Federal Energy Subsidies:

Energy, Environmental, and Fiscal Impacts

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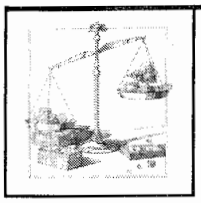
The Alliance to Save Energy
Energy Price and Tax Program
Mary Beth Zimmerman, Program Manager



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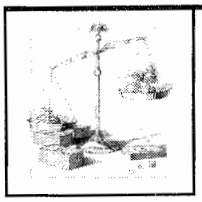

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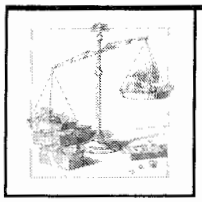

Acknowledgments

This report is dedicated to the many individuals who, over the past 15 years, have worked to bring the issue of energy market distortions to public policy debate. Their efforts began the process of change that this report aims to continue.

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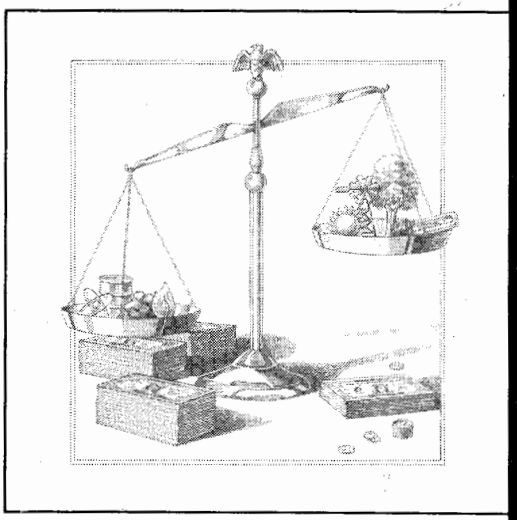
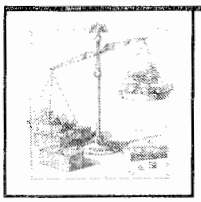




Executive Summary

The historical pattern of federal subsidies for energy supply and energy efficiency refutes the notion that there is a free market in energy. If this damaging pattern is not broken, the United States may fail to achieve its energy, environmental, fiscal and economic goals for the 1990s and beyond. This report on federal subsidies to the energy sector provides decisionmakers with some of the tools necessary to undertake an informed analysis of existing and new policy proposals — and to ensure that our national goals for the coming decades are achieved.

This report defines subsidies as: (1) government-provided goods and services, including risk-bearing, which otherwise would have to be purchased in the marketplace; and (2) reductions in tax burdens compared to standard treatment for a similar activity. We classify subsidies into three broad categories — tax benefits, which include subsidies such as tax credits and reductions in the tax rate; federal agency programs, such as federal ownership of energy enterprises and budgetary expenditures; and other market interventions, such as the assumption of legal risk.

We quantify for most subsidies a range that represents both the subsidy's value at market rates as well as the government's cost for providing it. This distinction, and others, are reflected in the difference between the high and low estimates. The report not only examines subsidies specifically targeted to the energy sector; it also analyzes those which significantly benefit the energy sector but are either generally applicable throughout the economy or are targeted to a sector other than energy.

This analysis is based on the year 1989, the most recent year for which we could obtain complete and reliable data. Where possible, we provide information on the impact and magnitude of the subsidies today.

How Big are Subsidies to the Energy Sector?

Federal subsidies to the energy sector — which includes both energy supply and efficiency — are pervasive and large. Subsidies to energy would have cost individuals and private corporations $36 billion in 1989 if they had to purchase these government-provided benefits. Of this $36 billion, tax benefits accounted for $18 billion, agency programs for $15 billion, and two quantified market interventions for $3 billion.

The five largest individual subsidies in 1989 — accelerated depreciation of energy-related capital stock ($9.6 billion), the Price-Anderson Act limitation on liability for nuclear accidents ($2.8 billion), the Department of Energy's research and development activities ($2.1 billion), the Strategic Petroleum Reserve ($2.1 billion), and the general investment tax credit ($2.0 billion) — accounted for half of the total subsidies. Although two of these individual subsidies (accelerated depreciation of capital stock and the general ITC) are no longer in effect for new investments, they continue to have residual effects. The other three remain active.

Tax Benefits

Of the $18 billion value of tax subsidies, about $12 billion represented tax benefits that were generally available to capital investment, such as the investment tax credit. Tax benefits targeted to specific sectors other than energy but still significantly benefiting the energy sector accounted for $1 billion. And $5 billion went for tax benefits specially targeted to the energy sector. Of the tax benefits targeted to the energy sector, the largest was the tax-exempt interest on bonds used for public power energy facilities ($1.4 billion).

The current tax code does not include a broadly defined investment tax credit, but it is important to note the ITC's influence since efforts to reinstitute it in some form are under way. An ITC favors investment in capital-intensive means of providing energy services — such as mining or drilling, and construction of power plants — over less-capital-intensive alternatives, such as energy efficiency. Nearly one-fourth of the tax benefits taken under the ITC in 1989 were used by the energy sector.

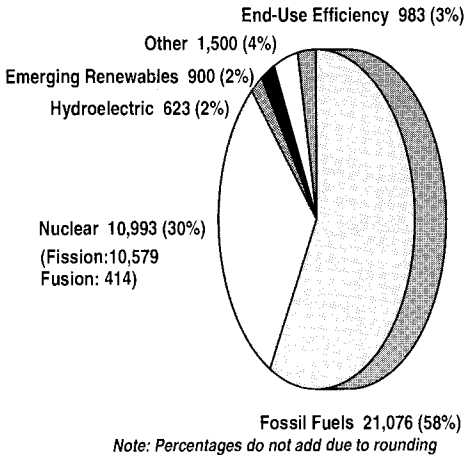
Agency Programs

The largest type of subsidy in the agency program category is federal grants to energy producers and consumers. The largest individual subsidies in agency programs are: Department of Energy R&D ($2.1 billion); the Strategic Petroleum Reserve ($2.1 billion); the Low-Income Home Energy Assistance program ($1.5 billion); the Rural Electrification Administration ($1.2 billion); and the Uranium Enrichment Enterprise ($1.0 billion).

Why is this Subsidy Pattern Damaging?

The pattern of federal subsidies in 1989 promoted poor energy policy for several reasons. First, it represented a radical tilt toward energy supply and away from energy efficiency. End-use efficiency received only $1 worth of subsidies for every $35 received by energy supply ($1.0 billion to $35.1 billion, respectively).

Energy Subsidies in 1989 by Energy Source
[Millions of 1989$]



Note: Percentages do not add due to rounding

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Second, this pattern favors mature, conventional energy resources — fossil fuels, fission-nuclear and hydroelectric — by more than 8 to 1 ($32.3 billion to $3.8 billion) over emerging energy resources such as solar or wind technologies. It may be appropriate to subsidize emerging energy resources, but mature resources should stand the test of the market. When this test is applied to subsidies in 1989, the pattern appears to be almost completely backward. In other words, the mature, conventional energy sources received almost 90 percent of all subsidies.

It is difficult to measure how subsidies distort energy price signals received by the consumer, but it may be helpful to evaluate the subsidy per unit of commodity sold. In the case of electricity, the total subsidies were .73 cents per KwH sold in 1989, or about 11 percent of the average cost of electricity. In the case of oil, the subsidies are 3 cents per gallon of gasoline. There also is significant disparity in the intensity with which the different energy sources are subsidized. Calculated on a subsidy-intensity basis — or, the subsidy per unit of energy consumed or conserved — nuclear fission-based electric power receives more than four times the amount of subsidy (2.0 cents per KwH sold in 1989) than any other source.

This pattern of subsidies also represents poor environmental policy because it encourages the use of polluting and environmentally risky energy sources. Fifty-eight percent of all subsidies ($21.1 billion) directly promotes the use of fossil fuels — over 18 times more than subsidizes efficiency and 23 times more than subsidizes emerging renewable technologies. Given the growing concern in this country about global warming, acid rain and other fossil fuel- related pollution problems, this imbalance is unwarranted. The subsidies are environmentally perverse even within the fossil fuel category — natural gas, the cleanest of the fossil fuels receives the least amount (20 percent) of the subsidies which promote fossil fuel use.

Nuclear fission, which does not produce any carbon dioxide or release other atmospheric pollutants from fossil combustion, received $10.6 billion, or 29 percent of total subsidies. Nuclear fission, however, involves other environmental risks such as low-level waste, decommissioning of plants, the potential for serious accidents, and the proliferation of nuclear material.

What Does This Mean for Taxpayers?

The cost to the taxpayer of providing these subsidies was at least $20 billion in 1989 — $7.7 billion in tax benefits and $12.7 billion in federal program expenditures and obligations. (This report uses the lower end of the range for estimating taxpayer costs.)

How much could the American taxpayer have saved in 1989? One way to answer that question is to consider what would have happened if total subsidies for all supply-side resources had been equal to the subsidy that end-use energy efficiency received. This limitation would have saved taxpayers about $19 billion of the $20.4 billion in 1989.

How much of this $20.4 billion could be saved given today's tax and program provisions? If we first exclude the provisions no longer in effect or programs no longer operating, and then add new provisions enacted or expanded since 1989, we would end up with subsidies totaling close to $17 billion. And if we then set the subsidies for energy supply equal to the $480 million that end-use energy efficiency received, taxpayers could save nearly $16 billion. These savings could take the form of increased tax revenues, reduced outlays, or increased recovery of costs from federally-owned energy enterprises.

