Congressional Budget Office

Testimony

Federal Financial Support for Fuels and Energy Technologies

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Chairman Lummis, Congressman Swalwell, and Members of the Subcommittee, thank you for the invitation to testify on federal financial support for the development and production of fuels and energy technologies. My testimony updates a Congressional Budget Office report from 2012 on the same topic.[1]

Summary

The federal government has provided various types of financial support for the development and production of fuels and energy technologies in recent decades. That support—which has taken the form of tax preferences (special provisions of tax law that reduce tax liabilities for certain activities, entities, or groups of people) and spending programs administered by the Department of Energy (DOE)—totals an estimated $19.8 billion in fiscal year 2013. (Unless otherwise indicated, all years discussed in this testimony are fiscal years, and all dollars are expressed in current terms.) That amount includes $16.4 billion in tax preferences and $3.4 billion in funding for DOE.

Tax Preferences Provide Much of the Federal Support for Fuels and Energy Technologies

Tax preferences for fuels and energy technologies were first established in 1916. For most years until 2005, the largest share of the support they provided went to domestic producers of oil and natural gas. Beginning in 2006, the cost of energy-related tax preferences grew substantially, and an increasing share of those costs was aimed at encouraging energy efficiency and energy produced from renewable sources, such as wind and the sun, which generally cause less environmental damage than does producing and consuming fossil fuels. Provisions aimed at increasing energy efficiency and the use of renewable sources of energy account for 74 percent of the estimated budgetary cost of federal energy-related tax preferences in fiscal year 2013. That mix reflects changes to the tax system made by the American Taxpayer Relief Act of 2012, which extended until December 31, 2013, four major provisions aimed at increasing energy efficiency and the use of renewable sources of energy. Those four provisions account for $6.8 billion of the cost in 2013.

Under current law, the mix of energy tax preferences will look quite different in the future. Most of the support for energy efficiency and renewable energy comes from provisions that have already expired or are scheduled to expire at the end of 2013. In contrast, most of the support for fossil fuels and nuclear power comes from provisions that are permanent.

Federal Support Is Also Provided in the Form of Direct Investments, Loans, and Loan Guarantees

The Department of Energy, which was established in 1977, also supports energy technologies by making direct investments (primarily for research and development) and by providing loans or loan guarantees. That support has varied over time, but, with the exception of the substantial funding provided in the 2009 economic stimulus legislation (the American Recovery and Reinvestment Act of 2009, or ARRA), it has generally declined—from $10.6 billion (in 2013 dollars) in 1980 to $3.4 billion in both 2012 and 2013. About half of that support is directed toward energy efficiency and renewable energy in 2013.

DOE received roughly $10 billion in funding for its subsidized credit programs in 2009 but has received only limited additional subsidy funding for those programs since then: $170 million in 2011 and no new subsidy funding in 2010, 2012, or 2013. Between 2009 and 2012, DOE provided an estimated $4 billion in subsidies for about $25 billion in loans and loan guarantees, primarily to generators of solar power, manufacturers of solar equipment, and producers of advanced vehicles.

The Government's Involvement in Energy Markets Can Sometimes Lead to a More Efficient Use of Resources

Without government intervention, households and businesses do not have a financial incentive to take into account the environmental damage or other costs to the nation associated with their choices about energy production and consumption. The most direct and cost-effective method for addressing that problem would be to levy a tax on energy sources that reflects the environmental costs associated with their production and use. Subsidies (such as tax preferences) for favored technologies can accomplish some of the same goals but in a less cost-effective way.

Also, unless the government intervenes, the amount of research and development (R&D) that the private sector undertakes is likely to be inefficiently low from society's perspective because firms cannot easily capture the "spillover benefits" that result from it, particularly in the early stages of developing a technology. Such research can create fundamental knowledge that can lead to significant

1. See Congressional Budget Office, *Federal Financial Support for the Development and Production of Fuels and Energy Technologies* (March 2012), www.cbo.gov/publication/43032.

benefits for society as a whole but not necessarily for the firms that paid for that research; thus government funding can be beneficial. By contrast, DOE's funding of energy technology demonstration projects at later stages in the development process has been far less cost-effective. Moreover, the Government Accountability Office, among others, has criticized DOE's management of such projects.

Tax Preferences

The federal government supports the production and use of fossil fuels, nuclear power, and renewable energy and encourages increased energy efficiency through provisions of law that reduce the amount of taxes paid by producers and consumers of energy from those fuels or technologies. Those tax preferences include special deductions, special tax rates, tax credits, and grants in lieu of tax credits. In 2013, the combined cost of reduced revenues and increased outlays from those tax preferences amounts to an estimated $16.4 billion according to the staff of the Joint Committee on Taxation. (See Table 1 on page 4, which reports preferences that are estimated to cost at least $50 million.)

The $16.4 billion does not include all tax provisions that benefit producers or consumers of fossil fuels, nuclear power, renewable energy, and energy efficiency. It excludes tax provisions that benefit the energy industry generally (such as the preference that allows firms to defer taxes on the gains from sales of electric transmission assets as a means of accelerating the restructuring of the electric transmission system) rather than target a particular fuel or energy-generating technology. Tax preferences designed to promote new fuels and energy technologies account for a small percentage of the cost of all federal tax preferences, which total hundreds of billions of dollars per year.[2]

Historical Trends

From 1916 to the 1970s, federal energy-related tax policy focused almost exclusively on increasing the production of domestic oil and natural gas; there were no tax incentives for promoting renewable energy or increasing energy efficiency.[3] In the 1970s, lawmakers began adding tax preferences for new sources of fossil fuel, alternatives to fossil fuel, and energy efficiency. Disruptions in the supply of oil in the 1970s heightened interest in encouraging the production of alternative transportation fuels, such as ethanol and "unconventional fuels" (for example, oil produced from shale and tar sands, or synthetic fuel produced from coal). Furthermore, growing awareness of environmental damage caused by producing energy from fossil fuels—such as the harmful effects of the carbon dioxide (CO_2) emissions from burning those fuels—led to tax preferences for improvements in energy efficiency and for the production of electricity from renewable sources.

