



# Renewable Energy R&D Funding History: A Comparison with Funding for Nuclear Energy, Fossil Energy, and Energy Efficiency R&D

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March 7, 2012

Congressional Research Service

7-5700

[www.crs.gov](http://www.crs.gov)

RS22858

## Summary

Energy-related research and development (R&D)—on coal-based synthetic petroleum and on atomic power—played an important role in the successful outcome of World War II. In the post-war era, the federal government conducted R&D on fossil fuel and nuclear energy sources to support peacetime economic growth. The energy crises of the 1970s spurred the government to broaden the focus to include renewable energy and energy efficiency. Over the 35-year period from the Department of Energy’s inception at the beginning of fiscal year (FY) 1978 through FY2012, federal funding for renewable energy R&D amounted to about 17% of the energy R&D total, compared with 15% for energy efficiency, 25% for fossil, and 37% for nuclear. For the 65-year period from 1948 through 2012, nearly 12% went to renewables, compared with 10% for efficiency, 25% for fossil, and 49% for nuclear.

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## Introduction

This report provides a cumulative history of Department of Energy (DOE) funding for renewable energy compared with funding for the other energy technologies—nuclear energy, fossil energy, and energy efficiency. Specifically, it provides a comparison that covers cumulative funding over the past 10 years (FY2003-FY2012), a second comparison that covers the 35-year period since DOE was established at the beginning of fiscal year 1978 (FY1978-FY2012), and a third comparison that covers a 65-year funding history (FY1948-FY2012) for DOE and predecessor agencies.

## Guide to Tables and Charts

**Table 1** shows the cumulative funding totals in real terms for the past 10 years (first column), 35 years (second column), and 65 years (third column). **Table 2** converts the data from **Table 1** into relative shares of spending for each technology, expressed as a percentage of total spending for each period.

**Figure 1** displays the data from the first column of **Table 2** as a pie chart. That chart shows the relative shares of cumulative DOE spending for each technology over the 10 years from FY2003 through FY2012. **Figure 2** provides a similar chart for the period from FY1978 through FY2012. **Figure 3** shows a chart for FY1948 through FY2012.

## Background

### Evolution of the Department of Energy

The availability of energy—especially gasoline and other liquid fuels—played a critical role in World War II.<sup>1</sup> Another energy-related factor was the application of research and development (R&D) to the atomic bomb (Manhattan Project) and other military technologies. During the post World War II era, the federal government began to apply R&D to the peacetime development of energy sources to support economic growth. At that time, the primary R&D focus was on fossil fuels and new forms of energy derived from nuclear fission and nuclear fusion.

The Atomic Energy Act of 1946 established the Atomic Energy Commission (AEC), which inherited all of the Manhattan Project’s R&D activities.<sup>2</sup> A major focus of the AEC was research on “atoms for peace,” the use of nuclear energy for civilian electric power production. Prompted by the Arab Oil Embargo of 1973, the Federal Energy Administration was established in mid-1974. In early 1975, the Energy Research and Development Administration (ERDA) was

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<sup>1</sup> Regarding coal-based synthetic petroleum production—before, during, and after World War II—see DOE’s discussion at [http://fossil.energy.gov/aboutus/history/syntheticfuels\\_history.html](http://fossil.energy.gov/aboutus/history/syntheticfuels_history.html).