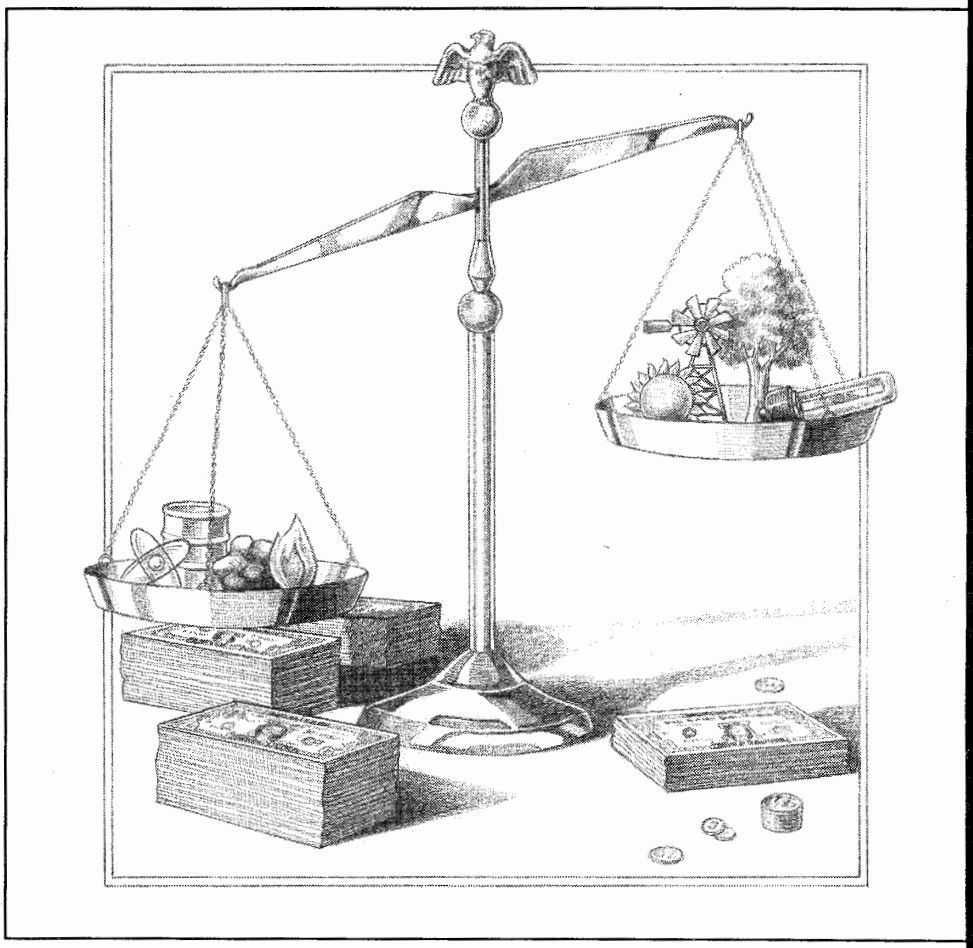
The damaging subsidy pattern identified in this report also adversely affects our economic performance. For example, subsidies to promote the production of oil will also promote the continued use of oil in all sectors. Oil imports already account for two-thirds of the national trade deficit. While oil production subsidies encourage domestic oil production, they also discourage consumers from seeking and private corporations from investing in alternatives to oil.

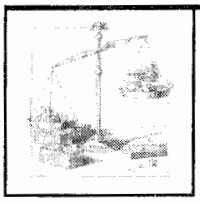
The wisdom of attempting to justify oil production subsidies on the grounds of national security must be challenged. The United States cannot afford to utilize its tax code and other government programs to compete with the geological reality that the remaining cheap, large oil reserves lie outside our borders. For economic and national security reasons, it is time to focus our policies on reducing U.S. reliance on oil, not just on reducing our dependence on oil imports.

Where Do We Go from Here?

It is important to consider the trend and historical pattern in energy subsidies as we evaluate new policy options. The long-term trend in R&D, for example, shows a bias against renewable energy and energy efficiency. If, in looking at this pattern, we find that subsidies for the differing energy resources are equal — which clearly they are not — we must recognize that past subsidies may render our "level playing field" not very level. Infrastructure decisions and other investments have been based on past subsidies, and these market effects can linger long after the subsidy itself is eliminated.

Many of the subsidies in place today were designed to meet specific policy objectives which may or may not still be operative. Others were put in place as an attempt to compensate for a subsidy to another energy source. Our goal is not to suggest that all subsidies are unwarranted, but rather to educate policymakers as they evaluate choices for the future. Decisions on individual policies should be made within the context of the entire picture of federal energy subsidies. This report does not discuss the merits of countering market distortions by eliminating particular subsidies or enacting new ones. We are confident, however, that this country's energy, environmental, fiscal, economic and national security goals can be better achieved through a subsidy pattern that is dramatically different than the one currently in place.





I. Introduction

Government policies and programs have an enormous potential to influence the day-to-day energy choices we make by changing the cost of individual energy resources, by making specific energy forms more or less readily available, and by absorbing or deferring the costs of market and environmental risks associated with particular forms of energy services. This report provides a picture of the nature and extent of federal subsidies to energy supply and energy efficiency as a first step in understanding how our current energy choices have been influenced by federal intervention.

We define subsidies either as government-provided goods or services, including risk-bearing, which otherwise would have had to be purchased in the marketplace, or reductions in tax burden compared to the standard treatment for a similar activity. The report identifies and evaluates subsidies targeted to, or significantly benefiting, the energy sector. To help complete the picture, we also present the most significant federal interventions affecting energy markets, even though they may not constitute subsidies *per se*.

This report compares the level of subsidies accruing to specific energy supply sources and energy efficiency to evaluate:

Energy Policy — How subsidies to energy supply compare with subsidies to energy efficiency investments.

Environmental Policy — How energy subsidy patterns affect environmental and health risks, especially with regard to global climate change.

Fiscal Policy — What it costs taxpayers to provide these subsidies.

Economic Policy — How energy subsidies affect opportunities for economic growth and competitiveness.

We are as comprehensive as possible in identifying and quantifying federal energy subsidies, which we categorize into three broad types of market interventions.

Tax benefits include any tax provision that reduces the effective rate of taxation for participants in energy markets.

Agency programs encompass a wide range of government activities, such as expenditures for R&D programs, low-interest loans, and losses on government-owned enterprises.

Other interventions involve the assumption of legal risks by the federal government, changes in the rules by which people may buy or sell energy services, and federal procurement of energy services and equipment. The "Other Interventions" section includes items that are not traditionally defined as subsidies, but which nevertheless alter energy markets.

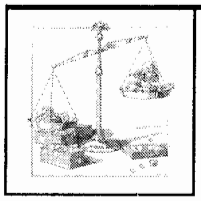
The report quantifies all tax expenditure and agency program subsidies, along with several subsidies identified as "other interventions." We include subsidies to both energy supply and energy efficiency. In developing subsidy estimates, we were careful to net special federal energy taxes out of estimates when appropriate[6] and to calculate high and low figures when there was more than one way to estimate the size of the subsidy. Royalties were assumed to be returns on the sale of federally-owned natural resource assets and are not considered taxes.[7]

Our goal is to promote more informed decisionmaking by providing a framework for analyzing existing policies and new policy proposals. Energy, environmental and fiscal policy choices should be made in light of the complex reality of current energy markets. The presence of large subsidies, many of which have been in existence for decades, belies the notion that there is a "free market" in energy.

Past and present subsidies affect energy markets by changing both the relative prices and the relative risks associated with various energy choices. Subsidies obscure the costs of using energy, making it difficult to assess the real costs and benefits of policy options. Finally, the sheer magnitude, complexity and indirect nature of many energy subsidies make it difficult to trace the impact of individual policy options on energy markets as a whole.

Many of the subsidies in place today were designed to meet specific policy objectives which may or may not still be operative. Others were put in place as an attempt to compensate for a subsidy to another energy source. Although many of these subsidies presently lack sound justification, we certainly do not believe that all individual subsidies are undesirable. By presenting a broad picture of energy market distortions, however, we hope that this report will facilitate sound policy choices for the 1990s and beyond.

Our analysis is based upon the 1989 tax code and federal budget, and it incorporates the sweeping changes instituted in the 1986 Tax Reform Act. It provides a more comprehensive snapshot of the magnitude of federal energy subsidies than previously assembled. Major changes in the tax code and other provisions that have occurred since 1989 are noted in the text. A companion piece being released by the Alliance To Save Energy later this year will evaluate energy tax provisions at the state and local levels.



II. Federal Energy Subsidies are Pervasive and Large

What is a Subsidy?

Subsidies are government-provided goods or services, including risk-bearing, that otherwise would have had to be purchased in the marketplace. Subsidies also can be reductions in tax burdens compared to the standard treatment for a similar activity.[8] Government-provided risk-bearing includes many intangible items such as insurance, indemnification, or other guarantees that reduce the private risk of doing business.[9] Since the federal government provides these benefits at no cost, or at rates below those available in the private market, the recipients of these subsidies are better off than if they had to purchase these items on the market.