Nevertheless, tax preferences for fossil fuels continued to make up the bulk of all energy-related tax incentives through the mid-2000s, accounting for more than two-thirds of the total cost in most years. The Energy Policy Act of 2005 changed the focus of energy-related tax policy—adding a number of provisions aimed at increasing energy efficiency and the use of alternative motor vehicles, such as fuel-cell and hybrid vehicles—and substantially increased the number of energy-related tax preferences and their total cost. By 2008, fossil fuels accounted for only 33 percent of the total cost of energy-related tax incentives. The Emergency Economic Stabilization Act of 2008 expanded and extended provisions related to energy efficiency and renewable energy. ARRA further expanded tax preferences for energy efficiency, renewable energy, and alternative vehicles. In addition, it created the Section 1603 grant program, which allowed producers of renewable energy to collect one-time cash payments in lieu of tax credits for current investment or future production.[4]

The value of tax preferences related to energy and the composition of that financial support have changed over

2. For a recent estimate of such costs, see Joint Committee on Taxation, *Estimates of Federal Tax Expenditures for Fiscal Years 2012–2017*, JCS-1-13 (February 1, 2013), www.jct.gov/publications.html?func=startdown&id=4503.

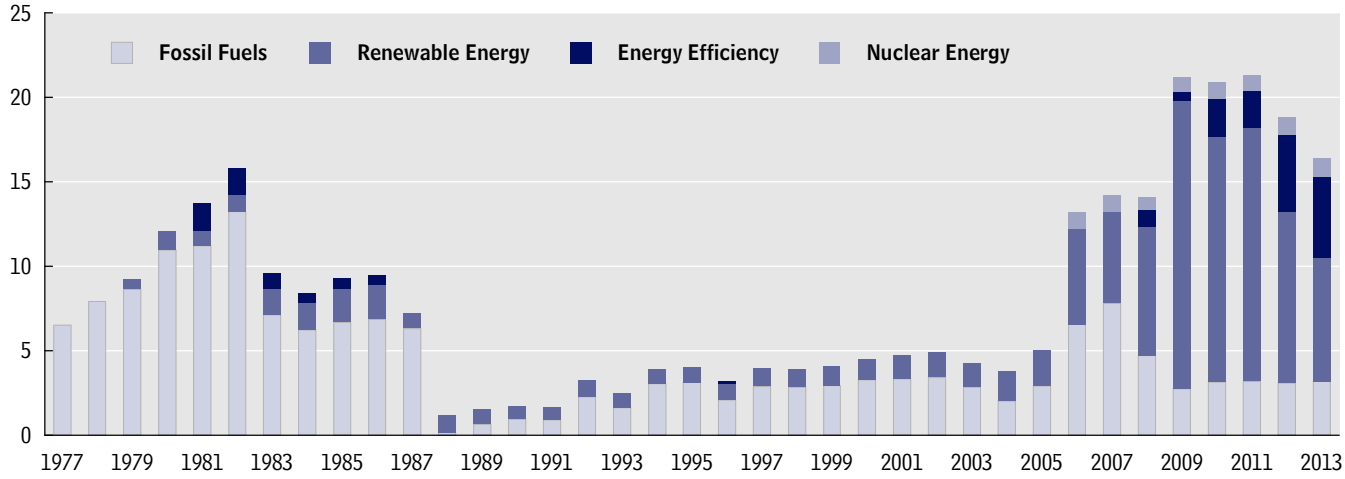
3. This discussion of historical trends draws largely from Molly F. Sherlock, *Energy Tax Policy: Historical Perspectives on and Current Status of Energy Tax Expenditures*, Report for Congress R41227 (Congressional Research Service, May 2, 2011).

4. Before Section 1603 grants were available, qualifying renewable-energy projects were federally supported primarily through production or investment tax credits. The Section 1603 grant program allowed companies to receive up-front cash grants in lieu of those tax credits, which, in many cases, the companies would be able to use only in future years in which they had sufficient tax liability.

Figure 1.

Cost of Energy-Related Tax Preferences, by Type of Fuel or Technology

(Billions of 2013 dollars)



Source: Congressional Budget Office based on data from Molly F. Sherlock, *Energy Tax Policy: Historical Perspectives on and Current Status of Energy Tax Expenditures*, Report for Congress R41227 (Congressional Research Service, May 2, 2011), p. 26; Joint Committee on Taxation, *Estimates of Federal Tax Expenditures for Fiscal Years 2012–2017*, JCS-1-13 (February 1, 2013), pp. 33–35, www.jct.gov/publications.html?func=startdown&id=4503; and the Office of Management and Budget.

Note: The estimates of costs resulting from individual tax preferences do not account for any potential interactions between preferences and do not include tax provisions estimated to cost less than $50 million. Nor do they reflect the budgetary effects of eliminating those preferences and of taxpayers' adjusting their activities in response to those changes.

time. Those changes stem from a combination of factors, including changes in the number of energy-related tax preferences; changes in the prices of oil and natural gas, which affect investment in those industries; and increases or decreases in overall tax rates, which make some existing tax preferences more or less valuable. In some cases, an existing tax credit was applied for a new purpose. For example, an income tax credit for alternative fuel mixtures was initially intended as an incentive for firms to produce liquid motor fuels from biomass (organic materials used to produce energy). In 2009, however, pulp and paper producers claimed the credit for blending "black liquor"—a by-product of the pulping process that is used to make paper—with liquid petroleum-based fuels to power their paper-making operations. That use greatly expanded the cost of the credit, which was allowed to expire at the end of 2009. The Internal Revenue Service subsequently ruled that black liquor would qualify for a different credit—the cellulosic biofuel producer tax credit; however, lawmakers later amended the law to prevent that unintended use.

