	(Column 3) Credit amount in dollars per MMBtu of heat energy of displaced fossil fuel feedstock[**]
Wind power	2.2 cents per kilowatt-hour	$6.45	$2.25
Geothermal power	2.2 cents per kilowatt-hour	$6.45	$2.25
Open-loop biomass	1.1 cents per kilowatt-hour	$3.22	$1.13
Advanced nuclear power	1.8 cents per kilowatt-hour	$5.28	$1.85
Ethanol[*]	45 cents per gallon	$5.92	$5.92
Biodiesel[*]	$1 per gallon	$8.45	$8.45

Notes:
 1 kilowatt-hour = 3,412 Btus
 1 gallon of ethanol = 76,000 Btus (low heating value)
 1 gallon of biodiesel = 118,296 Btus (low heating value)
 Displaced fossil fuel feedstock calculation assumes a fossil fuel heat rate thermal conversion
 factor for wind, geothermal, biomass, and nuclear power of 9,760 Btus per kilowatt-hour.
 Btus per kw-hour and thermal heat rate conversion factor taken from Energy Information Agency, *Monthly Energy Review*, Table A6, p. 178 (August 2011)
 Btu content of ethanol and biodiesel taken from Energy Information Agency, *Annual Energy Outlook 2007*, Table 12, p. 59 (February 2006)
[*] Expired December 31, 2011.
[**] This calculation does not account for the fossil fuels associated with the production of biofuels, nor does it account for all of the energy that is consumed indirectly in the production of electricity. Thus, for example, it does not account for the energy required to make the steel used in the construction of any wind turbines or the fossil fuels used to grow any biofuel crops.

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[20] The section 45 electricity production credit is allowed only on the wind produced for the first ten years the facility is placed in service. If the existence of the credit induces a wind facility to be built that would not otherwise have been, and such a facility lasts for 20 years, then half of the wind produced from such facility does not receive any Federal credit, and the true cost of the Federal credit for that facility is half of what is shown on the table.

One can also compute the implicit price that the government is willing to pay per MMBtu for the various provisions designed to encourage taxpayers to conserve energy. As an example, one can compute the implicit price the government is willing to pay to conserve motor fuel in the case of plug-in electric motor vehicles available for purchase in 2012 for which taxpayers could claim a tax credit. For example, the 2012 Nissan Leaf, an electric-drive motor vehicle, uses 34 kilowatt-hours of electricity to travel 100 miles of combined city and highway driving.[21] The gasoline-equivalent energy content of electricity is 12,307 watt-hours per gallon of gasoline.[22] This results in a fuel efficiency of 36.2 miles-per-gallon equivalent.[23] The Nissan Sentra, a comparable gasoline-powered vehicle, obtains 30 miles per gallon in combined city and highway driving per the EPA. Assuming a useful life of 120,000 miles, the Leaf will consume the equivalent of 685 fewer gallons of gasoline over its lifetime as compared to the Sentra.[24] The energy content of that gasoline is 78.1 MMBtus (at 114,000 Btus per gallon of gasoline). Thus, the $7,500 tax credit available to this vehicle amounts to $96.03 of credit per million British thermal units of displaced fossil fuel energy.

The $96.03 figure represents the credit cost per displaced MMBtu of fossil fuel only to the extent that the long run marginal energy source for the generation of electricity is *fossil-fuel based*. If the marginal energy source for electrical generation were nuclear or wind, for example, then the Leaf would displace fossil fuel consumption to the full amount of gasoline consumed by the Sentra over its lifetime. At 30 miles per gallon the Sentra consumes 4,000 gallons over 120,000 miles, or 456 MMBtus. This implies a credit cost of $16.44 per MMBtu of displaced fossil fuel energy if the marginal source of electrical generation is nuclear, wind, or other source that is not fossil-fuel based.[25]

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[21] Environmental Protection Agency, *Fuel Economy Guide, Model Year 2012*, March 8, 2012, p. 26.