The traditional image of a subsidy as a cash payment or tax break from the government to a corporation or individual reflects only a small part of the influence of government on markets. A great deal of market activity entails controlling and sharing the risks and rewards of economic activity. The manner in which these issues are resolved is reflected in pricing decisions and the resulting market structure. Our definition and assessment of energy subsidies incorporates this federal risk-bearing to provide a more comprehensive measure of government impact on markets.

Table 1: Types of Government Subsidies to Energy Markets

Subsidy Type	*Description*
Tax Subsidies (Quantified in this report)	
Tax Credits	Allows a portion of certain expenditures to be deducted from taxes owed.
Reductions in the Tax Rate	Exempts certain activities, products, or entities from taxation, or taxes them at a lower rate than market substitutes.
Reduction in the Tax Basis	Reduces the taxable income on which a given percentage tax is applied by accelerating the timing of tax deductions or by excluding portions of income from the calculation of the tax basis.
Altering the Taxable Entity	Changes the definition of who is required to pay a tax, enabling profits to be offset by losses in other peripheral or unrelated activities. Tax-avoidance strategies include passive investments, and the use of transfer pricing to shift profits to the point of lowest taxation (often foreign countries).
Federal Agency Activities (Quantified in this report; excise fees are netted out where appropriate)	
Federal grants	Reduces the share of total costs borne by the private sector via direct payments to particular energy-related activities.
Loans, Loan Guarantees, and Premium-Financed Insurance Programs	Reduces the costs of access to capital by directly subsidizing interest rates, eliminating premium charged by the lender for default risk, allowing exceptionally favorable repayment terms, or by operating insurance programs at a loss.
Federal R&D	Funds R&D on energy production or consumption, singly or in conjunction with private corporations.
Federal market planning	Reduces market volatility and uncertainty by providing market information and hedges against market disruptions.
Direct federal ownership of assets or of service operations	Provides energy-related products or services at below-market rates.
Administration and regulatory costs	Pays the cost of running the apparatus overseeing market interventions.
Other Interventions (Only Price-Anderson and under-accrual for nuclear decommissioning are quantified in this report)	
Assumption of legal risks/ Indemnification	Regulations which reduce, cap, shift, or eliminate risks that would otherwise be borne by a private company.
Changes in market rules through price regulation, or restrictions on supply- or demand-side alternatives	Regulations which govern access to energy markets, pricing, and terms of sale, and which can dramatically alter the risks and rewards of particular economic activities. These interventions may increase *or decrease* the welfare of the affected parties.
Federal procurement of energy services for internal use	Regulations governing the purchase of energy and energy efficient equipment for federal use.

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Figure 1: A Life-Cycle of Subsidies - The Case of Nuclear Fission

Exploration Support:
U.S. Geological Survey mineral surveys for uranium.

Pre-Production Phase:
DOE fission reactor research.

Primary Transport/Distribution:
Price-Anderson Act indemnification for uranium-transport accidents (for transport of raw materials or nuclear wastes).

Refinement:
DOE Uranium Enrichment Enterprise; ALVIS enrichment research; and operation of enrichment facilities at a loss.

Production:
Capital subsidies through investment tax credits, accelerated depreciation, and subsidized loans through the Rural Electrification Administration and the Export-Import Bank. Price-Anderson Act Liability cap for nuclear accidents.

Secondary Transportation/Distribution:
Capital subsidies and rights-of-way for power transmission infrastructure.

Marketing, Sales, Service, and Consumption:
Below-cost sales of enriched uranium; absence of risk sharing with industry on long-term power contracts between UEE and the Tennessee Valley Authority.

By-product Disposal:
Federal responsibility for nuclear waste disposal in return for a small per-kWh surcharge; DOE cleanup of uranium mill tailings sites.

Post-Operational Closure:
Allowance of under-accrual for plant decommissioning.

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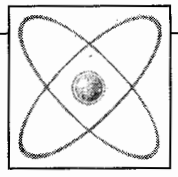

Thirteen Types of Subsidies and Market Interventions Extend Throughout Energy Markets

This report classifies subsidies and market interventions into three broad categories: tax benefits, federal agency interventions, and other interventions. Within these categories, we identify a total of thirteen different types of subsidies and interventions.

Tax benefits include tax credits; other reductions in the tax rate; reductions in the tax basis; or alterations in the definition of the taxable entity that facilitate a reduced tax burden.

Agency interventions include federal grants; direct ownership of assets or service organizations; research and development support; market planning support to reduce market volatility; loans, loan guarantees, and insurance programs; and administrative and regulatory costs. Excise fees levied on energy are netted from agency subsidies to energy where appropriate.

Other interventions include three main areas: the assumption of legal risks through indemnification of private activities; changes in market rules through price regulation, or through entry, purchase or sale restrictions on the supply- or demand-side; and specific federal procurement policies.

Table 1 describes the 13 types of subsidies. To illustrate the subsidy types for those who are unfamiliar with energy markets and programs, Appendix A-1 provides examples of the subsidies from the everyday (if not-so-real) lives of Beth and Bob.

Subsidies exist at every stage of the energy production process

Because subsidies extend throughout the energy production process, from the development of a new idea all the way through mature markets, the evaluation of the impacts of subsidization is very complex. To illustrate this complexity, Figure 1 provides a life-cycle analysis of subsidies for the case of nuclear fission power. The life cycle approach is a useful way to examine differences in federal intervention for evolving, cash-poor technologies versus mature, established technologies. It also delineates risk-shifting to the government. Figure 1, for example, illustrates how the commercial fission industry shifted a significant part of the risk associated with waste-handling, plant-closure, and uranium enrichment away from its investors and customers. Appendix A-2 provides a detailed matrix illustrating the prevalence of energy subsidies throughout energy markets for each energy type.

Establishing Values and Costs for Energy Subsidies

To estimate the magnitude of subsidies to the energy sector, we chose a zero baseline of government spending and policy activity, and developed estimates of both the cost of subsidies to the government and the value of these subsidies at market rates. The value of the subsidies at market rates is a better measure of energy market distortion and the barriers to entry for emerging energy sources. We also annualized multi-year federal capital spending, and losses on federal-ownership of energy facilities or lending programs. This adjustment matches the costs of these multi-

year programs to the period over which the subsidies were provided to the energy sector.

In many cases, our estimate of the cost or value of a subsidy is indicated by a range of figures. The low estimate provides a conservative valuation of the cost to the government of providing the subsidy; the high estimate focuses on the value of the particular benefit at market rates. The high and low estimates also reflect the availability of different methodologies for calculating some individual subsidies. The main sources of difference in the two estimates are presented in Appendix A-3.

We measure subsidies from a "no budget, no tax benefit, no energy policy" baseline

The "proper" role of government is characterized in as many different ways as there are people defining it. Rather than attempting to pick the proper role of government, we build our subsidy estimates from a zero baseline. On the program side, this means that we assume that all expenditures on energy benefit the sector in one way or another.

For tax subsidies, we assume that all tax exceptions constitute a subsidy to the receiving party, and we utilize estimates of the Joint Committee on Taxation and the U.S. Treasury for the amounts of the subsidy. These estimates have already incorporated the effect of Alternative Minimum Tax (AMT) provisions. (The AMT requires minimum tax payments from any private entity earning a profit regardless of available tax preference items and thereby reduces Treasury losses from the existing tax preferences.)

If a provision is theoretically available to all economic sectors, we include the energy portion of it as a subsidy if it provides large benefits to the energy sector or creates a distinct advantage for a certain type of energy resource. For example, general subsidies to capital favor capital-intensive means of producing energy, such as nuclear and coal-based electricity, over less capital-intensive alternatives, such as utility demand-side management programs.

While our baseline takes a broader view of subsidies than typically is employed, it has the advantage of providing a consistent basis for comparing subsidies across energy types. In addition, we provide data on a disaggregated level (in Appendix B) to enable other researchers to adjust our estimates to reflect alternative assumptions.

There is no clear point at which energy markets stop and other markets begin. Federal subsidies to industry, transport and real estate will all influence energy consumption patterns in some way. We limit our analysis by including transport subsidies only as they affect the distribution of energy, ignoring subsidies that shape modal choice (see Appendix A-4 for more detail on transport issues). We include real estate subsidies that appear to directly reduce the cost of efficiency in buildings, but not subsidies that affect density patterns or the choice between multi- and single-family homes, or otherwise indirectly influence energy demand. Finally, we include at least some of the agricultural subsidies that influence the cost of biomass fuels, primarily ethanol from corn.

Our baseline also includes a number of government activities that provide non-energy benefits, such as national security (although it does not consider U.S. forces stationed in the Persian Gulf to protect oil shipping lanes) or environmental protection, where these activities provide significant benefits to the energy sector as well. For example, the Strategic Petroleum Reserve has a national security component, but also specifically benefits oil. With respect to environmental protection, we regard federal expenditures intended to identify and mitigate the environmental impacts of producing or using energy as subsidies to the sector.

This baseline is consistent with the view that environmental and other externalities, being by definition uncompensated costs associated with using energy, are subsidies to the sector. Federal spending on environmental mitigation or R&D reduces the costs that would otherwise be borne by private firms were these costs reflected in market prices. Although we do not attempt to quantify the value of environmental externalities to the energy sector, we do provide a more detailed description of them in Appendix A-5 and the accompanying table presents a compendium of studies comparing the relative magnitude of the costs of environmental controls and the damages caused by pollution.