Measured in 2013 dollars, the cost of energy-related tax preferences more than doubled between 1977 and 1982 and then fell dramatically between 1982 and 1988, in part because of declines in tax rates and fuel prices (see Figure 1). The cost of energy-related tax preferences grew gradually between 1988 and 2005 and averaged about $5 billion a year (in 2013 dollars) from 2000 to 2005. Tax support has grown substantially since 2005, driven, in part, by new provisions in the Energy Tax Policy Act of 2005. The cost of tax preferences reached their peak from 2009 through 2011, exceeding $20 billion in each of those years, and has declined in both 2012 and 2013. That decline is due, in part, to the expiration of certain provisions, such as an excise tax credit for alcohol fuel (which expired on December 31, 2011).

Financial Support in 2013

The tax preferences that explicitly target energy use and production take three forms: preferences in the income tax system, such as special deductions, special tax rates, and credits; an excise tax credit; and Section 1603 grants (in lieu of future tax credits). In 2013, those preferences are estimated to provide financial support as follows:

Table 1.

Energy-Related Tax Preferences in Fiscal Year 2013

Primary Target of Support	Tax Preference	Total Cost in 2013 (Billions of dollars)	Expiration Date
	Energy-Related Tax Preferences Affecting Income Taxes		
Energy Efficiency	Credit for energy-efficiency improvements to existing homes	3.0	12/31/2013
	Residential efficiency property credit	0.9	12/31/2016
	Credit for plug-in electric vehicles	0.4	Expires for each manufacturer when the number of vehicles it sells reaches the limit set by the government
	Credit for the production of energy-efficient appliances	0.2	12/31/2013
	Deduction for expenditures on energy-efficient commercial building property	0.2	12/31/2013
	Ten-year depreciation for smart meters or other devices for monitoring and managing electrical distribution	0.1	None
Renewable Energy	Credits for the production of electricity from renewable resources[a]	1.7	12/31/2013
	Credit for investment in advanced-energy property, including property used in producing energy from wind, the sun, or geothermal sources	0.3	Fixed dollar amount of credits; available until used
	Credit for investments in solar and geothermal equipment, fuel cells, and microturbines	0.5	12/31/2016
	Five-year depreciation for certain renewable energy equipment	0.3	None
Fossil Fuels	Option to expense depletion costs on the basis of gross income rather than actual costs	1.1	None
	Expensing of exploration and development costs for oil and natural gas	0.9	None
	Amortization of air pollution control facilities	0.4	None
	Option to expense 50 percent of qualified property used to refine liquid fuels	0.4	12/31/2013
	Credit for investment in clean-coal facilities	0.2	Fixed dollar amount of credits; available until used
	Fifteen-year depreciation for natural gas pipelines	0.1	12/31/2010[b]
	Amortization of certain expenditures associated with oil and gas exploration	0.1	None

Continued

Table 1. **Continued**

Energy-Related Tax Preferences in Fiscal Year 2013

Primary Target of Support	Tax Preference	Total Cost in 2013 (Billions of dollars)	Expiration Date
	Energy-Related Tax Preferences Affecting Income Taxes (Continued)		
Nuclear Energy	Special tax rate for nuclear decommissioning reserve funds	1.1	None
	Subtotal, Tax Preferences Affecting Income Taxes	11.9	n.a.
	Energy-Related Tax Preferences Affecting Excise Taxes[c]		
Renewable Energy	Excise tax credit for biodiesel	1.9	12/31/2013
	Grants in Lieu of Tax Credits[d]		
Renewable Energy	Section 1603 grants	2.6[e]	12/31/2011
	All Energy-Related Tax Preferences		
	Total	**16.4**	**n.a.**

Sources: Congressional Budget Office based on data from Joint Committee on Taxation, *Estimates of Federal Tax Expenditures for Fiscal Years 2012–2017*, JCS-1-13 (February 1, 2013), pp. 33-35, www.jct.gov/publications.html?func=startdown&id=4503, and *List of Expiring Federal Tax Provisions 2013–2023*, JCX-3-13 (January 11, 2013), www.jct.gov/publications.html?func=startdown&id=4499; and Office of Management and Budget, *Budget of the U.S. Government, Fiscal Year 2013: Appendix* (February 2012), p. 1068, www.whitehouse.gov/omb/budget/Appendix/.

Notes: The estimates of costs resulting from individual tax preferences do not account for any potential interactions between preferences and do not include tax provisions estimated to cost less than $50 million. Nor do they reflect the budgetary effects of eliminating those preferences and of taxpayers' adjusting their activities in response to those changes.

n.a. = not applicable.

a. The production tax credit is generally available for 10 years beginning on the date that a facility is put in service. The American Taxpayer Relief Act of 2012 defined eligible facilities as those whose construction began before January 1, 2014.

b. Effects of depreciation extend beyond the expiration date.

c. The Joint Committee on Taxation and the Administration generally do not estimate tax expenditures in the excise tax system. They do, however, provide information on revenue reductions from excise tax credits for alcohol and biodiesel.

d. Companies that began constructing a facility and applied for the grant before December 31, 2011, are eligible; because grants are paid when facilities are placed in service, they are still being disbursed.

e. The Office of Management and Budget has determined that the Section 1603 grants are subject to sequestration. CBO applied the sequestration percentages published by OMB for nondefense mandatory programs (5.1 percent) to the estimated 2013 spending on those grants.

