



**Congressional
Research Service**

Informing the legislative debate since 1914

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

name redacted

Specialist in Energy Policy

February 2, 2016

Congressional Research Service

7-....

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 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 38-year period from the Department of Energy’s (DOE’s) inception at the beginning of fiscal year (FY) 1978 through FY2015, 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 68-year period from 1948 through 2015, nearly 12% went to renewables, compared with 10% for efficiency, 25% for fossil, and 49% for nuclear.

Contents

| | |
|--|---|
| Introduction | 1 |
| Cumulative Funding History | 1 |
| FY2014 and FY2015 Appropriations | 1 |
| Guide to Tables and Charts | 1 |
| Background | 1 |
| Evolution of the Department of Energy | 1 |
| Evolution of Energy Technology R&D Funding | 2 |

Figures

| | |
|---|---|
| Figure 1. DOE Energy Technology Share of Funding, FY2006-FY2015 | 4 |
| Figure 2. DOE Energy Technology Share of Funding, FY1978-FY2015 | 5 |
| Figure 3. DOE Energy Technology Share of Funding, FY1948-FY2015 | 6 |
| Figure 4. DOE Energy Technology Share of Funding, Comparison over Three Periods | 7 |

Tables

| | |
|--|---|
| Table 1. DOE Energy Technology Cumulative Funding Totals | 3 |
| Table 2. DOE Energy Technology Share of Funding | 3 |

Contacts

| | |
|----------------------------------|---|
| Author Contact Information | 7 |
|----------------------------------|---|

Introduction

Cumulative Funding History

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 (FY2006-FY2015), a second comparison that covers the 38-year period since DOE was established at the beginning of fiscal year 1978 (FY1978-FY2015), and a third comparison that covers a 68-year funding history (FY1948-FY2015) for DOE and predecessor agencies.

FY2014 and FY2015 Appropriations

The final amount of FY2014 Energy and Water Development appropriations for DOE energy technologies was established on January 17, 2014, by the Consolidated Appropriations Act, 2014 (P.L. 113-76), which contained appropriations for all FY2014 appropriations bills, including Energy and Water Development programs (Division D).¹

Final funding for FY2015 was set on December 16, 2014, by the Consolidated and Further Continuing Appropriations Act, 2015 (P.L. 113-235), which contained appropriations for all FY2015 appropriations bills, including Energy and Water Development programs (Division D).²

Guide to Tables and Charts

Table 1 shows the cumulative funding totals in real terms (2014 dollars) for the past 10 years (first column), 38 years (second column), and 68 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 FY2006 through FY2015. **Figure 2** provides a similar chart for the period from FY1978 through FY2015. **Figure 3** shows a chart for FY1948 through FY2015.

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.³ Another energy-related factor was the application of research and development

¹ For more details, see CRS Report R43121, *Energy and Water Development: FY2014 Appropriations*, coordinated by (name redacted).

² For more details, see CRS Report R43567, *Energy and Water Development: FY2015 Appropriations*, coordinated by (name redacted).

³ 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.

(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.⁴ 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 established, incorporating the AEC and several energy programs that had been operating under the Department of the Interior and other federal agencies.⁵

The Department of Energy (DOE) was established by law in 1977,⁶ 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.⁷

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.⁸ Total spending on fossil energy technologies over that period amounted to about \$16.6 billion, in constant FY2014 dollars. The federal government spent about \$50.2 billion (in constant FY2014 dollars) during that period for nuclear fission and nuclear fusion energy R&D.⁹

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 \$2.5 billion (in constant FY2014 dollars) on renewable energy R&D, \$900 million on energy efficiency R&D, and \$185 million on electric systems R&D.¹⁰ Since FY1978, DOE has been the main supplier of energy R&D funding.¹¹

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 (2014 constant

⁴ 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>.

⁵ DOE, *Department of Energy 1977-1994*, p. 17-22, (DOE/HR-0098) <http://energy.gov/downloads/summaryhistorypdf>.

⁶ The Department of Energy Organization Act, P.L. 95-91, was enacted on August 4, 1977.

⁷ 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).

⁸ 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.

⁹ Ibid.

¹⁰ *DOE Conservation and Renewable Energy Base Table*. February 1990.

