

Executive Summary

Background

In May 1999, the Office of Policy, U.S. Department of Energy (DOE), asked the Energy Information Administration (EIA) to update EIA's 1992 Service Report on Federal energy subsidies.¹ In September 1999, the first volume of the update was released, focusing on primary energy.² Prior to the release of that report, the Office of Policy asked that EIA also report on subsidies in energy transformation and end use.³ The present report responds to the latter request. Both of the Office of Policy's requests asked the EIA to focus on Federal programs that provided a "financial benefit" and were "specifically targeted" to energy markets.

Federal energy subsidies take three principal forms:

- **Direct Payments to Producers or Consumers.** These are Federal programs that directly affect the energy industry and for which the Federal Government provides a direct financial benefit. Currently, four energy programs provide direct payments to producers or consumers, three of which are addressed in this report: the Department of Health and Human Services' Low Income Home Energy Assistance Program (LIHEAP), and two DOE programs, the Weatherization Assistance Program and the State Energy Program. The fourth program, Renewable Energy Production Incentive, was addressed in EIA's September 1999 report.
- **Tax Expenditures.** Tax expenditures are provisions in the Federal tax code that reduce the tax liability of firms or individuals who take specified actions that affect energy production, consumption, or conservation in ways deemed to be in the public interest. Three tax expenditures are currently applied in transformation and end-use markets: the exclusion of interest income on bonds for certain energy facilities; the exclusion for utility-sponsored conservation measures; and the credit/deduction for clean fuel vehicles.
- **Research and Development (R&D).** R&D expenditures do not directly affect current energy production and prices, but if successful they could affect future production and prices. R&D expenditures are currently applied to four energy end uses: buildings technology, industry, transportation, and a small portion that is unallocated.⁴

Except for subsidies to electricity, this report measures subsidies on the basis of the cost of the programs to the Federal budget. Using the Federal budget has the advantage of ease of measurement; however, budget values may understate both the economic costs and the market impacts of specific programs, especially where small subsidies

¹Energy Information Administration, *Federal Energy Subsidies: Direct and Indirect Interventions in Energy Markets*, SR/EMEU/92-02 (Washington, DC, November 1992).

²Energy Information Administration, *Federal Energy Market Interventions 1999: Primary Energy*, SR/OIAF/99-03 (Washington, DC, September 1999). Primary energy is all energy consumed by end users, excluding electricity but including the energy consumed by electricity generators.

³Transformation refers to the production of electricity by transforming other forms of energy into electrical energy. End use refers to any application by which energy is consumed in the residential, commercial, industrial, and transportation sectors of the economy.

⁴Another R&D project, Advanced Turbine Systems, was treated as a primary energy element in the previous report because of its emphasis on efficient consumption of fossil fuels.

are applied to large existing markets. Some subsidies offer relatively large payments to producers using certain energy technologies that otherwise would be uneconomical at present. In these cases, the immediate effects on markets may be small, but the impact on specific technologies may be significant. Proponents justify subsidies by pointing to expected social benefits that may exceed the expected cost of the program. No attempt is made in this report to evaluate the social benefits that may accrue from these programs.

Summary of Results

Energy Transformation and End Use Subsidies

Federal subsidies for transformation and end-use activities are estimated to be \$2.2 billion in fiscal year 1999, a decline of about 10 percent in real terms from the total found for similar items in fiscal year 1992 (Table ES1 and Figure ES1).⁵ It is estimated that direct subsidies—the sum of direct expenditures and tax expenditures—totaled \$1.8 billion in fiscal year 1999, of which direct expenditures totaled \$1.4 billion. R&D subsidies accounted for the remainder, just over \$0.45 billion.

Table ES1. Summary of Energy Transformation and End Use Subsidy Elements in Federal Programs by Fuel and Program Type on a Budget Outlay Basis, Fiscal Year 1999
(Million 1999 Dollars)

Fuel	Type of Subsidy ^a				Total
	Direct Expenditures	Tax Expenditures		Research and Development	
		Income	Excise		
Oil	255	0	0	0	255
Gas	501	0	0	0	501
Renewables	40	0	0	0	40
Electricity ^a	459	155	0	0	614
Conservation ^b	166	110	0	0	276
End Use ^b	0	105	0	454	559
Total	1,421	370	0	454	2,245

^aDoes not include supports to TVA, the Power Marketing Administrations, and the Rural Utilities Service, which are described in Chapter 4 and summarized under Federal Electricity Support.