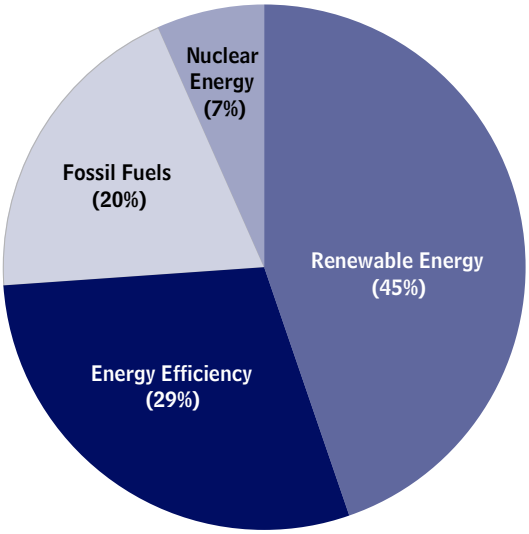
- $11.9 billion for energy-related preferences in the income tax system.[5]
  - The two most costly preferences are the credit for energy-efficiency improvements to existing homes ($3.0 billion) and the credits for electricity production from renewable resources ($1.7 billion—$1.4 billion for wind and $0.3 billion for biomass).
  - Energy efficiency accounts for the largest share of support offered through the income tax system ($4.8 billion), followed by fossil fuels ($3.2 billion).
- $1.9 billion for an excise tax credit for biodiesel.[6]

5. Joint Committee on Taxation, *Estimates of Federal Tax Expenditures for Fiscal Years 2012–2017*, JCS-1-13 (February 1, 2013), www.jct.gov/publications.html?func=startdown&id=4503.

6. Estimates provided by staff of the Joint Committee on Taxation. For a discussion of the effects of biofuel tax credits, see Congressional Budget Office, *Using Biofuel Tax Credits to Achieve Energy and Environmental Policy Goals* (July 2010), www.cbo.gov/publication/21444.

Figure 2.

Allocation of Energy-Related Tax Preferences in Fiscal Year 2013, by Type of Fuel or Technology



Sources: Congressional Budget Office based on data from the Joint Committee on Taxation, *Estimates of Federal Tax Expenditures for Fiscal Years 2012–2017*, JCS-1-13 (February 1, 2013), pp. 33–35, www.jct.gov/publications.html?func=startdown&id=4503; and the Office of Management and Budget.

Note: This figure encompasses all of the tax preferences listed in Table 1.

- $2.6 billion for grants under the Section 1603 program.[7] Those grants are primarily used by producers of wind-generated electricity.

In 2013, an estimated total of $7.3 billion, or 45 percent of the energy-related tax preferences, is directed toward renewable energy, and $4.8 billion, or 29 percent, is directed toward energy efficiency (see Figure 2).[8]

Expiration Dates for Provisions

Many of the tax provisions that target energy efficiency and renewable energy have expired or were extended through 2013 by the American Taxpayer Relief Act. Most of the support for energy efficiency and renewable energy in 2013 comes from provisions that are temporary. In contrast, most of the support for fossil fuels and nuclear energy comes from provisions that are permanent.

Provisions That Have Expired. The Section 1603 grant provisions expired on December 31, 2011—the last date on which projects could become eligible for the benefit. Facilities that were under construction as of that date qualify for the option to take the cash grant in lieu of tax credits, but the grants will be provided when the facility is put into service. Thus, some grants will be disbursed in 2013 or later.

The provision that allowed accelerated deprecation for natural gas pipelines expired on December 31, 2010. However, the effects of the preference extend beyond the expiration date.

Provisions That Have Been Extended. The American Taxpayer Relief Act extended the expiration date of four major tax credits related to fuels and energy technologies to December 31, 2013, and allowed the credits that expired on December 31, 2011, to be claimed retroactively. Specifically, the act extended the following major preferences:

- The credit for energy-efficiency improvements to existing homes,
- The credit for the production of energy-efficient appliances,
- The credits for the production of electricity from renewable resources, and
- The excise tax credit for biodiesel.

The act also changed the criteria used to determine eligibility for the tax credit for producers of electricity from renewable resources. Under the previous rules, producers would be eligible only if they had begun producing

7. The Office of Management and Budget (OMB) has determined that the Section 1603 grants are subject to sequestration. CBO applied the sequestration percentages published by OMB for nondefense mandatory programs (5.1 percent) to the estimated 2013 spending on those grants. For further discussion of the sequestration, see the section on "Financial Support for Energy Technologies in 2013" on page 7.

8. For a more detailed discussion of energy-related tax preferences, see Joint Committee on Taxation, *Present Law and Analysis of Energy-Related Tax Expenditures and Description of the Revenue Provisions Contained in H.R. 1380, the New Alternative Transportation to Give Americans Solutions Act of 2011*, JCX-47-11 (September 20, 2011), www.jct.gov/publications.html?func=startdown&id=4360.

electricity before the expiration date. The act redefined those criteria, making producers eligible for the credit as long as they began constructing the electricity-producing facility before the expiration date—that is, before January 1, 2014. The total estimated cost of the four tax preferences in 2013 is $6.8 billion.

Department of Energy Programs

In fiscal year 2013, DOE's funding (or budget authority) for fossil-fuel R&D, electrical energy, nuclear energy, energy efficiency, and renewable energy (all of which are referred to in this analysis as fuels and energy technologies) totals $3.4 billion.[9] Federal agencies are currently operating under a continuing resolution that generally provides funding at or near the same levels as in fiscal year 2012. (The continuing resolution expires on March 27, 2013.) The funding estimates for fiscal year 2013 presented in this testimony represent annualized versions of the budget authority provided by the continuing resolution, reduced to reflect the results of sequestration (that is, the across-the-board cuts mandated by the Budget Control Act of 2011) and specified in the sequestration report issued on March 1, 2013, by the Office of Management and Budget (OMB).