Some government activities we include in the report provide taxpayer-supported benefits accruing in part or entirely to foreign energy producers or consumers. Programs such as Export-Import Bank energy loans share the benefits between U.S. equipment producers and the recipient country. Other programs, such as energy-development grants to developing nations through the Multilateral Development Banks, have a less clear link.[10] Appendix A-6 presents a more detailed description of the international aspect of energy subsidies.

We regard special energy taxes and restrictions on producers as negative subsidies if they are unrelated to externalities and are not user fees. As with externalities, excessive restrictions on energy producers are not quantified. Special energy taxes are deducted from subsidy totals where appropriate. These taxes are explained in detail in Appendix B. Royalty payments are treated as a return on the sale of a federally-owned natural resource (identical to such payments to private land owners) and are not treated as taxes.

A final issue about energy taxes involves tax system bias. For example, the U.S. federal tax system relies heavily on income taxes to raise revenues, while many other countries rely on consumption

taxes, such as the Value Added Tax (VAT). Although examining all of the incentives of various tax systems is beyond the scope of this report, a couple of points are worth noting.

First, the approach taken by both Treasury and the Joint Committee on Taxation (and used here), is that assets should be deducted from taxes as they are used up. Thus, long-term capital is deducted over multiple years while expenditures with a life of less than a year or so are written off immediately. Many tax subsidies result from violations of this principle.

Wind and solar power industries have argued that they are disadvantaged by this approach, since all of their costs are capital costs, which must be deducted from taxes over multiple years. While it is true that the underlying tax principles allow a greater portion of fossil-based power (in the form of fuel costs) to be deducted immediately, it is important to remember that the production of coal, oil and natural gas fuels rely on tremendous capital investments for extraction, processing and transportation. To the extent that the capital used to produce these fuels is treated by the tax system in the same way that capital used to produce wind or solar power is treated (i.e., deducted from taxes over its service life), the price of the fuel would rise accordingly. Unfortunately, many current and past tax subsidies have done just the opposite, allowing the capital costs associated with fuel extraction, processing and use to be written off far more quickly than their realistic service lives.

Second, not all market participants operate under the same tax code provisions. For private citizens, all expenditures other than mortgage expenses and state and local property taxes are made with after-tax income. Expenses for energy services are not tax deductible. For businesses, most expenses are tax deductible. This disparity can introduce some distortions into the decisions each group makes with regard to energy services. This is especially important because, in general, energy efficiency and emerging renewables are the only energy forms produced by households.

Differentiating between the cost of subsidies to the government and their value at market rates

An additional problem with valuing federal subsidies is that many market interventions do not represent a direct cost to the government but do have a financial value to the recipient. We capture this difference in our low and high estimates (see Appendix A-3). Our low estimate includes only the federal government's cost for subsidies provided to the energy sector in 1989, plus the low estimate for the value of the nuclear liability cap under the Price-Anderson Act. We include this cap under the assumption that the federal government should be accruing an internal trust on an annual basis to fund any expected losses. The low subsidy estimate includes conservative assumptions regarding federal accrued losses and liabilities through the government's ownership of energy-related enterprises and management of loan, loan guarantee, and insurance programs.

Our high estimate measures the value of government subsidies at market rates. The high and low estimates differ in two main respects. First, we use less conservative estimates of program losses and federal assumption of legal risks in the high estimate. Second, the high estimate includes market value estimates for government intermediation in financial and insurance markets, as well as the income-equivalent measures for tax subsidies (i.e., the value to the recipient), rather than the direct cost to government. These differences are shown schematically with examples in Table 2.

Size of the Estimate. Many assumptions and measurements are involved in estimating the cost of tax subsidies, loan and loan guarantee interest rate subsidies and defaults, and losses on, or unrecognized closure costs for, government-owned enterprises. Past studies, audits, and surveys of these programs rarely reached the same conclusions on program losses or costs. We eliminated out-of-date or unrealistic estimates and developed high and low estimates based on the remaining studies.

Intermediation value. Because of economies of scale and a very low default risk, government-provided services can provide a market edge for the recipient through access to financing, insurance, or physical resources at better terms, or at a lower cost, than the recipient could obtain in the open market. For example, if an energy-firm receives federal funds at an interest rate that is 3 percent less than the rate offered by a bank, its reduced interest payments are counted as a subsidy in our high estimate, even though they are not reflected in federal outlays.

In addition, federally provided tax benefits are themselves tax-exempt to the recipient, though in many cases the benefits are indistinguishable from income. In such cases, if the government purchased an identical service through budget outlays and gave it to the current recipient of the tax benefit, that grant would enter into the recipient's *pre-tax* income. The fact that tax benefits increase *after-tax* income rather than pre-tax income increases the value of the subsidy to the recipient. This additional value is reflected in the high estimate.

The "Outlay Equivalent" tax expenditure measure in the Federal Budget incorporates this added value. Consider the following example regarding the percentage depletion tax benefits for oil and gas production in 1989. Treasury estimated the revenue loss of the provision at $390 million (our low estimate), but the outlay equivalent at $530 million (our high estimate), 36 percent higher. The higher measure recognizes the fact that if these tax preferences were replaced with federal grants to oil

Table 2: Types of Government Subsidies to Energy Markets

Subsidy Type	*Monetary Transfers*	*Government Intermediation in Procurement of Economic Goods*	*Regulation/Changing Market Rules*
Impact on Subsidy Estimates	Included in Low Estimate	Partially Included in High Estimate	Included in High Estimate Only in a Few Cases
Tax Subsidies [Quantified in this report]			
Tax Credits	Allows a portion of certain expenditures to be deducted from net taxes owed.	See description below.	
Reductions in the Tax Rate	Conveys a financial advantage in three main ways: ■ **Activities Exempt from Taxation.** Certain activities or products may be exempt from tax. *[Alcohol fuel exemption from motor fuel excise tax; tax-exempt interest payments on certain types of bonds].* ■ **Entities Exempt from Taxation.** Entire entities may be exempted from federal income taxes although they may compete with other providers of the same service that are taxed. *[Some publicly-owned electric utilities; all federally-owned energy enterprises.]* ■ **Lower Tax Rate.** A particular type of firm or activity pays a lower percentage tax. *[Lower rates on capital gains].*	Many tax expenditure items convey an additional benefit to the recipient. Since the tax benefits are often identical to income, the fact that the tax savings itself is treated as tax-free income increases the real value of the tax subsidy. This incremental value is reflected in the U.S. Treasury's "Outlay Equivalent" estimates, and is the basis for our high estimate for tax subsidies. *[Applies to many special tax provisions].*	
Reductions in the Tax Basis	Reduces the taxable income on which a given percentage tax is applied in two main ways: ■ **Timing.** Firms may be allowed to deduct costs of investments from taxable income much faster than the investments actually depreciate. The reduction in current taxes rather than future taxes is worth more since the current tax savings could be invested and earn interest. *[Accelerated depreciation on plant and equipment].* ■ **Amount.** The exclusion of certain portions of income from taxation conveys a benefit on the methods that produce that type of income. *[Tax-free dividend re-investment allowance for public utilities (inactive); percentage depletion allowance (which allows tax deductions which are greater than the amount actually invested)].*	See description above.	
Altering the Taxable Entity	Redefining the taxable entity may enable profits to be offset by losses in other peripheral or unrelated activities. ■ **Exceptions to General Rules of Taxation.** Exceptions to general rules on consolidation of tax returns can give rise to subsidies. *[Allowing passive losses in oil and gas drilling to offset profits in other areas].* ■ **Shifting Profits in a Vertically-Integrated Corporation.** When the taxable entity is difficult to define and transactions between divisions are done at artificially-set transfer prices, profits can be shifted among divisions and countries to minimize the tax burden. *[The oil industry used shipping subsidiaries in the 1970s in this manner].*	See description above.	

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Subsidy Type	*Monetary Transfers*	*Government Intermediation in Procurement of Economic Goods*	*Regulation/Changing Market Rules*
Impact on Subsidy Estimates	**Included in Low Estimate**	**Partially Included in High Estimate**	**Included in High Estimate Only in a Few Cases**
Federal Agency Activities [Quantified in this report]			
Federal Grants	Direct payments to particular energy-related activities which reduces the share of total costs borne by the private sector. *[MARAD subsidy to U.S. shipbuilders; low-income energy assistance program].*	Direct payments may be tax-exempt. *[Tax-exempt payments to black lung victims].*	
Loans, Loan Guarantees, and Premium-Financed Insurance Programs	Reduces the costs of access to capital by directly subsidizing interest rates, eliminating the premium charged by the lender for default risk, allowing exceptionally favorable repayment terms, or by operating insurance programs at a loss. Reported at cost to government of providing these financial services. *[Rural Electrification Administration loan programs; Export-Import Bank loans and loan guarantees to energy equipment exports (benefiting U.S. suppliers); Federal Crop Insurance Corporation premium subsidies].*	Using the government as a borrowing or risk absorbing agent allows the loan or insurance recipient to benefit from the government's economies of scale in raising funds or insuring risks, reducing costs still further. In addition, the costs to be covered through loan or premium fees do not include any profit margin. Beneficiaries of federal borrowing include all agency programs borrowing from the U.S. Treasury or the Federal Financing Bank. Insurance-based programs include the FCIC. *[Eximbank, REA, TVA, FCIC].*	
Federal R&D	Funds R&D on energy production or consumption, singly or in conjunction with private corporations, reducing the risks of innovation. *[Fusion research or research on ways to solve energy-related externalities].*		
Federal Market Planning	Reduces market volatility and uncertainty by providing market information and hedges against market disruptions. *[Strategic Petroleum Reserve, DOE National Response Capability].*	Below private-market government borrowing rates to construct facilities such as the Strategic Petroleum Reserve and to finance its inventory add an incremental subsidy.	
Direct Federal Ownership of Assets or of Service Operations	Provides energy-related products or services at a loss. This benefits the consumer of that product or service. *[Power Marketing Administrations; Uranium Enrichment Enterprise; Army Corps of Engineers maintenance of intercoastal waterways].*	Government lack of any rate of return requirement and absorption of operating risks reduces the cost structure still further.	
Administration and Regulatory Costs	Pays the cost of running the apparatus that oversees these interventions. This is an additional subsidy to the beneficiary markets. *[Administrative costs of running DOE; Nuclear Regulatory Commission oversight of nuclear plants].*		