[22] 65 Fed. Reg. 36987 (June 12, 2000). This value factors in the efficiencies associated with producing and transmitting electricity, including the U.S. average fossil-fuel electricity generation efficiency (32.8 percent), and the U.S. average electricity transmission efficiency (92.4 percent). The calculation also factors in the petroleum refining and distribution efficiency (83 percent). *Ibid.* The assumptions embedded in this guidance have a significant impact on the calculations in the text. For example, the U.S. average fossil fuel electricity generation efficiency may not be the right efficiency value to use, if one assumes that domestic power production at the margin is being supplied by more efficient natural gas generators. In addition, according to the Energy Information Administration, 30 percent of U.S. power production comes from non-fossil fuel sources such as nuclear, hydroelectric, and other renewable power. U.S. Energy Information Administration, *Annual Energy Outlook 2012 Early Release Overview*, January 23, 2012, p. 2, Figure 3. These sources of power are not factored into the calculation.

[23] Thirty-four kilowatt-hours per hundred miles equals 340 watt-hours per mile. Three hundred forty watt-hours per mile divided by 12,307 watt-hours per gallon of gasoline equals 0.02763 gallons of gasoline per mile. One gallon of gasoline divided by 0.02763 gallons of gasoline/mile equals 36.2 miles per gallon.

[24] (120,000 miles/36.2 miles per gallon equivalent) - (120,000 miles/30 miles per gallon) = 685 gallons.

[25] The $96.03 and $16.44 of credit per MMBtus are not directly comparable to the values in Table 1 because neither calculation includes a comprehensive carbon footprint analysis that accounts for all of the fossil fuel energy consumed in the entire production process. In addition, Column 3 in Table 1 relies on recent data from the Energy Information Agency to assume an average thermal efficiency of about 35 percent for electricity generated using fossil fuels, while the watt-hours per gallon of gasoline factor in the vehicle calculation uses a thermal efficiency factor of 32.8, as required by regulation (see footnote 22, above).

Whichever measurement is used, there are likely more efficient ways to conserve energy. However, there may be other policy goals behind government support for electric vehicles. Since the primary fuel sources for electricity generation are domestically based, widespread use of electric vehicles would reduce reliance on foreign-source oil, given that traditional gasoline engines rely primarily on a fuel over 62 percent of which is imported from foreign suppliers.[26] However, widespread use of electric vehicles might then entail greater reliance on coal resources, thus raising concerns about greenhouse gas emissions.

Vehicles that rely on both gasoline and electric power, such as the Chevy Volt, pose an additional challenge to calculate a credit cost per displaced MMBtu of energy. The Chevy Volt is an electric-drive motor vehicle whose battery is charged either by a remote source of electricity or by an onboard gasoline generator. An evaluation of the tax credit for this vehicle would require an additional assumption about the average charging method by users of the vehicle.

Similar calculations can be made for other tax preferences that are intended to encourage conservation or displace existing energy sources with more environmentally benign energy sources. However, many such calculations are sensitive to the geographic location of the taxpayer and the qualified energy property. For example, the payoff in reduced energy consumption from additional insulation of a personal residence depends upon the climate in which the taxpayer resides and the amount of insulation initially in the residence. The tax credit available to taxpayers for additional insulation depends only upon the quantity of insulation and the price paid for the insulation, and the price of insulation does not vary widely across the nation. Therefore, the implicit price that the government is willing to pay per MMBtu conserved varies with such factors as the location of the taxpayer and pre-existing levels of insulation.

As a further example, consider the hypothetical installation of a 10-kilowatthour rated photovoltaic power system. The University of California Energy Institute estimates the installed cost of such a system at approximately $80,000.[27] If, over the assumed 25-year life of such a system, it could garner eight hours of daylight for 365 days per year, it would produce 730,000 kilowatt-hours of electricity, offsetting an equal amount of electricity produced from other sources. The present-law 30-percent tax credit for the installation of such a system would imply that the government was willing to pay $9.64[28] per MMBtu of displaced electricity. However, if in a different location the same system were only to average five hours of sunlight per day, it would produce 456,250 kilowatt-hours of electricity. As the installed cost of the system does not

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[26] U.S. Energy Information Administration, *Annual Energy Review 2010*, October 2011, p. 131, Figure 5.0.