Virtually all of the relevant DOE funding is for direct investments by DOE rather than for making loans or loan guarantees. The $3.4 billion accounts for less than 20 percent of DOE's 2013 appropriations; much of that agency's funding is for maintaining the U.S. nuclear weapons stockpile and the environmental cleanup of old nuclear facilities. Other agencies also spend money in ways that affect the demand for and supply of energy. This testimony focuses only on DOE's expenditures that promote the development of specific fuels or energy technologies.[10]

9. Budget authority is the authority provided by law to incur financial obligations that will result in outlays of government funds.

10. Those amounts do not include, and this testimony does not address, the cost of energy-related activities of other agencies, such as leasing and resource-management programs of the Department of the Interior and programs supporting rural electricity production and transmission operated by the Department of Agriculture. This testimony also does not address the government's role in the production of electricity through such entities as the Tennessee Valley Authority and the Bonneville Power Administration.

Historical Trends

The Department of Energy was established in the late 1970s in response to a dramatic increase in oil prices. Throughout most of its history, DOE has supported energy technologies primarily by funding R&D and demonstration projects. DOE's initial funding for energy technologies was aimed at creating new domestic sources of energy. Budget authority for DOE's technology programs has varied significantly over the past three decades. In 1980, such programs received appropriations totaling about $10.6 billion (measured in 2013 dollars; see Figure 3). After 1980, however, the federal government's interest in funding the development of new energy sources waned. By 2000, appropriations for DOE's energy technology programs had fallen to about $2.2 billion (in 2013 dollars). DOE's funding for that purpose began to rise again in the 2000s, driven at least in part by concern about CO_2 emissions from the generation of electricity.

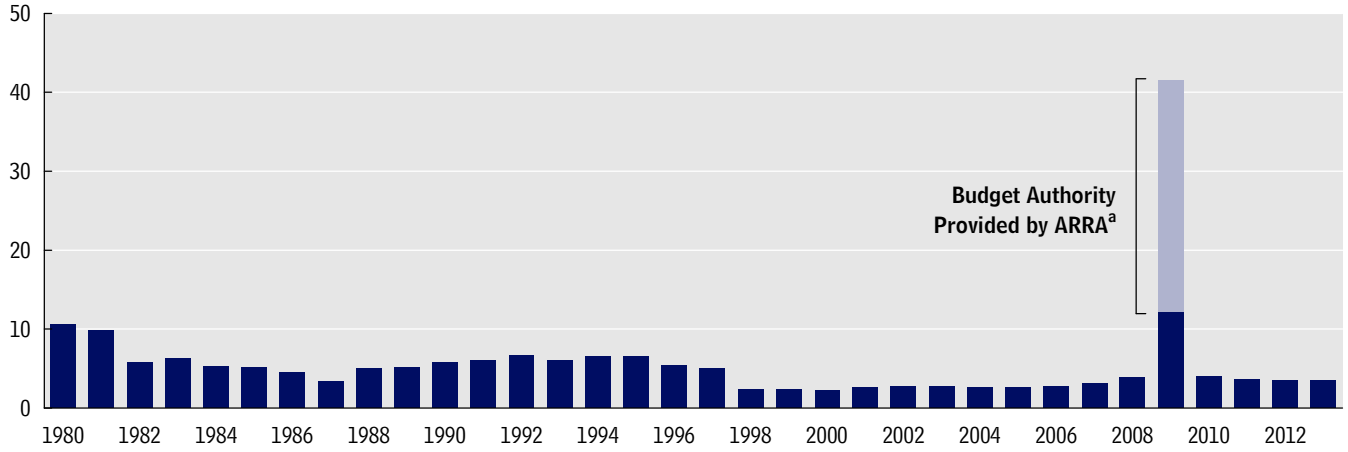
In 2009, DOE received $39 billion (in current dollars) for support of energy technologies (after accounting for rescissions and transfers)—roughly 17 times the average annual appropriation for the preceding decade. That funding comprised $27.6 billion in budget authority provided under ARRA and $11.4 billion in regular appropriations. Forty percent of the ARRA funding was for weatherization and for implementing other energy conservation measures, a much higher percentage than in most annual appropriations for DOE. Through loan guarantees or grants, ARRA also funded the manufacture of advanced batteries and other innovative energy technologies. The regular 2009 appropriation included $7.5 billion for the subsidy cost of loans for manufacturing advanced-technology vehicles. The credit subsidies are intended to be leveraged into loans with much larger face values.

Although ARRA funds have generally been spent more rapidly than funds that DOE has received through the normal appropriation process, roughly $5 billion of ARRA funding for the fuels and energy technology programs remains unspent. In particular, as of mid-February 2013, less than $1 billion of the $3.4 billion appropriated by ARRA for fossil-fuel programs had been spent. Several of the demonstration projects in the fossil-fuel program (mainly projects that would capture and sequester CO_2 emissions from coal-fired electricity generators) have been canceled by the private partners. What will happen

Figure 3.

DOE's Financial Support for Energy Technologies and Energy Efficiency

(Budget authority, in billions of 2013 dollars)



Source: Congressional Budget Office based on data from the Department of Energy, Office of the Chief Financial Officer, and the Office of Management and Budget.

Notes: As of the date of this testimony (March 13, 2013), no full-year regular appropriation bills have been enacted for fiscal year 2013. Instead, all agencies are operating under a continuing resolution that expires on March 27, 2013. The estimate of budget authority reflects the assumption that accounts are funded at the annualized level provided by the continuing resolution, as reduced by the across-the-board cuts mandated by the Budget Control Act of 2011.

DOE = Department of Energy.

a. Funding provided by the American Recovery and Reinvestment Act of 2009 (ARRA) reflects transfers and rescissions of budget authority for Section 1705 loan guarantees made after ARRA was enacted.

to the funds that had been allocated for those projects is unclear.