¹¹ 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.

dollars). Funding then dropped steadily, reaching a bottom of about \$2 billion (2014 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 nearly \$13 billion (2014 dollars) in FY2009. For FY2015, DOE energy R&D funding stood at nearly \$3.7 billion (2014 dollars).

Table 1. DOE Energy Technology Cumulative Funding Totals
(billions of 2014 dollars)

| Technology | Period | | |
|-------------------|-----------------------------|-----------------------------|-----------------------------|
| | FY2006-FY2015 (10 years) | FY1978-FY2015 (38 years) | FY1948-FY2015 (68 years) |
| Renewable Energy | \$ 8.52 | \$ 24.28 | \$ 25.94 |
| Energy Efficiency | 7.03 | 21.57 | 21.72 |
| Fossil Energy | 10.07 | 35.07 | 51.70 |
| Nuclear Energy | 12.23 | 52.30 | 102.48 |
| Electric Systems | 6.44 | 9.20 | 9.39 |
| Total | \$ 44.29 | \$ 142.41 | \$ 211.22 |

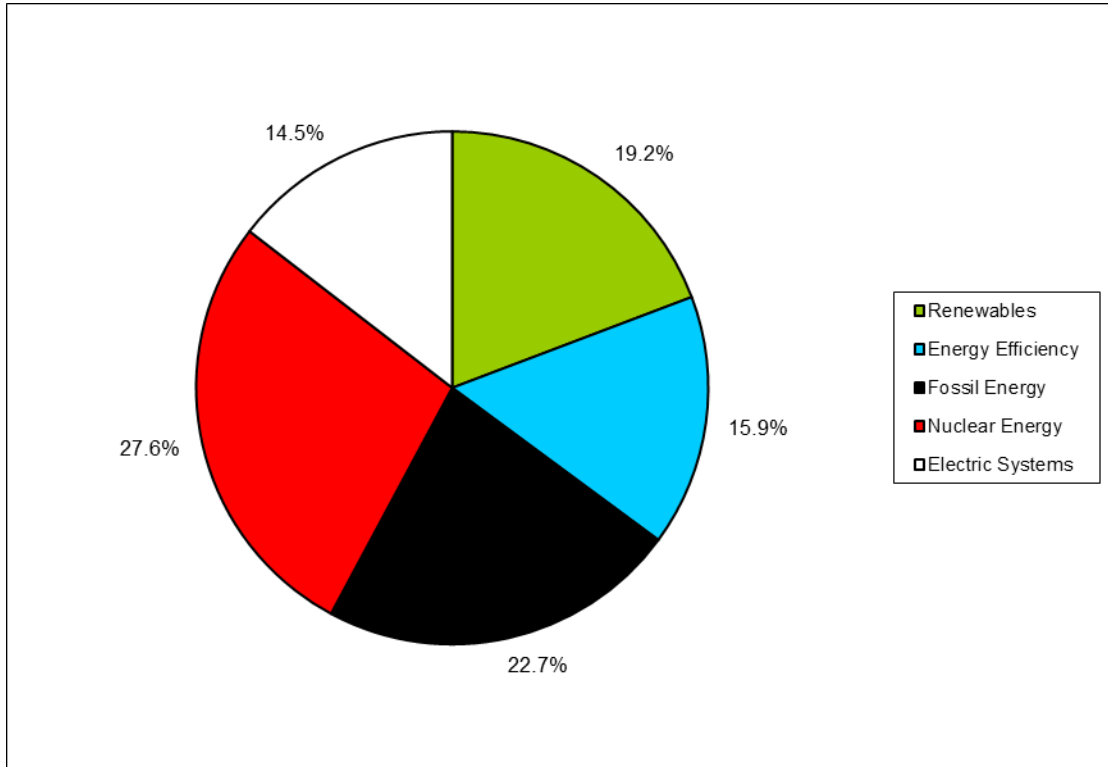
Sources: DOE Budget Authority History Table by Appropriation, May 2007; DOE Congressional Budget Requests (several years); DOE (Pacific Northwest Laboratory), *An Analysis of Federal Incentives Used to Stimulate Energy Production*, 1980. Deflator Source: *The Budget for Fiscal Year 2016*. Historical Tables. Table 10.1. Gross Domestic Product and Deflators Used in the Historical Tables, 1940-2020.