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Subsidy Type	*Monetary Transfers*	*Government Intermediation in Procurement of Economic Goods*	*Regulation/Changing Market Rules*
Impact on Subsidy Estimates	Included in Low Estimate	Partially Included in High Estimate	Included in High Estimate Only in a Few Cases
Other Interventions [Only Price-Anderson and under-accrual for nuclear decommissioning are quantified in this report]			
Assumption of Legal Risks / Indemnification	Risks borne by the government may be self-insured through payments to an internal risk pool. *[Imputed payments for Price-Anderson risk exposure].*	Reduces, caps, or eliminates the risks associated with later appropriation of returns due to negligence or accidents via federal indemnification or statutes which shift risk onto the surrounding public. *[Price-Anderson liability caps and indemnification for nuclear accidents; oil spill liability caps].*	Implicit absorption of legal risks by allowing private operators to underaccrue for expected future events. *[Underaccrual for nuclear decommissioning costs; cap on nuclear accident liability].*
Changes in Market Rules Through Price Regulation, or Restrictions on Supply-or Demand-side Alternatives			■ **Price:** Restrictions on pricing reduce the ability of market mechanisms to adjust to changes in market conditions for energy and energy services. *[Petroleum price controls (inactive)].* ■ **Supply-side:** Market intervention affecting the type, amount, or timing of supplies through direct ownership of energy resources or production capacity, licensing and right-of-way authorizations, export restrictions, and requirements to use (or not use) certain production inputs. *[Transmission and highway rights-of-way; Jones Act restrictions on foreign shipping vessels].* ■ **Demand-side:** Alters demand patterns through import restrictions and the required purchase of particular energy services. *[Import restrictions on oil and uranium (both inactive)].*
Federal Procurement of Energy Services for Internal Use			Alters aggregate demand patterns through the types of energy services the government itself procures. *[Federal procurement preference for alternative-fueled vehicles].*

Notes to Table and Estimates:

1. Tax expenditures estimates are based on figures published by the Joint Committee on Taxation and the Department of Treasury's Office of Tax Analysis. High estimates reflect Treasury's "Outlay Equivalent" data, which incorporate the fact that tax benefits are treated as tax-exempt income. Low estimates reflect the lower of the Treasury "Revenue Loss" or Joint Tax estimates for each provision. These estimates are allocated to particular fuels based on more detailed data on the parties eligible for each provision. (See Appendix B).

2. Data for subsidies via the federal agencies are primarily from budget and supporting documents from the Office of Management and Budget, the General Accounting Office, and the individual agency. Large scale losses on loans, loan guarantees, insurance programs, or defunct-but-undepreciated capital assets have been spread over the estimated number of years that the program was not properly accruing for losses or writing down its capital. This approach tries to match the costs of the oversight with the benefits that the loan, insurance, or capital users received during the same period.

3. Loan subsidy calculations compare the interest rate charged with the government's cost of borrowing for a comparable period of time using Treasury Bonds. Private market bond data are used to estimate the value of government intermediation in lending programs, and are reflected in the high estimates for these programs.

4. Administrative and regulatory costs are allocated at as low a level as possible within each agency, to better match the costs of administration with the recipient activities.

5. Regulations governing access to energy markets, pricing and terms of sale are included for illustrative purposes but could not be quantified.

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and gas producers, $530 million in federal grants would be necessary to generate the current benefit of $390 million in increased after-tax income.[11]

Regulation/Changes in Market Rules. Federal regulations can provide benefits for private firms without any federal outlay by changing the rules by which energy resources compete with each other and with non-energy goods and services. Regulations can mandate federal purchases of specific energy products, limit liability, limit entry into particular markets, alter the price of energy services, and so on. It is very difficult to quantify the value of these interventions, and not all government regulations are preferential. Many regulations increase energy costs as well. This report simply classifies each regulation and tries to identify whether the intervention is likely to increase or decrease the cost of energy.

Adjusting for Multi-Year Capital Spending and Program Losses

Federal purchases of large energy-related capital, such as the Strategic Petroleum Reserve, will provide multiple years of benefits to oil consumers. Similarly, the cost of defaults on energy loans and loan guarantees, or of cleaning up federally owned energy facilities (such as the uranium enrichment facilities) represent an under-accrual in past years which enabled the government to provide loans or enriched uranium at a lower cost.

To measure the annual benefit of energy subsidies, we amortized these benefits and costs over the number of years in which the capital will be used, or the years in which the federal services were under-priced. The method we used for doing so is described in detail in Appendix B. While this approach often reduced our aggregate subsidy estimate for 1989 (and increased it in other years), it provided a much better measure of the annual benefits accruing to the energy sector. In addition, it reduces the volatility of the subsidy estimates from year to year.

Table 3: Largest Federal Subsidies to Energy in 1989
[Energy Shares—Millions of 1989$]

Provision	*High Est.*	*% of Total*	*Low Est.*	*% of Total*	*Type*	*Status*
ACRS/Accel. Deprec. of Machin. & Equip.	9,568	26.5%	2,763	13.0%	Tax, Basis	Residual
Price-Anderson Cap on Nuclear Accident Liability	2,750	7.6%	832	3.9%	Indemnification	Active
DOE Energy R&D	2,125	5.9%	1,975	9.3%	R&D	Active
Strategic Petroleum Reserve	2,062	5.7%	1,737	8.2%	Mkt. Planning	Active
ITCs: New Machinery and Equipment	1,969	5.5%	766	3.6%	Tax, Credit	Residual
Low Income Home Energy Assistance Program	1,513	4.2%	1,513	7.1%	Grants	Active
Tax-Exempt Bonds, Public Power Facilities	1,387	3.8%	1,138	5.4%	Tax, Rate	Active
Rural Electrification Administration	1,184	3.3%	1,123	5.3%	Loans	Active
Uranium Enrichment Enterprise	1,027	2.8%	279	1.3%	Ownership	Active
Utility Normalization of Excess Deferred Taxes	996	2.8%	0	0.0%	Tax, Basis	Active
Social Security Admin., Black Lung Payments	892	2.5%	892	4.2%	Grants	Active
Office of Surface Mining Reclamation and Enforcement	879	2.4%	879	4.1%	Grants/ Regulation	Active
Army Corps of Engineers Civil Program	643	1.8%	643	3.0%	Ownership	Active
DOE Waste Management	620	1.7%	620	2.9%	Ownership	Active
Power Marketing Administrations	616	1.7%	427	2.0%	Ownership	Active
Tax Exclusion, Electric Coop. Income	565	1.6%	403	1.9%	Tax, Rate	Active
Tax-Exempt Bonds, Pollution Control Equipment	563	1.6%	461	2.2%	Tax, Rate	Residual
Percentage Depletion Benefits: Oil and Gas	530	1.5%	390	1.8%	Tax, Basis	Active
Export-Import Bank	499	1.4%	434	2.0%	Loans	Active
All Others	5,686	15.8%	3,954	18.6%		
Total All Subsidies	*36,074*	*100.0%*	*21,230*	*100.0%*		

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Federal Subsidies to the Energy Sector in 1989 Are Valued at $36 Billion

The federal subsidies to the energy sector in 1989 would have cost energy producers and consumers roughly $36 billion in the private market. This estimate is based on the value at market rates of the federal government's provision of tax subsidies, agency activities, and the Price-Anderson nuclear liability cap and under-accrual for nuclear decommissioning costs (classified under the "other interventions" section).

Of total federal subsidies, tax benefits accounted for $18 billion, agency programs $15 billion and the two quantified market interventions $3 billion. Because calculating the value of energy subsidies is not always clear-cut, we give both a low and high estimate for the value of certain subsidies, basing the range of values on different estimators, assumptions, and/or methods of calculation, as shown in Appendix A-3. The $36 billion high estimate includes the higher of the Joint Tax Committee and U.S. Treasury estimates of tax expenditures; it also generally considers the fact that subsidy receipts are not taxed as income and therefore can be included as a value to the firm. The high estimate also reflects higher[12] estimates of the market value of government-provided goods and services, including the reduction in legal risk for private corporations.