Financial Support for Energy Technologies in 2013

The $3.4 billion available to the Department of Energy in fiscal year 2013 for the development and production of fuels and energy technologies has two components: direct investments, which received $3.4 billion, and credit programs, which received $42 million (see Table 2 for the direct investments; the credit amounts are not listed in that table because they are less than $50 million).

The funding indicated in Table 2 reflects the results of the sequestration mandated by the Budget Control Act. As detailed by OMB, the sequestration reduced DOE's funding for fuels and energy technology programs by $181 million in 2013. The sequestration resulted in a 5 percent reduction in budget authority for most of the programs listed in Table 2.[11]

Direct Investments. Most of DOE's direct investments in support of specific energy technologies are currently divided into four general areas: energy efficiency and renewable energy, nuclear energy, fossil-fuel R&D, and electricity delivery and energy reliability. In addition, funding was provided for the Advanced Research Projects Agency-Energy, which funds high-risk research that has the potential for a high payoff for any of the four areas. The $3.4 billion for direct investments is allocated as follows (see Figure 4):

- 51 percent for energy efficiency and renewable energy, divided roughly equally between energy-efficiency programs (which focus on improving the efficiency of buildings and automobiles and provide grants for weatherization and conservation) and renewable-energy programs (which emphasize the development of solar, biomass, wind, and other such energy sources);

11. Part of the spending for the electricity delivery and energy reliability programs is classified as defense discretionary spending and so is subject to a 7.8 percent sequestration reduction. OMB reports that the amount sequestered in that program is less than $500,000.

Table 2.

DOE's Financial Support for Energy Technologies and Energy Efficiency in Fiscal Year 2013

	Budget Authority (Billions of dollars)
Direct Investments	
Energy efficiency and renewable energy	1.7
Nuclear energy	0.7
Fossil-energy research and development	0.5
Advanced Research Projects Agency—Energy	0.3
Electricity delivery and energy reliability	0.1
Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Research Fund	*
Subtotal	3.4
Credit Programs	
Advanced Technology Vehicles Manufacturing Loan Program Account	*
Title 17 Innovative Technology Loan Guarantee Program	*
Total	**3.4**

Sources: Congressional Budget Office based on data from Office of Management and Budget, *OMB Report to the Congress on the Joint Committee Sequestration for Fiscal Year 2013* (March 1, 2013), www.whitehouse.gov/sites/default/files/omb/assets/legislative_reports/fy13ombjcsequestrationreport.pdf (1 MB).

Notes: As of the date of this testimony (March 13, 2013), no full-year regular appropriation bills have been enacted for fiscal year 2013. Instead, all agencies are operating under a continuing resolution that expires on March 27, 2013. The estimates of budget authority reflect the assumption that accounts are funded at the annualized level provided by the continuing resolution, as reduced by the across-the-board cuts mandated by the Budget Control Act of 2011.

DOE = Department of Energy; * = between zero and $50 million.

- 22 percent for nuclear energy programs (which focus on making reactors safer and cheaper), developing a sustainable nuclear fuel cycle, and maintaining federal nuclear energy research facilities;
- 15 percent for fossil-fuel R&D programs, primarily for reducing emissions, particularly of CO_2, from coal-fired electricity generation;
- 8 percent for the Advanced Research Projects Agency—Energy; and
- 4 percent for electricity delivery and energy reliability programs (which support improvements in the electricity grid that increase energy efficiency).

Credit Programs. DOE directs resources to promote the deployment of new energy technologies by providing loans and loan guarantees to private firms that bring them to market. In recent years, DOE has extended credit through three major programs:

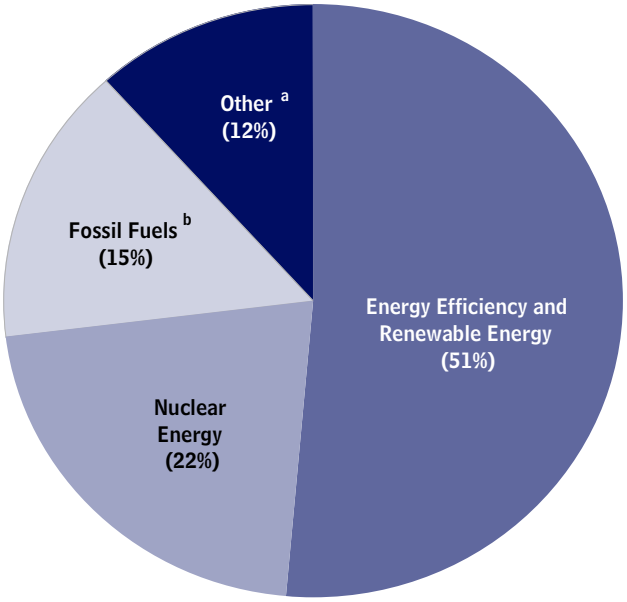
- The Advanced Technology Vehicle Manufacturing (ATVM) program—a permanent loan program that aims to improve the energy efficiency of automobiles;
- The Section 1705 program—a temporary loan guarantee program that supports loans for some renewable-energy systems, electric power transmission, and innovative biofuel projects; and
- The Section 1703 program—a permanent loan guarantee program that aims to increase investment in nuclear facilities or other innovative clean-energy facilities.[12]

DOE's credit programs operate under the rules established by the Federal Credit Reform Act of 1990 for calculating the budgetary cost of direct loans and loan

12. Together, the Section 1705 and Section 1703 programs are commonly referred to as the Title 17 program.

Figure 4.

Allocation of DOE's Direct Investments in Energy Technologies and Energy Efficiency, Fiscal Year 2013



Sources: Congressional Budget Office based on data from the Office of Management and Budget, *OMB Report to the Congress on the Joint Committee Sequestration for Fiscal Year 2013* (March 1, 2013), www.whitehouse.gov/sites/default/files/omb/assets/legislative_reports/fy13ombjcsequestrationreport.pdf (1 MB).