<sup>2</sup> DOE, *Origins of the U.S. Department of Energy*, (DOE/HR-0098, draft), p. 8. Also, see DOE, *A History of the Atomic Energy Commission*, (DOE/ES-0003/ 1; by Alice L. Buck) July 1983 <http://www.atomictraveler.com/HistoryofAEC.pdf>.

established, incorporating the AEC and several energy programs that had been operating under the Department of the Interior and other federal agencies.<sup>3</sup>

The Department of Energy (DOE) was established by law in 1977,<sup>4</sup> incorporating activities of the FEA and ERDA. All of the energy R&D programs—fossil, nuclear, renewable, and energy efficiency—were brought under its administration. DOE also undertook a small program in energy storage and electricity system R&D that supports the four main energy technology programs.<sup>5</sup>

## **Evolution of Energy Technology R&D Funding**

From FY1948 through FY1977 the federal government provided an extensive amount of R&D support for fossil energy and nuclear power technologies.<sup>6</sup> Total spending on fossil energy technologies over that period amounted to about \$16.2 billion, in constant FY2011 dollars. The federal government spent about \$48.8 billion (in constant FY2011 dollars) during that period for nuclear fission and nuclear fusion energy R&D.<sup>7</sup>

The energy crises of the 1970s spurred the federal government to expand its R&D programs to include renewable (wind, solar, biomass, geothermal, hydro) energy and energy efficiency technologies. Modest efforts to support renewable energy and energy efficiency began during the early 1970s. From FY1973 through FY1977 the federal government spent about \$1.6 billion (in constant FY2011 dollars) on renewable energy R&D, \$147 million on energy efficiency R&D, and \$178 million on electric systems R&D.<sup>8</sup> Since FY1978, DOE has been the main supplier of energy R&D funding.<sup>9</sup>

In real (constant dollar) terms, funding support for all four of the main energy technologies skyrocketed during the 1970s to a combined peak in FY1979 at about \$8 billion (2011 constant dollars). Funding then dropped steadily, reaching a plateau of about \$2 billion (2011 dollars) per year during the late 1990s. Since then, funding has increased gradually—except that the Recovery Act provided a one-year spike up to about \$12 billion (2011 dollars) in FY2009. For FY2012, DOE energy R&D funding stands at about \$3.3 billion (2011 dollars).

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<sup>3</sup> DOE, *Department of Energy 1977-1994*, p. 17-22, (DOE/HR-0098) <http://energy.gov/downloads/summaryhistorypdf>.

<sup>4</sup> The Department of Energy Organization Act, P.L. 95-91, was enacted on August 4, 1977.

<sup>5</sup> This program includes R&D on advanced batteries to store electricity and transmission equipment to transfer electricity with less heat loss (i.e. at higher levels of energy efficiency).

<sup>6</sup> DOE, Pacific Northwest Laboratory. *An Analysis of Federal Incentives Used to Stimulate Energy Production*. 1980. The spending for fossil energy included coal, oil, and natural gas technologies.

<sup>7</sup> Ibid.

<sup>8</sup> *DOE Conservation and Renewable Energy Base Table*. February 1990.

<sup>9</sup> There has been some energy R&D funding—on a much smaller scale—provided by the Department of Defense and other agencies. Coverage of that funding is beyond the scope of this report.

**Table 1. DOE Energy Technology Cumulative Funding Totals**  
(billions of 2011 dollars)

Technology	Period		
	FY2003-FY2012 (10 years)	FY1978-FY2012 (35 years)	FY1948-FY2012 (65 years)
Renewable Energy	\$ 6.83	\$ 20.94	\$ 22.55
Energy Efficiency	6.54	18.64	18.79
Fossil Energy	10.12	32.23	48.41
Nuclear Energy	10.32	46.87	95.69
Electric Systems	6.03	8.35	8.53
Total	\$39.85	\$127.03	\$193.97