The amount of overall subsidy drops to $21 billion if the lower estimates are used. Most of the difference between the high and low estimates is attributable to a few specific subsidies, such as accelerated depreciation and investment tax credits (ITCs) on new machinery and equipment, the Uranium Enrichment Enterprise, and utility retention of excess deferred taxes following the Tax Reform Act of 1986. Subsidies having the largest difference between high and low estimates are detailed in Appendix A-7. Subsidies that take the form of federal outlays are the easiest to identify and quantify, and as a result, direct federal outlays provide more certainty about the extent of federal intervention than do tax benefits or other market interventions. Within the low estimates, agency programs account for the largest portion of energy subsidies.

Using the high estimate, five individual subsidies — accelerated depreciation, the Price-Anderson cap on nuclear liability, DOE research and development, the Strategic Petroleum Reserve, and the ITC — accounted for half of the $36 billion in subsidies in 1989 (see Table 3). While accelerated depreciation and the general ITC are no longer in effect, the other three remain active.

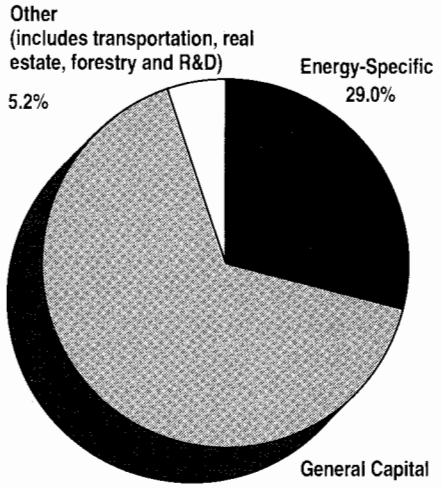
Although some of the larger subsidies in place for 1989 have been phased out, several new provisions have been added, including alternative minimum tax relief for independent oil and gas producers and the establishment of oil spill liability limits. In addition, our estimates do not include a number of federal programs benefiting energy that already were in place in 1989.[13] The energy portions of these programs were independently estimated to be $1.7 billion (in 1989 dollars) in Fiscal 1984.[14] Since a number of the agencies included in this figure are extensively involved in global climate change issues, their energy-related spending in 1989 is likely to be higher than it was in 1984.

Tax Provisions

The tax code subsidizes energy markets in two fundamental ways. The first is through tax preferences, such as an ITC for geothermal technology, that are available only to a specific energy technology or sector of the energy industry. The second is through tax provisions that are generally available and applicable to a broader range of economic activity, and for which the energy sector takes a portion of the benefits that are claimed. The ITC for plant and equipment is one example of such a provision. This report evaluates the impact of both types of provisions.

In 1989, energy tax subsidies' total value to the recipient was $18 billion. This value includes direct revenue losses to the government, as discussed in the section of this report on fiscal impacts, and the value to the recipient of those income-equivalent benefits not being taxed. About $13 billion of this total was due to generally available tax credits, primarily for capital investment; the balance of approximately $5.3 billion was for tax benefits specifically targeted to the energy sector. Figure 2 illustrates the large impact of the generally available tax provisions on the energy sector, accounting for about 66 percent of the tax benefits to energy in 1989.

Figure 2: Capital Tax Benefits vs. Energy-Specific Tax Benefits to the Energy Sector in 1989



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The largest generally applicable tax benefits are those attributable to capital investment. The energy sector extensively used two generally applicable tax benefits to capital — accelerated depreciation and the ITC. In both cases, nearly one-quarter of the tax benefits taken for these provisions accrued to energy supplies, largely because energy production and electricity generation made nearly one-quarter of all capital investments in the United States from 1980 to 1989. Appendix A-8 lists every tax subsidy benefiting energy, and shows which ones are not specifically targeted at the energy sector.

Table 4 identifies the largest of the individual tax subsidies to energy, including both the generally applicable subsidies and the energy-specific ones.

Accelerated depreciation and the ITC for general capital purchases, accounting for $10 billion and $2 billion respectively, were eliminated by the Tax Reform Act of 1986. Due to transition rules and the

multi-year nature of tax benefits stemming from capital investments, the provisions continued to have a large impact on energy markets in 1989.

While the current tax code lacks a broadly defined ITC, it is important to note the ITC's effect on energy markets since proposals to re-institute it in some form are ongoing. We estimate that the energy sector received 23 percent of the benefits from the general ITC in 1989, despite steadily declining capital spending in the sector since 1982. Such tax provisions favor investment in capital-intensive means of providing energy services, such as mining, drilling and power plant construction, over less capital-intensive methods such as efficiency. The large size of these subsidies suggest that current subsidies could grow substantially if these provisions are reinstated in a manner which allowed energy production and electricity generation to be eligible.

This tax credit does not necessarily induce new or accelerated investment, particularly in the case of public utilities with an obligation to serve all customers. In fact, until 1975 utility investments were eligible for a credit only half as big as other investments. In the case of public utilities, an ITC simply lowers the cost of investments that must be made consistent with capacity planning requirements and is likely to bias investment toward conventional power plants and away from efficiency (purchased through demand-side management programs).

Tax-exempt bonds issued by state and municipal governments for a variety of energy-related purposes (public power facilities being the largest energy-related use) represent the second largest tax benefit for energy. Between 1982 and 1989, more than 10 percent of all new tax-exempt bond issues and 21 percent of advanced refunding tax-exempt issues financed energy infrastructure.[15] Additional tax-exempt bonds supported road transportation infrastructure, primarily benefiting the transport of oil. The Tax Reform Act of 1986 specifically provides for the tax-exempt status of many energy related uses of bonds.[16]

Tax-exempt bonds allow investors to exclude interest income from the bonds from taxable income. This exemption should be distinguished from two of the other provisions, the tax-exempt status of publicly owned utilities and the tax exclusion for certain electric cooperatives. The tax-exempt status of public power allows public power facilities to exempt all income from operations from taxation. The tax exclusion for certain electric cooperatives allows the coop to transfer profits to power users tax-free. Although the recipient must then count the funds as income, this approach differs from standard dividends in that no corporate tax has been paid.

Program Provisions

Because energy is involved in nearly every aspect of our lives, energy-related agency programs include most of the civilian portion of the Department of Energy and scattered programs in nearly every other federal agency. In the Department of Agriculture, for instance, the Rural Electrification Administration provides low-cost loans for electric production and distribution. The Department of Health and Human Services operates the Low Income Home Energy Assistance Program (LIHEAP), which helps low-income persons both pay their energy bills and weatherize their homes. The Department of Defense operates the Army Corps of Engineers, responsible for developing and maintaining waterways and ports (which are heavily used to transport coal and oil), as well as defending key foreign oil shipping lanes.

Federal programs accounted for $15.0 billion worth of federal energy subsidies in 1989. Figure 3 breaks out this amount into six types of program subsidies.

Of the six types of agency programs, federal grants to energy producers and consumers

Table 4: Ten Largest Tax Subsidies to the Energy Sector in 1989
[Energy Shares—Millions of 1989 $]

Provision	*High Est.*	*Low Est.*	*Status*	*Target Sector*
ACRS/Accel. Deprec. of Machin. & Equip.	9,568	2,763	Residual	General Capital
ITCs: New Machinery and Equipment	1,969	766	Residual	General Capital
Tax-Exempt Bonds, Public Power Facilities	1,388	1,138	Active	Energy
Utility Normalization of Excess Deferred Taxes	996	0.0	Active	Energy
Tax Exclusion, Electric Coop. Income	565	403	Active	Energy
Tax-Exempt Bonds, Pollution Control Equip.	563	461	Residual	General Capital
Percentage Depletion Benefits: Oil and Gas	530	390	Active	Energy
Alcohol Fuels Excise Tax Exemption	485	300	Active	Energy
Gas and Oil Exception to Passive Loss Restrictions	300	135	Active	Energy
Tax-Exempt Publicly-Owned Utilities	283	283	Active	Energy
Total	16,647	6,639		
Percent of All Tax Subsidies	91.74%	86.37%		
All Other Tax Subsidies	1,499	1,048		

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accounts for more of the program-related subsidies to energy than any other category. The largest of these programs are the Low Income Home Energy Assistance Program ($1,513 million) and Social Security Administration payments to black lung victims ($892 million). The next largest category is federal ownership of energy resources and services. The government is involved in energy production in many ways, including the production and enrichment of uranium for sale to nuclear power facilities, the production and sale of oil from the Naval Petroleum Reserve, and the operation of the Power Marketing Administrations (PMAs), which produce electricity.

Our no-budget baseline means that agency administrative and regulatory costs are included in these figures, since these expenses are ultimately necessary to support specific energy programs. Excluding all of these costs reduces our total subsidy estimates by less than 2 percent. Deducting only general government overhead, but retaining government spending on safety and health oversight (such as for the Nuclear Regulatory Commission) reduces our subsidy estimate by only 0.6 percent.[17]

A comprehensive listing of the magnitude and distribution of energy subsidies provided in 1989 by each federal department is presented in Appendix A-9. High and low estimates are presented separately.

The largest program-related subsidies are for DOE R&D ($2.1 billion), the Strategic Petroleum Reserve ($2.1 billion), the Low Income Home Energy Assistance Program ($1.5 billion), the Rural Electrification Administration ($1.2 billion), and the Uranium Enrichment Enterprise ($1.0 billion). Of these, only the Uranium Enrichment Enterprise has a substantially smaller value in our low estimate (see Appendix A-7). Table 5 presents the largest energy subsidies in 1989 provided through federal agency activities. With the exception of LIHEAP, these expenditures are for long-lived capital projects. Even if these programs were arbitrarily canceled, the federal government would bear large losses from sunk costs such as capital infrastructure and R&D. The annualized value presented in this report is but one portion of many years of large subsidies.