^bConservation programs are directed primarily at consumers of energy and often are supported by grants. End-use programs are oriented to the development and introduction of new technologies for use in specific sectors.

Note: Totals may not equal sum of components due to independent rounding.

Source: Estimates presented in this report.

⁵The summary estimates shown here are for subsidies in a single year, fiscal year 1999. Comparisons with EIA's 1992 report rely on data for two years, fiscal year 1992 and fiscal year 1999. Consequently, comparisons across energy sources and uses may not adequately describe cumulative or historical effects, for which the allocations could differ.

Direct expenditures made under LIHEAP, the DOE Weatherization Assistance Program, and the State Energy Program all have declined somewhat since 1992 (Table ES2), and the share of subsidies attributable to direct expenditures has fallen from 80 percent in 1992 to 63 percent in 1999. The reductions in LIHEAP funding notwithstanding, a large portion of transformation and end use subsidies remain specifically addressed to low-income households. Tax expenditures totaled \$370 million in 1999, representing a 75-percent increase since 1992.

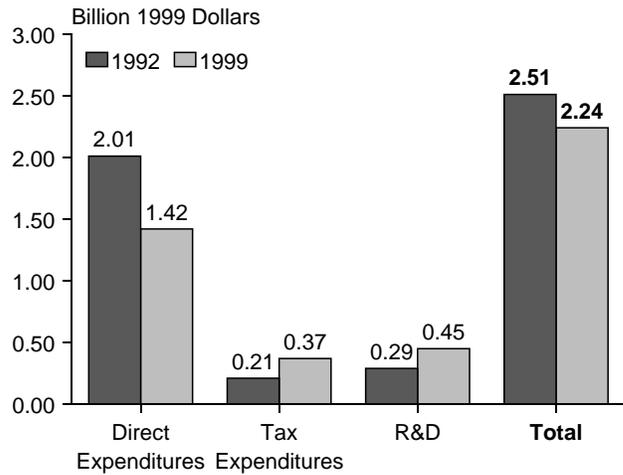
R&D outlays for transformation and end use have also increased, from the 1992 level of \$0.29 billion (1999 dollars) to \$0.45 billion in fiscal year 1999. Every end-use area was found to have higher spending levels. Transportation R&D programs showed the largest increase, from \$125 million in 1992 (1999 dollars) to \$202 million in 1999, a 62-percent increase.

Total Energy Subsidies

The estimated value for all energy subsidies identified in this report and in EIA's September 1999 report is \$6.2 billion in fiscal year 1999 (Table ES3).⁶ Fossil fuels received by far the largest share of these subsidies, nearly half the total. Led by the ethanol excise exclusion, renewables received about \$1.1 billion, or about 18 percent of total subsidies. Nuclear, electricity, and end-use programs each accounted for about 10 percent of total subsidies. Conservation programs received about 4 percent of total subsidies. Total subsidies have declined by nearly 16 percent since 1992, a reduction demonstrated across four broad program types (Figure ES2). LIHEAP expenditures have declined by 27 percent and R&D spending by 13 percent.

Generally, these energy subsidies are small relative to the energy economy as a whole, and to the energy companies themselves (Table ES4). The total estimate for all subsidies, \$6.2 billion, is only 1.1 percent of total annual expenditures on energy in the United States. The magnitude of subsidies on a per-unit basis varies inversely with expenditures in specific energy sectors. Oil and end-use electricity, which together make up about 86 percent of all energy expenditures, receive negligible subsidies relative to their shares of the energy market. Subsidies to natural gas and coal are slightly higher in proportion to the size of the coal and natural gas sectors of the energy economy. Nuclear energy receives subsidies valued at 16 percent of the nuclear energy sector. The alcohol fuels excise tax exemption provides a substantial per-unit subsidy, valued at 26 percent of the energy sector that is represented by the renewable energy sources grouped in Table ES4.

Figure ES1. Summary of Energy Transformation and End Use Subsidy Elements, 1992 and 1999



Notes: Totals for 1992 and 1999 exclude estimates of supports to Federal electricity suppliers. Totals may not equal sum of components due to independent rounding.

Sources: Energy Information Administration, *Federal Energy Subsidies: Direct and Indirect Interventions in Energy Markets*, SR/EMEU/92-02 (Washington, DC, November 1992), and estimates presented in this report.