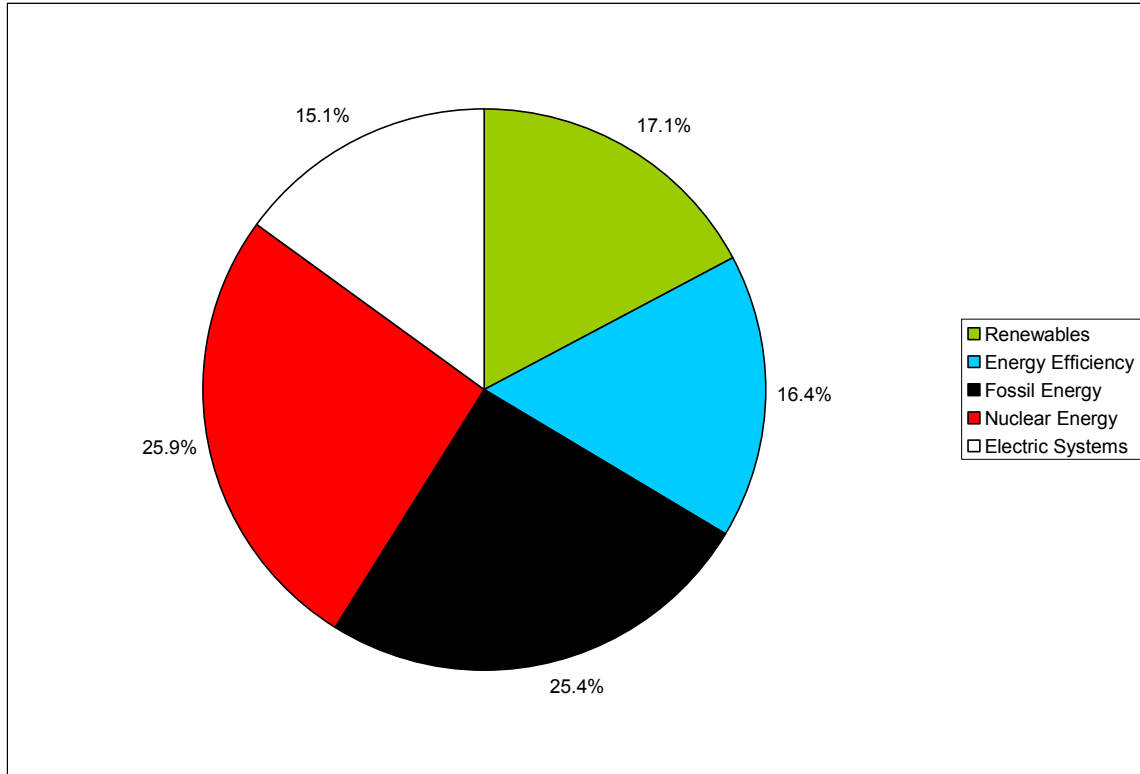
**Sources:** DOE Budget Authority History Table by Appropriation, May 2007; DOE Congressional Budget Requests (several years); DOE (Pacific Northwest Laboratory), *An Analysis of Federal Incentives Used to Stimulate Energy Production*, 1980. Deflator Source: *The Budget for Fiscal Year 2013*. Historical Tables. Table 10.1. Gross Domestic Product and Deflators Used in the Historical Tables, 1940-2017.

**Table 2. DOE Energy Technology Share of Funding**  
(percent; derived from Table 1)

Technology	Period		
	FY2003-FY2012 (10 years)	FY1978-FY2012 (35 years)	FY1948-FY2012 (65 years)
Renewable Energy	17.1%	16.5%	11.6%
Energy Efficiency	16.4%	14.7%	9.7%
Fossil Energy	25.4%	25.4%	25.0%
Nuclear Energy	25.9%	36.9%	49.3%
Electric Systems	15.1%	6.6%	4.4%
Total	100.0%	100.0%	100.0%