One federal program not included here, the military protection of oil shipping lanes in the Middle East and elsewhere, could enormously impact overall subsidy levels. The magnitude of this subsidy is one of the most difficult interventions to assess since it is so thoroughly incorporated into overall national security efforts. Independent estimates of the cost to the government for this protection (which are not included in our current subsidy totals) range widely from $1 billion to $70 billion.[19]

Other Market Interventions

The federal subsidies to energy discussed above would not provide a complete picture of the federal role in energy markets without consideration of the many ways in which the government intercedes through changes in the structure of energy markets. Broadly, these interventions include: indemnification programs; intervention in market pricing, supply or demand decisions; and federal energy procurement for the government's own use.

Of these other interventions, only two, both involving the government's assumption of private risk, are quantified. These are the limitation on nuclear liability under the Price-Anderson Act and the under-accrual of funds for nuclear decommissioning. Although not all market interventions are defined as subsidies, these two are. These interventions account for a total subsidy value of $832 million (low estimate) to $2.9 billion (high estimate). The Price-Anderson cap on nuclear liability accounts for all of the $832 million in the low estimate and $2.75 billion of the high estimate. Under-accrual for nuclear decommissioning accounts for another $197 million in the high estimate.

The limitations on liability for nuclear power accidents provided under the Price-Anderson Act basically act as an insurance policy taken out by the federal government on behalf of nuclear plant operators and handlers of nuclear fuel, and imposed on the population surrounding the plant and on taxpayers in general. The amount of the subsidy does not represent an actual payment of premiums for this "insurance," but rather an actuarial estimate of the annualized expected cost of the indemnification. We include a value for the Price-Anderson cap in our low estimate even though this doesn't require cash outlays. Our assumption here is that even if the government is self-insuring, it should be making some annual provision for expected losses.

The under-accrual for nuclear decommissioning operates in a similar manner — if the funds to pay for this are insufficient, the remaining costs could well be borne by the taxpayer. Our low estimate assumes that current accruals are sufficient. Both of these items differ from the subsidized insurance programs classified under federal programs in that indemnification is simply a promise to pay. There is no attempt, as there is with insurance programs, to ration risk at least in part through actuarial measurements and risk-adjusted premiums.

Figure 3: Types of Program Subsidies in 1989 [Millions of 1989$]

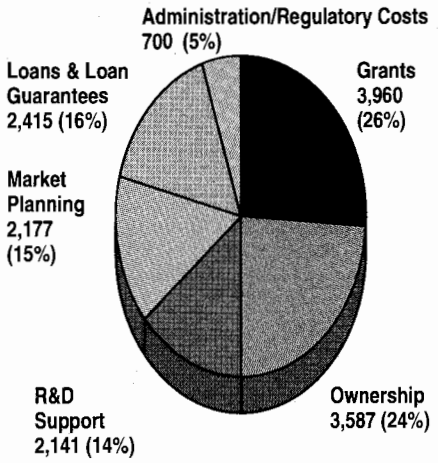

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Table 5: Largest Agency Program Subsidies in 1989
[Energy Shares—Millions 1989$]

Provision	*High Estimate*	*% of Total*	*Low Estimate*	*% of Total*	*Type*
DOE Energy R&D	2,125	14.2%	1,975	15.5%	R&D
Strategic Petroleum Reserve	2,062	13.8%	1,737	13.7%	Market Planning
Low Income Home Energy Assistance Program	1,513	10.1%	1,513	11.9%	Grants
Rural Electrification Administration	1,184	7.9%	1,123	8.8%	Loans
Uranium Enrichment Enterprise	1,027	6.9%	279	2.2%	Ownership
Social Security Admin. Black Lung Payments	892	6.0%	892	7.0%	Grants
Office of Surface Mining Reclamation and Enforcement	879	5.9%	879	6.9%	Grants/Regulation
Army Corps of Engineers	643	4.3%	643	5.1%	Ownership
DOE Waste Management	620	4.1%	620	4.9%	Ownership
Power Marketing Administrations	616	4.1%	427	3.4%	Ownership
Export-Import Bank	499	3.3%	434	3.4%	Loans
Coast Guard	484	3.2%	484	3.8%	Grants
Dept. of Labor Black Lung Trust Fund	349	2.3%	260	2.1%	Grants
All Others	2,089	13.9%	1,445	11.4%	
Total All Subsidies	*14,982*	*100.0%*	*12,711*	*100.0%*	

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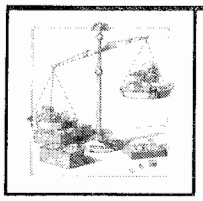
The federal government has many avenues for intervening in market price, supply or demand decisions. On the supply side, for example, federal intervention includes government-established rights-of-way for electric and gas transport, licensing the production of energy from federal lands, imposing restrictions on the sale, transport or use of energy resources (such as the Jones Act restriction on the use of foreign shipping vessels), and establishing performance standards (such as the Corporate Average Fuel Economy standards). Although some provisions, such as performance thresholds, benefit end-use efficiency, we have classified them as supply interventions because they restrict the options for suppliers.

Market interventions by the government on the demand side include restricting the import of energy resources and requiring private purchases of particular energy services (such as the Public Utility Regulatory Policies Act requirement for utility power purchases from independent power producers). Government regulations can also establish prices, either directly through price controls (these were almost completely repealed by 1989), or indirectly through regulation of utility wholesale and interstate transactions. Although such regulation could help these markets mirror competitive markets (by offsetting monopolistic tendencies, for instance), they are interventions nonetheless. Appendix A-10 lists some of these market interventions and our assessment of their impact on energy markets.

The federal government is the largest energy user in the United States, so its procurement of energy resources can affect market structure simply by virtue of the type of products and services it demands. In 1989, the government spent $8.7 billion to heat and power federal facilities and to fuel its transport fleet. Of this, only $45 million, or 1.3 percent (and 0.5 percent of overall spending to purchase energy) of the total energy costs of federal buildings, went to efficiency improvements in those buildings.[20]

Federal purchases of energy services are not inherently subsidies. However, the purchase of energy at prices above the least-cost alternatives would constitute subsidies to the preferred energy source. These subsidies may be explicit policies to foster technological development, as with current purchase preferences for alternative-fueled vehicles. They may also be implicit, as in the purchase of heating and cooling services for buildings even though efficiency improvements would be less expensive. In both cases, the value of the subsidy would be equal to the price premium paid on the energy purchase.

The impact of some of these interventions on energy markets can be as large or larger than the interventions we quantified above for tax and program subsidies. While some of these interventions, such as limitations on liability, clearly benefit the recipient energy type, others may actually penalize or discourage the use of specific energy resources, even while possibly encouraging the use of alternative energy resources. In addition, some interventions change market rules in ways that shift wealth among energy sectors, effectively creating cross-subsidies within energy markets. Because we were unable to quantify the impacts of these changes in market rules in any comprehensive manner, we simply identified the intervention qualitatively, along with our sense of its market impact.



III. Federal Energy Subsidies in Recent Years Represented Poor Energy, Environmental, Fiscal and Economic Policy

Energy markets, and subsidies to those markets, do not operate in a vacuum. The energy choices we make today shape our energy options in the future, the quality of our environment, the productivity of the economy, and our national security. Most of these subsidies also affect the federal deficit and revenue requirements. Unfortunately, although individual subsidies might meet one or more of these policy objectives, energy subsidies as a whole fail to promote our overall energy, environmental, fiscal or economic interests.

Energy Subsidies in 1989 Favored Mature, Conventional Energy Sources by $32.3 Billion to $3.8 Billion over Non-Conventional Energy Resources, and Energy Supply by $35.1 Billion to $1.0 Billion over End-Use Energy Efficiency

Federal energy subsidies in 1989 primarily benefited conventional energy sources. These sources are characterized by mature technologies and an established industry base which is capable of fending for itself in R&D and project financing. We include in this category coal, oil, natural gas, fission and hydroelectric. Although each of these energy sectors could be working on new technologies to utilize a particular fuel (e.g., clean burning coal technologies), this is true of most industries.

Non-conventional energy sources, in contrast, are characterized by a small installed base and immature technologies. We include in this category emerging renewables (primarily non-ethanol biomass, solar, wind and geothermal), waste-to-energy, ethanol, end-use efficiency, supply efficiency and fusion.