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

| Technology | Period | | |
|-------------------|-----------------------------|-----------------------------|-----------------------------|
| | FY2006-FY2015 (10 years) | FY1978-FY2015 (38 years) | FY1948-FY2015 (68 years) |
| Renewable Energy | 19.2% | 17.0% | 12.3% |
| Energy Efficiency | 15.9% | 15.1% | 10.3% |
| Fossil Energy | 22.7% | 24.6% | 24.5% |
| Nuclear Energy | 27.6% | 36.7% | 48.5% |
| Electric Systems | 14.5% | 6.5% | 4.4% |
| Total | 100.0% | 100.0% | 100.0% |

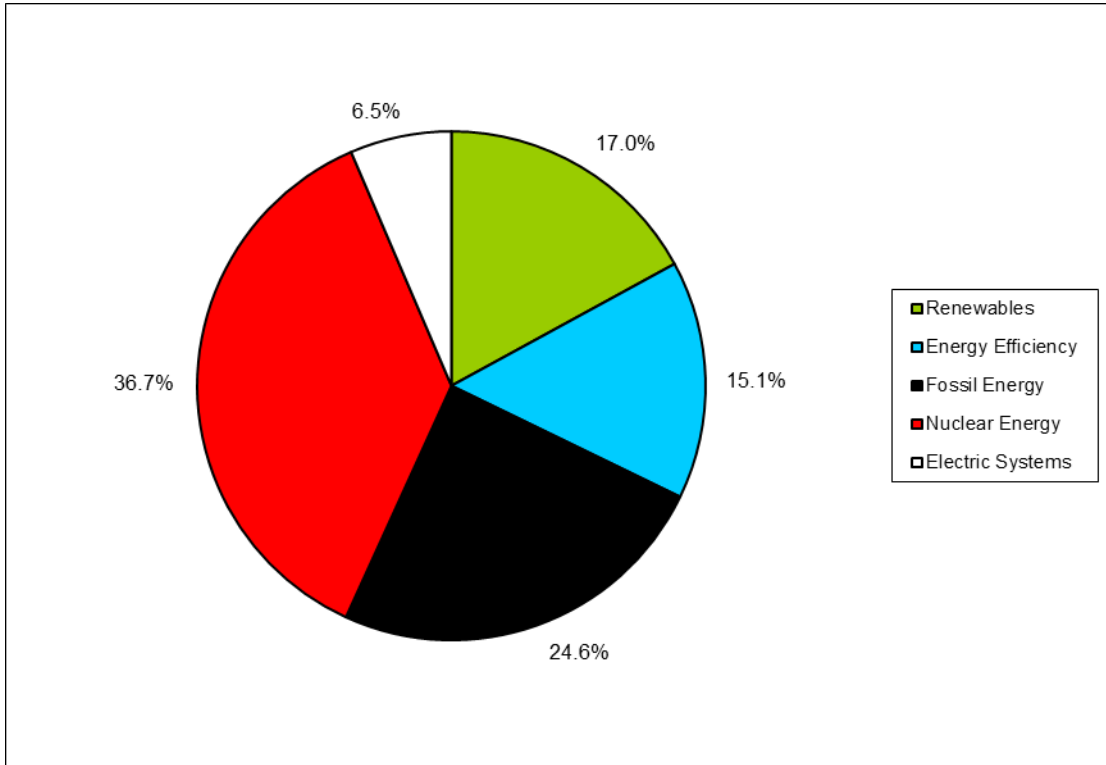
Sources: DOE Budget Authority History Table by Appropriation, May 2007; DOE Congressional Budget Requests (several years); DOE (Pacific Northwest Laboratory), *An Analysis of Federal Incentives Used to Stimulate Energy Production*, 1980; DOE Conservation and Renewable Energy Base Table. February 1990. Deflator Source: *The Budget for Fiscal Year 2016*. Historical Tables. Table 10.1. Gross Domestic Product and Deflators Used in the Historical Tables, 1940-2020.