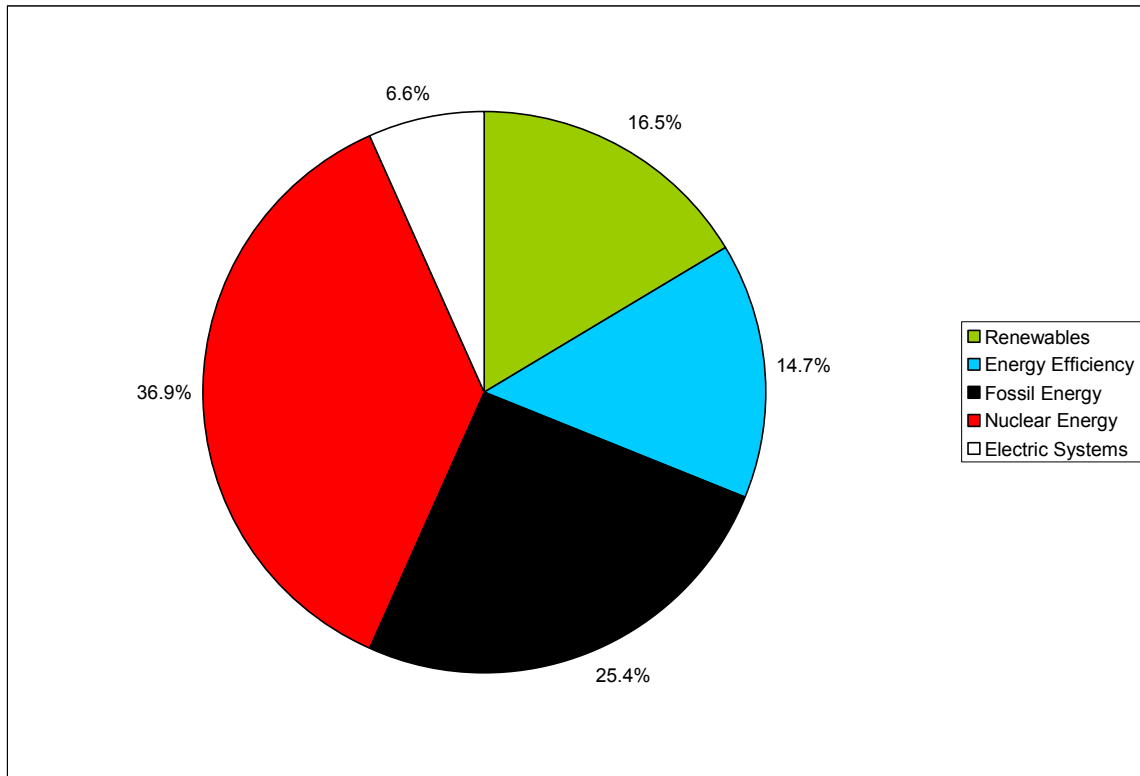
**Sources:** DOE Budget Authority History Table by Appropriation, May 2007; DOE Congressional Budget Requests (several years); DOE (Pacific Northwest Laboratory), *An Analysis of Federal Incentives Used to Stimulate Energy Production*, 1980; DOE Conservation and Renewable Energy Base Table. February 1990. Deflator Source: *The Budget for Fiscal Year 2013*. Historical Tables. Table 10.1. Gross Domestic Product and Deflators Used in the Historical Tables, 1940-2017.

Figure I. DOE Energy Technology Share of Funding, FY2003-FY2012



**Source:** DOE Budget Authority History Table by Appropriation, May 2007; DOE Congressional Budget Requests (several years); Deflator Source: *The Budget for Fiscal Year 2013*. Historical Tables. Table 10.1. Gross Domestic Product and Deflators Used in the Historical Tables, 1940-2017.