Notes: As of the date of this testimony (March 13, 2013), no full-year regular appropriation bills have been enacted for fiscal year 2013. Instead, all agencies are operating under a continuing resolution that expires on March 27, 2013. The estimates of budget authority reflect the assumption that accounts are funded at the annualized level provided by the continuing resolution, as reduced by the across-the-board cuts mandated by the Budget Control Act of 2011.

DOE = Department of Energy.

a. Includes electricity delivery and energy reliability and the Advanced Research Projects Agency—Energy.

b. Includes fossil-energy research and development and the Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Research Fund.

guarantees issued by the federal government.[13] In general, before DOE (or any agency) can make loans or loan guarantees, lawmakers must provide funding sufficient to cover the government's cost of the loan, referred to as the subsidy cost. Funding for subsidy costs may be derived from an appropriation from the U.S. Treasury, and those costs can be reduced by fees paid by borrowers. Lawmakers control the amount of federal credit assistance either by appropriating the amount needed for the subsidies or, in cases in which gross subsidy costs are covered by fees, by setting limits on the volume of loans or loan guarantees.

The subsidy costs for DOE's loans and loan guarantees are the estimated lifetime costs of the credit assistance, which include losses from defaults—such as the loss that will result from the loan guarantee DOE provided for Solyndra, a manufacturer of photovoltaic systems that declared bankruptcy in 2011—net of any recoveries on the loan. Estimates of the risks of default, and the consequent budgetary costs, change as government agencies gain more experience with each loan or loan guarantee. As a result, the estimated subsidy cost of federal loans and loan guarantees is frequently revised over the life of a credit program. (Under the Federal Credit Reform Act, such revisions are determined by agencies and recorded in the budget as "credit reestimates" on an annual basis.)

Lawmakers initially provided subsidy funding for the ATVM program and for Section 1705 loan guarantees (primarily for renewable energy) but not for Section 1703 loan guarantees (primarily for nuclear power). In total, the ATVM program and the Section 1705 loan guarantees have received $10 billion in budget authority for subsidies (after accounting for rescissions and transfers). Most of the guarantees authorized under Section 1703 are intended to be self-supporting, with recipients paying a fee designed to cover the government's cost of providing the guarantee; however, DOE's 2011 appropriation included $170 million in subsidies for some of those loan guarantees. None of the credit programs received a subsidy appropriation for 2013, but DOE received $42 million for administrative expenses.

The estimated subsidy cost of the ATVM program and Section 1705 loan guarantees for fiscal years 2009 to 2012 totaled $4.0 billion on about $25 billion in loans

13. Estimates prepared pursuant to the Federal Credit Reform Act do not, however, provide a comprehensive measure of what federal credit programs actually cost the government. See Congressional Budget Office, *Fair-Value Accounting for Federal Credit Programs* (March 2012), www.cbo.gov/publication/43027.

and loan guarantees. DOE made loans totaling $9.1 billion to six manufacturers of advanced-technology vehicles, with an estimated subsidy cost of $1.6 billion.[14] Guarantee authority for the Section 1705 program expired on September 30, 2011, at which point DOE had made commitments for $15.6 billion in loan guarantees, with an estimated subsidy cost of $2.4 billion. Eighty percent of those loan guarantees went either to generators of solar power or to manufacturers of solar equipment. As of the end of 2012, DOE had not finalized any Section 1703 loan guarantees, although it is authorized to guarantee debt totaling $34 billion under that program (provided that recipients pay a fee covering the projected subsidy cost of those loans).

Cost-Effectiveness of Government Actions

The federal government's intervention in energy markets can be beneficial if it leads to a more efficient use of resources than would occur in a purely private market. It is most likely to be beneficial in cases in which private choices about the production or use of energy create external costs or spillover benefits—costs or benefits that are experienced by society as a whole rather than falling on firms or households in proportion to their production and consumption.[15]

Reducing External Costs Through the Tax System

Environmental costs are examples of external costs. The production and consumption of energy causes environmental damage that is not borne directly by households and firms in proportion to their production or use of energy. For example, coal combustion emits carbon dioxide as well as sulfur dioxide, which causes damage to downwind lakes and contains particulates that increase the incidence of asthma. Similarly, gasoline combustion releases CO_2 and smog-causing emissions that increase the incidence of respiratory-related illnesses and death. Without government intervention, environmental costs are not reflected in the prices charged for various fuels and energy services, so firms and households lack an incentive to take them into account when deciding what types and quantity of energy to produce and consume.

Some policymakers and analysts view the United States' dependence on oil as another source of external costs. Because many sectors of the U.S. economy—especially transportation—use oil, the United States is economically vulnerable to a disruption in the supply of oil. Reducing exposure to that disruption would require a large decrease in the total amount of oil consumed in the United States. To the extent that such vulnerability exists and does not affect consumers in direct proportion to their oil consumption, households and businesses will tend to use more oil than would be best from a societal perspective.

The most cost-effective way to reduce the external costs associated with energy would be to enact policies, such as taxes, that would increase the prices of various types of energy to reflect the external costs that their production and use entail. That approach would provide a financial incentive for businesses and households to consider those external costs when deciding on the types and amounts of energy to use.

In the absence of such price increases, the government could directly subsidize the investment in (or use of) technologies that lead to lower external costs, such as improvements in energy efficiency or the use of renewable energy. Subsidies, such as tax preferences or direct payments, are typically less cost-effective than incorporating external costs into energy prices, for at least three reasons:

- They may cause the government to pay firms or households to make choices about investment, production, or consumption that they would have made anyway in the absence of the subsidies;
- They typically support particular technologies, which may not be the least expensive method of reducing external costs; and

14. The ATVM program initially obligated $3.5 billion of its $7.5 billion in subsidy funds; DOE has since revised the estimated subsidy costs for those loans downward by $1.9 billion. In the case of the Section 1705 loan guarantees, DOE initially estimated that the subsidy costs would total $1.9 billion but has since raised that estimate by $0.5 billion.