Figure I. DOE Energy Technology Share of Funding, FY2006-FY2015



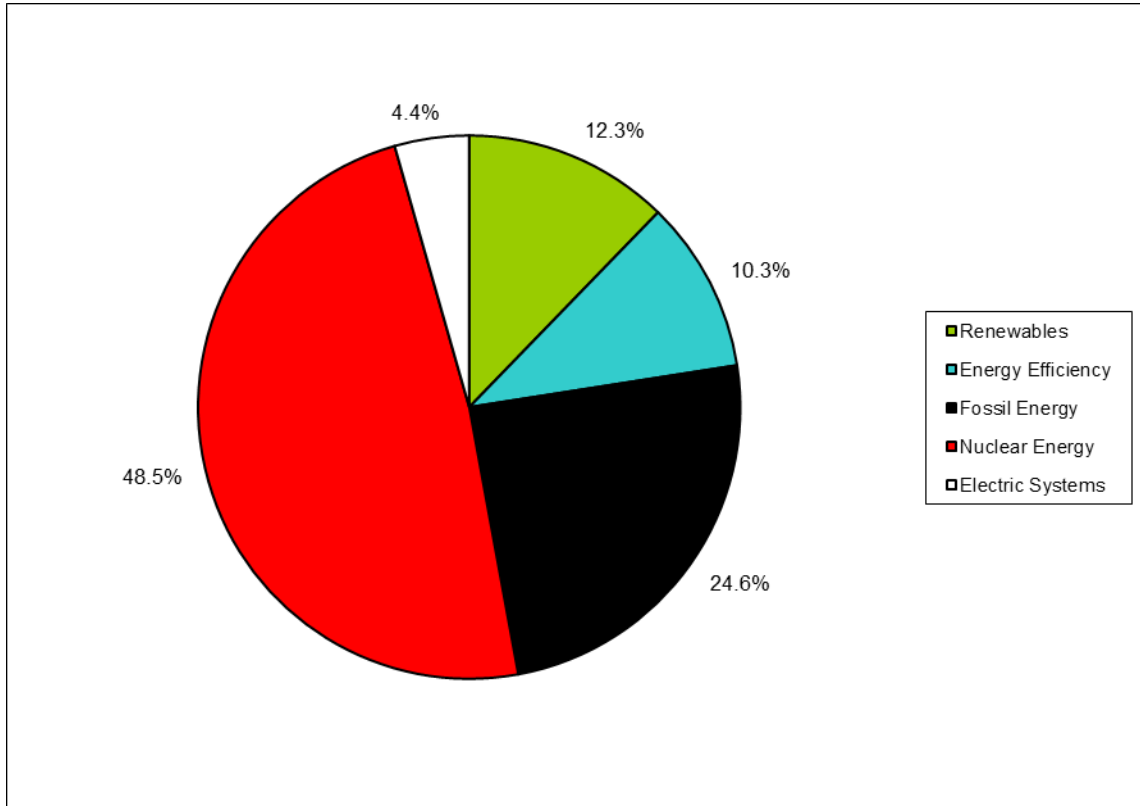
Source: DOE Budget Authority History Table by Appropriation, May 2007; DOE Congressional Budget Requests (several years); Deflator Source: *The Budget for Fiscal Year 2016*. Historical Tables. Table 10.1. Gross Domestic Product and Deflators Used in the Historical Tables, 1940-2020.