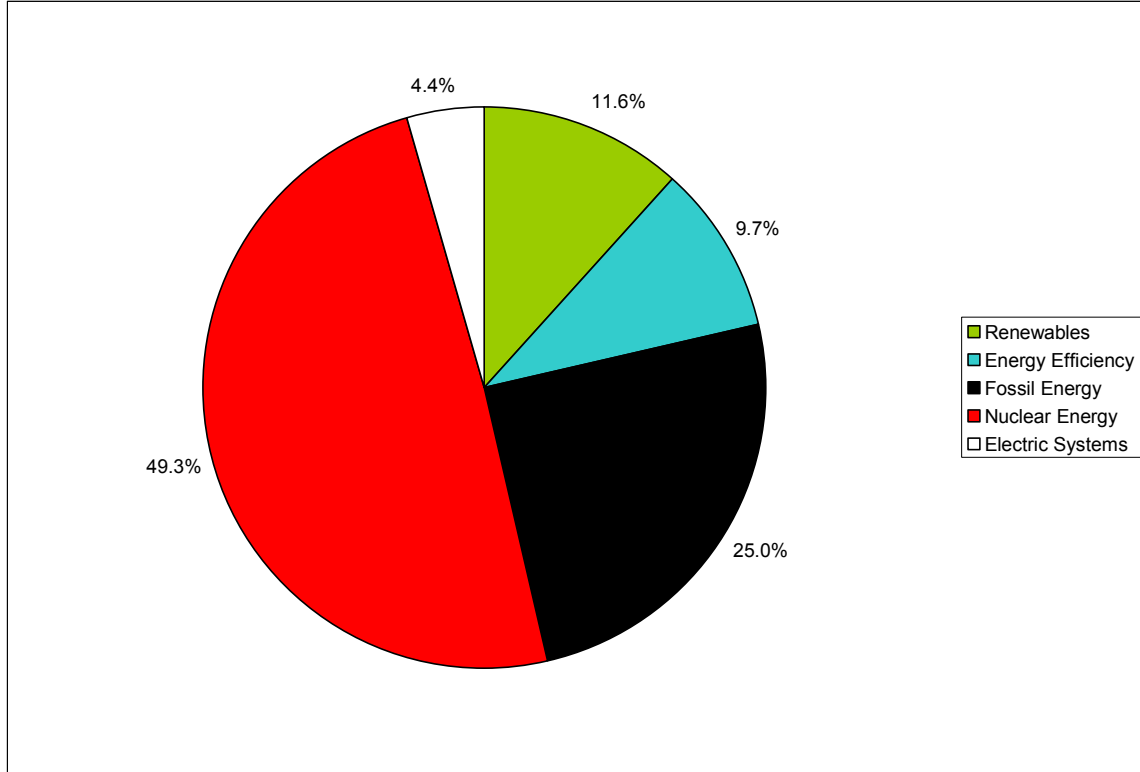
Figure 2. DOE Energy Technology Share of Funding, FY1978-FY2012



**Sources:** DOE Budget Authority History Table by Appropriation, May 2007; DOE Congressional Budget Requests (several years); Deflator Source: *The Budget for Fiscal Year 2013*. Historical Tables. Table 10.1. Gross Domestic Product and Deflators Used in the Historical Tables, 1940-2017.