⁶The \$6.2 billion estimate represents the sum of the values for energy transformation and end use in this report and the values for primary energy published in Energy Information Administration, *Federal Financial Interventions and Subsidies in Energy Markets 1999: Primary Energy*, SR/OIAF/99-03 (Washington, DC, September 1999).

Table ES2. Comparison of Estimates of Federal Financial Interventions and Subsidies in Energy Transformation and End Use on a Budget Outlay Basis: Values for Corresponding Categories From the 1992 and 1999 EIA Reports

Subsidy Category	1992 Estimate (Million 1992 Dollars)	1992 Estimate (Million 1999 Dollars)	1999 Estimate (Million 1999 Dollars)
Direct Expenditures			
LIHEAP	1,500	1,712	1,255
Weatherization Assistance and State Energy Programs . . .	262	299	166
<i>Subtotal (Direct Expenditures)</i>	<i>1,762</i>	<i>2,010</i>	<i>1,421</i>
Tax Expenditures			
Interest Income Exclusion (Certain Energy Facilities)	185	211	155
Utility-Sponsored Conservation Exclusion ^a	NI	NI	110
Credit/Deduction for Clean Fuel Vehicles ^a	NI	NI	105
<i>Subtotal (Tax Expenditures)</i>	<i>185</i>	<i>211</i>	<i>370</i>
Research and Development			
Building Technology, State and Community Programs	45	51	81
Industry ^b	97	110	133
Transportation	109	125	202
Unallocated	3	3	38
Federal Energy Management Program Adjustment ^c	-4	-5	NA
<i>Subtotal (Research and Development)</i>	<i>249</i>	<i>285</i>	<i>454</i>
Total	2,196	2,506	2,245

NI = not included. NA = not applicable.

^aProgram not in existence in 1992.

^bExpenditures for Advanced Turbine Systems (\$33 million) were reported as primary energy.

^cFEMP was not itemized separately in 1992 budget documents. It has been removed in this report.

Sources: Energy Information Administration, *Federal Energy Subsidies: Direct and Indirect Interventions in Energy Markets, SR/EMEU/92-02* (Washington, DC, November 1992); *Federal Financial Interventions and Energy Subsidies in Energy Markets 1999: Primary Energy, SR/OIAF/99-03* (Washington, DC, September 1999); and estimates presented in this report.

Federal Electricity Support

The total estimate of \$2.2 billion for Federal subsidies to energy transformation and end use does not include estimates of support provided through Federal electricity supply programs, because of uncertainties associated with the estimation methodologies. These agencies and programs, the Tennessee Valley Authority (TVA), the Bonneville Power Administration (BPA), the other three Power Marketing Administrations (PMAs), and the Rural Utilities Service are discussed in Chapter 4. Three alternative methods of estimating support are developed and presented there.

The first methodology, a market price comparison, is based on the difference between average revenues from sales for resale made by the PMAs and the average wholesale revenues for privately owned utilities in the surrounding regions. The second approach, an interest rate approach, measures the difference in borrowing costs for recipients of Federal support and what their borrowing costs would be under various benchmark rates. The third methodology, return on assets, compares cost recovery at Federal utilities with that required in the private sector, where electric utilities generally recover their operating costs plus depreciation of capital assets, plus some allowance for cost of capital.

Table ES3. Summary of Total Energy Subsidy Elements in Federal Programs by Fuel and Program Type on a Budget Outlay Basis, Fiscal Year 1999
(Million 1999 Dollars)

Fuel	Type of Subsidy				Total
	Direct Expenditures	Tax Expenditures		Research and Development	
		Income	Excise		
Oil	255	263	0	49	567
Gas	501	1,048	0	115	1,664
Coal	0	85	0	404	489
Oil, Gas, and Coal Combined ^a	0	205	0	0	205
Nuclear	0	0	0	640	640
Renewables	44	15	^b 725	327	1,111
Electricity ^c	459	195	0	^d 33	687
Conservation	166	110	0	0	276
End Use	0	105	0	454	559
Total	1,425	2,026	725	2,021	6,198

^aThe category Oil, Gas, and Coal Combined includes expenditures that were not allocated to any one of the three individual fuels.

^bAlcohol fuels excise tax.