Figure 2. DOE Energy Technology Share of Funding, FY1978-FY2015



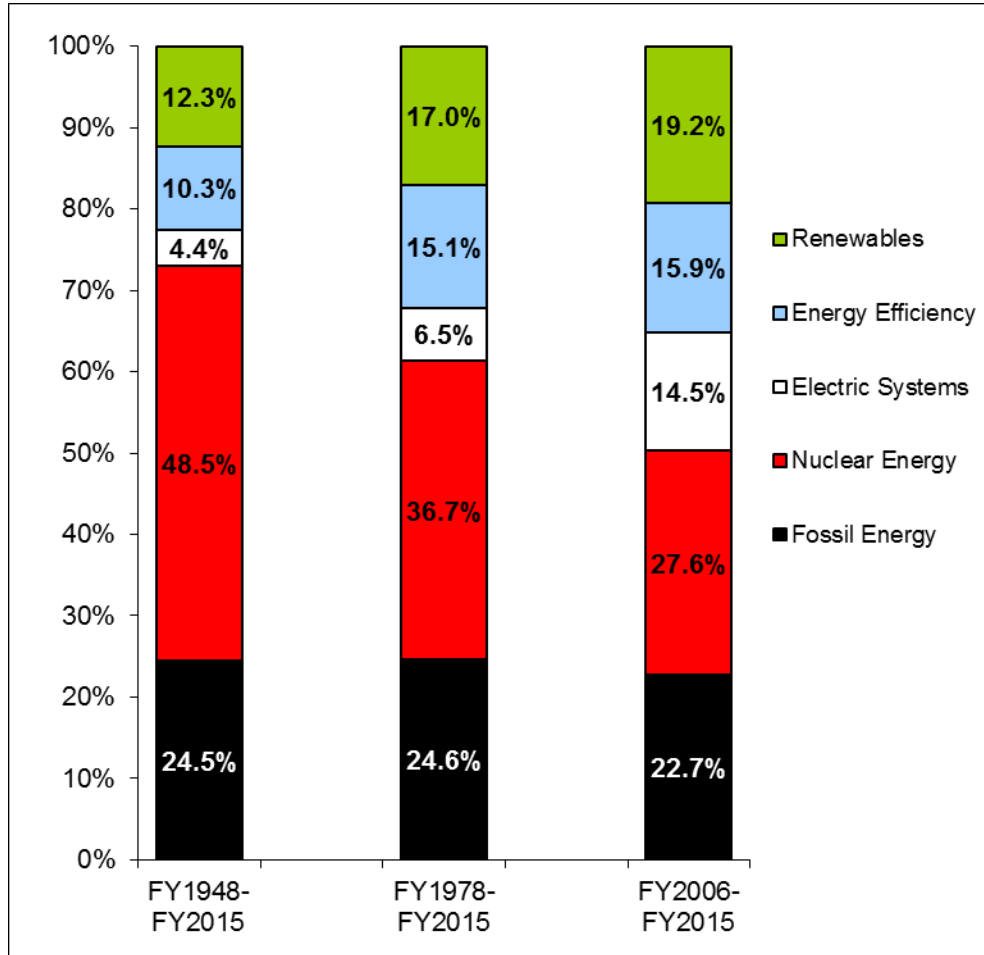
Sources: DOE Budget Authority History Table by Appropriation, May 2007; DOE Congressional Budget Requests (several years); Deflator Source: *The Budget for Fiscal Year 2016*. Historical Tables. Table 10.1. Gross Domestic Product and Deflators Used in the Historical Tables, 1940-2020.

Figure 3. DOE Energy Technology Share of Funding, FY1948-FY2015



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 2016*. Historical Tables. Table 10.1.

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



Source: 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 2016*. Historical Tables. Table 10.1.

Notes: Column to far left shows shares for the period FY1948-FY2015; middle column shows shares for period from FY1978-FY2015; and far right column shows shares for period from FY2006-FY2015.

Author Contact Information

(name redacted)
 Specialist in Energy Policy
 /redacted/@crs.loc.gov-....

EveryCRSReport.com

The Congressional Research Service (CRS) is a federal legislative branch agency, housed inside the Library of Congress, charged with providing the United States Congress non-partisan advice on issues that may come before Congress.

EveryCRSReport.com republishes CRS reports that are available to all Congressional staff. The reports are not classified, and Members of Congress routinely make individual reports available to the public.

Prior to our republication, we redacted names, phone numbers and email addresses of analysts who produced the reports. We also added this page to the report. We have not intentionally made any other changes to any report published on EveryCRSReport.com.

CRS reports, as a work of the United States government, are not subject to copyright protection in the United States. Any CRS report may be reproduced and distributed in its entirety without permission from CRS. However, as a CRS report may include copyrighted images or material from a third party, you may need to obtain permission of the copyright holder if you wish to copy or otherwise use copyrighted material.

Information in a CRS report should not be relied upon for purposes other than public understanding of information that has been provided by CRS to members of Congress in connection with CRS' institutional role.

EveryCRSReport.com is not a government website and is not affiliated with CRS. We do not claim copyright on any CRS report we have republished.