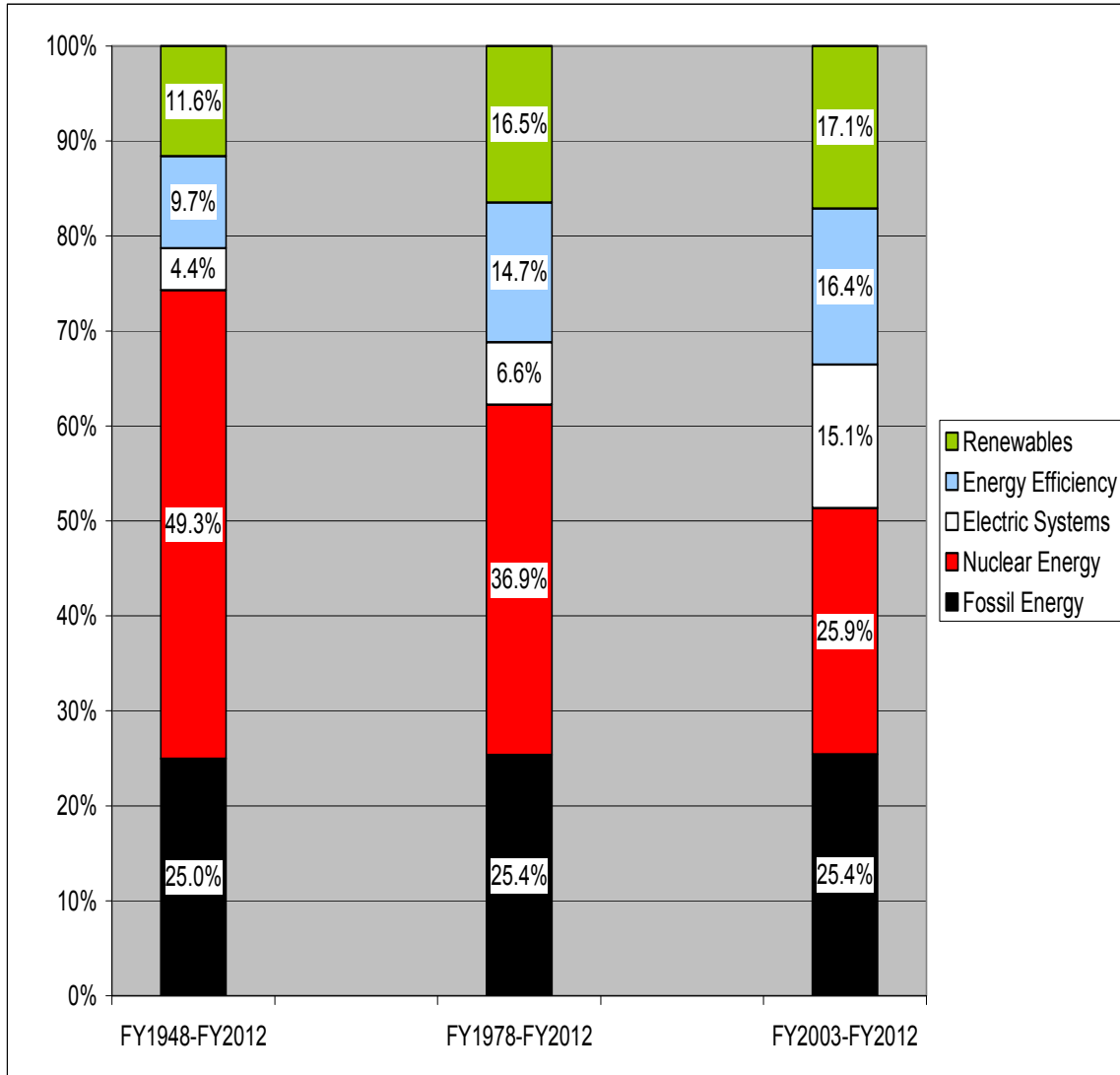


Figure 3. DOE Energy Technology Share of Funding, FY1948-FY2012



**Sources:** DOE Budget Authority History Table by Appropriation, May 2007; DOE Congressional Budget Requests (several years); DOE (Pacific Northwest Laboratory), *An Analysis of Federal Incentives Used to Stimulate Energy Production*, 1980; DOE Conservation and Renewable Energy Base Table, Feb. 1990. Deflator Source: *The Budget for Fiscal Year 2013*. Historical Tables. Table 10.1.

Figure 4. DOE Energy Technology Share of Funding, Comparison over Three Periods



**Sources:** DOE Budget Authority History Table by Appropriation, May 2007; DOE Congressional Budget Requests (several years); DOE (Pacific Northwest Laboratory), *An Analysis of Federal Incentives Used to Stimulate Energy Production*, 1980; DOE Conservation and Renewable Energy Base Table. Feb. 1990. Deflator Source: *The Budget for Fiscal Year 2013*. Historical Tables. Table 10.1.

**Note:** Column to far left shows shares for the period FY1948-FY2012; middle column shows shares for period from FY1978-FY2012; and far right column shows shares for period from FY2003-FY2012.

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