15. For a more comprehensive discussion of those two types of market failures, see Congressional Budget Office, *Evaluating the Role of Prices and R&D in Reducing Carbon Dioxide Emissions* (September 2006), www.cbo.gov/publication/18131.

- They increase government expenditures or reduce revenues, which adds to the deficit or requires that the government pay for those subsidies by reducing other spending or by increasing other taxes, possibly those that discourage the productive use of labor and capital. (For example, taxes on labor income tend to reduce the amount of time that individuals choose to work.)[16]

Many of the tax preferences are directed toward technologies that have the potential to reduce the external costs of energy production and use. Of the cost of those preferences, 74 percent is for energy efficiency or renewable energy: Energy efficiency lowers external costs by reducing the total consumption of energy; renewable energy can reduce external costs because, in most cases, it produces lower emissions than do fossil-fuel alternatives.[17] Historically, however, tax preferences have been targeted toward encouraging, not discouraging, the use of fossil fuels, particularly oil. Under current law, most of the tax preferences for energy efficiency and renewable energy will expire, but most preferences for fossil fuels are permanent.

Increasing Spillover Benefits Through Support for R&D

Knowledge created by investments in R&D—for energy technologies as well as for many other types of technologies—may yield spillover benefits for society that do not translate into profits for the innovating firm. Legal arrangements, such as patents, help innovators capture some of the benefits that result from innovation (although they also tend to reduce the total benefits from those same innovations by limiting their spread). Spillover benefits are typically largest from basic research, which can create general scientific knowledge that cannot be subject to patents, and diminish as technologies approach commercial production. Although the inability of innovators to fully capture the benefits of their work is not a circumstance unique to energy R&D, that inability leads to an inefficiently low level of R&D on technologies that might reduce pollution or the consumption of oil.

A large share of DOE's spending on energy technologies has been directed toward R&D. One comprehensive review of research indicates that government funding of energy R&D has yielded benefits greater than its costs in many cases.[18] Different types of energy R&D have produced very different returns. In general, funding aimed at the early stages of developing a technology, such as basic research, has been more likely to yield benefits in excess of costs than has funding for demonstration projects.[19] Moreover, DOE's handling of demonstration projects has long been criticized by the Government Accountability Office and others because of inadequacies in DOE's project management.[20]

One review of the literature on DOE's efforts to develop renewable energy sources concluded that a large proportion of government-sponsored R&D focused on those sources—wind and solar thermal energy, for example—has been technically successful.[21] However, such sources constitute just a small share of today's market, in part because the prices of conventional sources of energy do not reflect the external costs of their production and consumption. That review also concluded that the forecasts of cost reduction for those sources of energy were generally achieved but that the forecasts of market

16. Taxes that reflect external costs can also indirectly reduce incentives to work and invest by lowering inflation-adjusted returns on labor and capital (if prices rise and wages and returns on capital do not). That indirect effect, referred to as the tax interaction effect, can be at least partially offset by using the revenue generated by the tax that reflects external costs to reduce taxes that discourage the use of labor and capital.

17. For a more detailed discussion of whether renewable fuels, such as ethanol, might lead to decreases in greenhouse gas emissions, see Congressional Budget Office, *The Impact of Ethanol Use on Food Prices and Greenhouse-Gas Emissions* (April 2009), www.cbo.gov/publication/41173.

18. National Research Council, *Energy Research at DOE: Was It Worth It? Energy Efficiency and Fossil Energy Research 1978 to 2000* (National Academy Press, 2001), www.nap.edu/openbook.php?isbn=0309074487.

19. For a more comprehensive discussion, see Congressional Budget Office, *Federal Climate Change Programs: Funding History and Policy Issues* (March 2010), www.cbo.gov/publication/21196.

20. See, for example, Government Accountability Office, *Department of Energy: Consistent Application of Requirements Needed to Improve Project Management*, GAO-07-518 (May 2007), www.gao.gov/products/GAO-07-518.

21. See James McVeigh and others, *Winner, Loser, or Innocent Victim? Has Renewable Energy Performed as Expected?* Discussion Paper 99-28 (Resources for the Future, 1999), www.rff.org/Publications/Pages/PublicationDetails.aspx?PublicationID=17068.

penetration and sales were generally overstated. The authors of the study also concluded that one of the major factors contributing to the lack of commercial success of the renewable-energy technologies was the decline in the inflation-adjusted price of oil during the forecast period. Other factors included changes in the structure of the markets for electricity generation and changes in the regulation of railroads that decreased the delivered price of coal. In sum, although the price of renewable energy fell, so did the price of fossil energy. Because consumers did not pay for the external costs of their consumption of fossil fuels, those energy sources retained a commercial advantage.

About This Document

This testimony updates *Federal Financial Support for the Development and Production of Fuels and Energy Technologies*, a report written by Philip Webre and Terry Dinan that the Congressional Budget Office (CBO) released in March 2012. In keeping with CBO's mandate to provide objective, impartial analysis, this testimony contains no recommendations.

Mark Booth, Megan Carroll, Kathleen Gramp, and Logan Timmerhoff of CBO contributed significantly to the analysis on which this testimony is based, and Vi Nguyen fact-checked it. Joseph Kile and Chad Shirley supervised that work. Useful comments were provided by Christopher Overend of the Joint Committee on Taxation. The assistance of an external reviewer implies no responsibility for the final product, which rests solely with CBO.

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