[27] Severin Borenstein, "The Market Value and Cost of Solar Photovoltaic Electricity Production," Center for the Study of Energy Markets Working Paper 176, University of California, Berkeley, January 2008.

[28] If measured in terms of displaced fossil fuel consumption as was done in column 3 of Table 1, the comparable figure would be $3.37 per MMBtu of displaced fossil fuel consumption.

vary, in this case the present-law 30-percent tax credit for the installation of the system would imply that the government was willing to pay $15.42[29] per MMBtu of displaced electricity.

Alternative minimum tax, nonrefundability, and other constraints on tax expenditures

Another design issue that affects the efficacy of many tax credits is their restricted availability. Many tax credits have stipulated dollar limitations, are nonrefundable, or cannot be used to offset tax liability determined under the alternative minimum tax ("AMT"). If a credit designed to overcome an externality is capped, then after the cap is reached the marginal cost of further investment becomes equal to the market price again, which is presumed to be inefficient because of the externality. The impact of these limitations is to make the credit less valuable to those without sufficient tax liability to claim the full credit, for those subject to the AMT, or those who have reached any cap on the credit. Given the arguments outlined above as to the rationale for targeted tax credits, it is not economically efficient to limit their availability based on the tax status of a possible user of the credit. It can be argued that, if such social benefits exist and are best achieved through the tax system, the credit should be both refundable and available to AMT taxpayers. In some cases making the credits refundable may introduce compliance problems that would exceed the benefits from encouraging the targeted activities for the populations lacking sufficient tax liability to make use of the credit. With respect to the AMT, the rationale for the limitation is to protect the objective of the AMT, which is to insure that all taxpayers pay a minimum (determined by the AMT) amount of tax. Two differing policy goals thus come in conflict in this instance. Similarly, caps on the aggregate amount of a credit that a taxpayer may claim are presumably designed to limit the credit's use out of some sense of fairness, but again, this conflicts with the goal of pollution reduction.

Fossil fuel production incentives

The favorable tax treatment accorded fossil fuel industries generally operates by reducing the tax burden on capital employed in the sector, thus encouraging more capital to be employed in that sector of the economy. The incentives for fossil fuel production reduce the after-tax costs associated with these activities, likely increase the amount of capital employed in these activities in the long run, and potentially reduce the prices of fossil fuels.[30]

As the rationale for many of the tax incentives for renewable energy and conservation is to reduce the use of fossil fuels, many have questioned the rationale for simultaneous tax subsidies to increase fossil fuel production. The principal argument in favor of the tax incentives for fossil fuel production is that a healthy domestic fossil fuels production base serves national

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[29] If measured in terms of displaced fossil fuel consumption as was done in column 3 of Table 1, the comparable figure would be $5.39 per MMBtu of displaced fossil fuel consumption.

[30] Any price reduction is likely to be attenuated in the case of a globally traded commodity, such as oil, where the price is determined globally. In such a case, an increase in U.S. output may have a greater effect decreasing imports of foreign oil than on decreasing crude prices for domestic consumers. Similarly, a decrease in U.S. output may have a greater effect increasing imports of foreign oil than on increasing crude prices for domestic consumers.

security goals, by reducing our dependence on foreign sources of oil. However, it can be argued that minimizing such reliance would be more effectively achieved through a direct tax on imported oil or an import fee, which could encourage less consumption and promote the use of lower emission, renewable energy alternatives. Also, other observers have argued that current prices and expected future demand for fossil fuels provide sufficient market-based incentives for domestic exploration and production, and have argued that the present law subsidies are unnecessary to secure a viable domestic fossil fuels production industry.