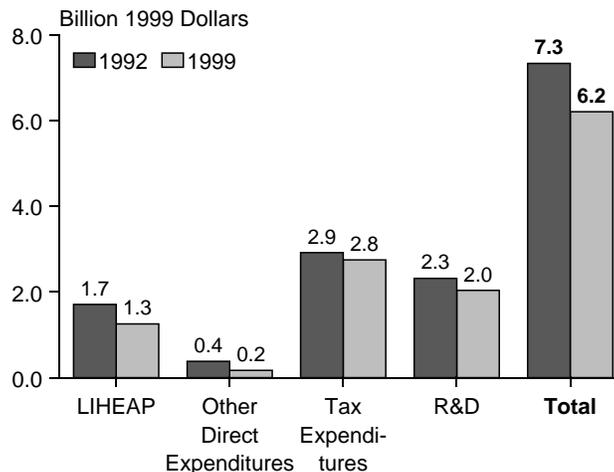
^cFurther estimates of Federal electricity supports, not included in this table, are presented in Chapter 4.

^dElectricity research and development includes only Advanced Turbine Systems. Other generation technology research and development is distributed by fuel.

Note: Totals may not equal sum of components due to independent rounding.

Sources: Energy Information Administration, *Federal Financial Interventions and Subsidies in Energy Markets 1999: Primary Energy*, SR/OIAF/99-03 (Washington, DC, September 1999), and estimates presented in this report.

Figure ES2. Summary of Federal Energy Subsidy Elements, 1992 and 1999



Notes: Tax expenditures, direct expenditures, and research and development expenditures for 1992 include some amounts attributable to electricity as a fuel. Totals may not equal sum of components due to independent rounding.

Sources: Energy Information Administration, *Federal Energy Subsidies: Direct and Indirect Interventions in Energy Markets*, SR/EMEU/92-02 (Washington, DC, November 1992); *Federal Financial Interventions and Subsidies in Energy Markets 1999: Primary Energy*, SR/OIAF/99-03 (Washington, DC, September 1999); and estimates presented in this report.

Table ES4. Magnitude of Energy Subsidies per Unit, 1999

Energy Use	Primary Energy					Transformation and End Use	Total
	Oil	Natural Gas	Coal	Nuclear	Biomass, Solar, Wind, Geothermal ^a	End-Use Electricity	
1998 U.S. Consumption (Quadrillion Btu)	36.57	21.84	21.62	7.16	3.48	11.05 ^b	90.67^c
1998 Average Wholesale Price (1998 Dollars per Million Btu)	1.88 ^d	1.78 ^e	0.83 ^f	NA	NA	9.61	—
1995 End-Use Energy Expenditures ^g (Million 1999 Dollars)	251,025	78,690	28,559	4,102	4,333	180,562	547,384^h
1999 Subsidies (Million 1999 Dollars)	661 ⁱ	1,720 ⁱ	544 ⁱ	640	1,111	687	6,198^j
1999 Subsidies per Unit (Percent)	0.26	2.19	1.91	15.60	25.64	0.38	1.13

^aIncludes utility generation attributable to the renewable energy sources listed, as well as ethanol use. Ethanol accounts for 65 percent of the total subsidy.

^bSales to ultimate consumers. Energy consumed as fuel input at electric utilities is represented as primary energy.

^cTotal consumption is the sum of primary energy use, excluding end-use electricity.

^dFirst purchase price.

^eWellhead price.

^fValue of coal produced at free-on-board mines.

^gPetroleum expenditures are net of ethanol; renewable expenditures sum ethanol, residential and industrial biomass, and estimated revenue attributable to end-use consumption of electricity from renewable sources; end-use electricity expenditures are net of utility expenditures on renewables and fuel input at electric utilities. Total electricity revenues were \$218,346 million in 1998 (nominal dollars).

^hTotal expenditures are net of expenditures for energy input at electric utilities. Total includes \$114 million expended on net imports of coal coke not otherwise referenced.

ⁱValues include subsidies of \$205 million attributed to fossil fuels generally.

^jTotal includes subsidies to conservation and end use not referenced otherwise.

NA = not available.

Sources: Energy Information Administration, *Annual Energy Review 1998*, DOE/EIA-0384(98) (Washington, DC, August 1999); *State Energy Price and Expenditure Report 1995*, DOE/EIA-0376(95) (Washington, DC, August 1998); *State Energy Data Report 1997*, DOE/EIA-0214(97) (Washington, DC, September 1999); and Form EIA-861, "Annual Electric Utility Report" (1998).

There are inherent difficulties in making comparisons between Federal programs and private suppliers of electricity. The available wholesale price data generally do not capture the variety of power transactions—such as firm and non-firm, contract and spot transactions—that comprise the electricity marketplace. For the return on assets approach, it is difficult to determine the appropriate rate of return, if any, on assets owned ultimately by the public. For the interest rate approach, several benchmark interest rates are compared with the rates paid on debt held by Federal utilities; however, the appropriate selection of a comparison rate is largely a matter of judgment. Because of these uncertainties, the values developed by these methods should be seen as a rough indication of the magnitude of Federal support.

All three methods of valuation suggest that Federal support to selected electricity consumers has declined since 1990 (Tables ES5 and ES6). Estimates of support identified through the return on assets approach show the steepest decline, from \$3.3 billion in the high estimate for 1990 (in 1999 dollars) to about \$1.6 billion in 1998. The estimates developed under the market price methodology fell from \$1.9 billion in 1990 to \$1.4 billion in 1998. Interest rate

supports to the TVA, BPA, and the three smaller PMAs in 1990 could not be reestimated, because certain historical data were not available. Supports provided through direct loans and loan guarantees administered by the Rural Utilities Service do not appear to have declined. Explicit supports have remained about the same, ranging from \$1 billion to \$1.6 billion, and implicit liabilities may be much larger.⁷ Despite the nominal magnitude of these estimates, they are small when compared to total electricity revenues. The highest estimate, \$2.145 billion, amounts to only 1 percent of total electricity revenues in 1998; and the low estimate, \$325 million, amounts to only 0.1 percent of total electricity revenues in 1998.

Table ES5. Summary of Federal Support to Electricity Estimated by Three Valuation Methods, 1998
(Million 1999 Dollars)

Program	Method				
	Market Price	Interest Rate		Return on Assets	
		Low Estimate	High Estimate	Low Estimate	High Estimate
Tennessee Valley Authority	—	77	248	228	557
Bonneville Power Administration	732	24	116	190	466
Western Area Power Administration	407	4	90	167	335
Southeastern Power Administration	152	54	94	45	128
Southwestern Power Administration	106	23	41	25	66
Rural Utilities Service	—	144	1,557	—	—
Total	1,397	325	2,145	655	1,553

Note: Totals may not equal sum of components due to independent rounding.
Sources: Estimates presented in Chapter 4.

Table ES6. Summary of Federal Support to Electricity Estimated by Three Valuation Methods, 1990
(Million 1999 Dollars)

Program	Method				
	Market Price	Interest Rate ^a		Return on Assets	
		Low Estimate	High Estimate	Low Estimate	High Estimate
Tennessee Valley Authority	440	—	—	1,257	1,993
Bonneville Power Administration	357	—	—	481	671
Western Area Power Administration	704	—	—	315	435
Southeastern Power Administration	260	—	—	76	118
Southwestern Power Administration	150	—	—	51	74
Rural Utilities Service ^b	—	—	—	—	—
Total	1,912	—	—	2,179	3,290

^aInterest rate estimates for 1990 could not be reestimated using the methodology in this report due to lack of some historical data.

^bEstimates of supports conferred through the Rural Utilities Service could not be reestimated due to lack of some historical data.

Note: Totals may not equal sum of components due to independent rounding.
Sources: Estimates presented in Chapter 4.

⁷See Chapter 5 of this report, page 61.

Energy Trust Fund Outlays

Energy trust funds were described in detail in EIA's September 1999 report on primary energy. The results are briefly summarized in this volume to consolidate all findings. Total outlays for certain energy trust funds have increased since 1992.⁸ Four show percentage increases, led by the Aquatic Resources Trust Fund (359 percent) and the Pipeline Safety Fund (157 percent). Three show percentage decreases, the largest of which is the Nuclear Waste Fund (down 39 percent). Altogether, outlays from the seven trust funds increased by 19 percent, from \$1.95 billion (1999 dollars) in fiscal year 1992 to \$2.3 billion in fiscal year 1999. The ultimate costs associated with these programs, storing high-level nuclear waste or repairing damage caused by leaking underground storage tanks, cannot be known with precision, and many of the costs may be realized far in the future. Therefore, costs associated with these programs are not included in summary totals.

⁸Neither EIA's September 1999 report nor EIA's report of November 1992 evaluated the full costs of trust fund programs because of the difficulty in determining the actuarial sufficiency of the excise taxes.