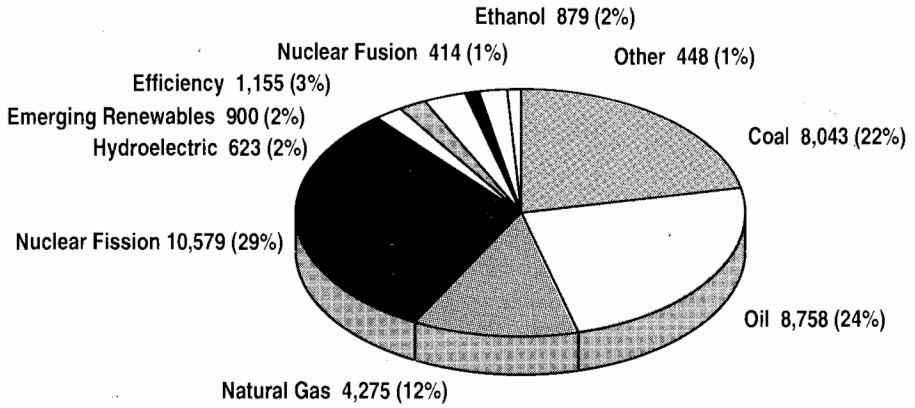
Federal subsidies favoring conventional fuels reduced the costs of innovation and new capacity in mature and conventional industries, increasing the barriers to entry for newer, cleaner and emerging technologies. Two conventional energy sources, fossil and fission nuclear, easily dominate federal subsidies, receiving more than $31 billion (or 87 percent) of the total $36 billion in energy subsidies in 1989 (see Figure 4). Using the low estimates reduces this share to 85 percent.

Even if we ignore tax provisions which have been phased out, fossil and fission energy still account for 84 percent of the continuing subsidies under the high estimate. Subsidies such as oil spill liability limits and alternative minimum tax relief for independent oil and gas producers, introduced since 1989, could further increase this percentage. Similarly, including a mid-point estimate of the cost of defending oil imports ($35 billion) would increase the conventional energy share of subsidies to 93 percent (see Appendix B for more detail on the defense costs of oil transport).

In contrast, emerging renewable energy resources — non-ethanol biomass, solar, wind and geothermal — receive only $0.9 billion, or 2.5 percent of total subsidies. Individual emerging renewable options receive only 0.1 percent to 1.1 percent of the total pie. Even if ethanol and waste-to-energy are included, the figure rises only to 6.1 percent. Table 6 identifies subsidies by energy source. Subsidies accounted for by electricity generation are allocated to the fuel used to create the electricity. A small portion of the subsidies could not be allocated to any particular fuel.

The disparity in subsidy levels is even greater when subsidies to energy supply are compared to subsidies to end-use energy efficiency. End-use energy efficiency receives only $1 worth of subsidies for every $35 received by energy

Figure 4: Shares of Total Subsidies in 1989 *[In Millions of 1989$]*



Note: "Other" includes waste-to-energy and subsidies to general electricity
Percentages do not add due to rounding

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Table 6: Aggregate Subsidies in 1989 by Energy Source [Millions of 1989$]

Energy Source	High	Low	% Shares High	% Shares Low
Fossil Fuels				
Coal	8,042.9	5,557.3	22.30%	26.18%
Oil	8,758.2	5,469.0	24.28%	25.76%
Natural Gas	4,275.2	2,148.7	11.85%	10.12%
Mixed Oil & Gas	(0.4)	(0.4)	0.00%	0.00%
Total Fossil	**21,075.8**	**13,174.6**	**58.42%**	**62.06%**
Nuclear				
Fission	10,578.9	5,039.1	29.33%	23.74%
Fusion	413.6	413.6	1.15%	1.95%
Total Nuclear	**10,992.5**	**5,452.7**	**30.47%**	**25.68%**
Hydroelectric	**623.4**	**377.1**	**1.73%**	**1.78%**
Emerging Renewables				
Non-ethanol Biomass	381.8	260.3	1.06%	1.23%
Solar	175.9	157.6	0.49%	0.74%
Wind	64.2	38.6	0.18%	0.18%
Geothermal	253.8	158.1	0.70%	0.74%
Other (e.g. hydrogen)	23.9	23.9	0.07%	0.11%
Total Emerging Renew.	**899.7**	**638.5**	**2.49%**	**3.01%**
Other Sources of Supply				
Ethanol	879.3	533.7	2.44%	2.51%
Waste-to-energy	404.4	274.1	1.12%	1.29%
Mixed supply	43.7	46.9	0.12%	0.22%
Supply efficiency	**172.1**	**165.7**	**0.48%**	**0.78%**
Total Supply Subsidies	***35,091.0***	***20,663.3***	***97.27%***	***97.33%***
End-Use Efficiency	***983.3***	***566.9***	***2.73%***	***2.67%***
Total Subsidies in 1989	***36,074.3***	***21,230.2***	***100.00%***	***100.00%***
Supply: End-Use Subsidy Ratio in 1989 $ supply/$1 end-use effic.	$35.69	$36.45		

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supplies, or 2.7 percent of total energy subsidies. Even if supply efficiency (improvements in the amount of energy used in fuel processing and electricity generation and transmission) is included, the subsidy is still under 4 percent. While several key non-quantified market interventions support energy efficiency (such as CAFE and appliance standards[21]), many others (such as PURPA, tax-exempt parking benefits, and many agency programs in the Departments of Interior and Defense) support energy consumption.

Calculation of the size of subsidies to emerging energy sectors is complicated by a lack of complete and accurate data on investments in these sectors. This is especially true for those subsidies which require estimates of investments made throughout the 1980s rather than for a single recent year. As a result, we worked from relatively poor investment estimates for these sectors. Although estimating subsidies for emerging energy resources is significantly problematic, even relatively large adjustments to the size of these sectors would have little effect on the overall distribution of subsidies between conventional and emerging energy resources.

The level of energy efficiency investments is even more difficult to quantify. First, many energy efficiency investments only entail process adjustments, such as shifting the rate at which furnaces cycle on and off. Second, investments made in residences are subject to a different set of tax laws than those made by businesses. Third, only a portion of efficiency investments are capitalized and therefore eligible for depreciation benefits (and that portion varies enormously). Therefore, our estimates of energy efficiency investments are very rough and should be treated as such.

Despite these data problems, the bias in federal support toward conventional fuels suggests that subsidies for new and emerging technologies may be necessary in the short term to aggressively develop cleaner, lower-cost and domestically produced energy services. The federal government has taken some steps in this regard. For example, federal support for the development of new energy efficiency technologies has contributed to the widespread adoption of new windows, lighting systems, refrigerators and other products which are at least twice as energy efficient as the products they replaced. And new tax credits are promoting the development of renewable technologies in the solar and windpower areas.

The elimination of many of the subsidies to mature sectors of the energy industry appears to be warranted. These subsidies should be analyzed to determine if they are relevant to today's policy concerns and whether they discourage the development of newer, more productive technologies.

Differences in the types of subsidies received

Although one might expect conventional energy resources to rely relatively more heavily on tax breaks than other types of subsidies, there is actually little difference between conventional and non-conventional energy sources in the portion of subsidies received from tax benefits vs. agency programs. The one exception is for emerging renewable energy sources (non-ethanol biomass, solar, wind and geothermal) where tax subsidies are actually relatively more important (see Table 7). This is largely due to the use of tax benefits by electric utilities for production of geothermal- and biomass- based electricity.

It is clear that the bulk of tax subsidies accrue first to fossil fuels, then to nuclear power, with other energy sources well behind that. The bulk of tax subsidies are due to generally applicable tax benefits, and particularly the subsidies to capital (Table 8). Ethanol and waste-to-energy production are the most dependent on energy-related tax provisions for their federal support. In the

case of ethanol, this is due to the exemption of alcohol fuels to the federal motor gasoline tax; in the case of waste-to-energy production, this stems from the availability of tax-exempt bonds for plant construction.

On the program side, fission dominates the subsidy picture in the federal ownership and administration/regulatory categories; the former primarily due to the Uranium Enrichment Enterprise and the latter to the Nuclear Regulatory Commission. Fossil fuels dominate the remaining categories, with the Strategic Petroleum Reserve and LIHEAP payments to fossil fuel customers providing the most subsidy. End-use efficiency receives the bulk of its agency support in the form of R&D and weatherization grants from LIHEAP. Table 9 provides a complete breakout of agency programs by energy source.

Table 9 shows that subsidies to conventional and "non-conventional" energy sources are relatively equal only for agency R&D support. In all other types of subsidies, conventional fuels dominate the picture. Even within R&D, however, we find that the largest subsidies accrue to coal, fission and fusion. End-use and supply efficiency R&D investments follow, and the remaining subsidies are scattered among various renewable energy forms.

Individual subsidies by fuel source

Within fossil fuels, coal and oil receive $16.8 billion, or 79 percent, of the fossil fuel subsidy of $21.1 billion. The relatively large size of coal subsidies is attributable primarily to black lung programs and capital tax subsidies for electricity generation, a portion of which is derived back to coal. Oil subsidies are dominated by its share of accelerated depreciation of capital assets and by the Strategic Petroleum Reserve. Oil's share of subsidies would grow substantially if defense costs of oil shipping were considered.

Table 7: Types of Subsidies to Conventional vs. Non-Conventional Energy Sources in 1989 *[Millions of 1989$]*

Energy Source	*Taxes*	*Agency*	*Other*	*Total*	*% Shares*
Fossil Total	11,964.3	9,111.5	0.0	21,075.8	58.42%
Coal	4,109.2	3,933.7	0.0	8,042.9	22.30%
Oil	4,706.8	4,051.5	0.0	8,758.2	24.28%
Natural Gas	3,148.3	1,126.8	0.0	4,275.2	11.85%
Mixed Oil & Gas	0.0	(0.4)	0.0	(0.4)	0.00%
Fission	3,887.4	3,744.2	2,947.3	10,578.9	29.33%
Hydroelectricity	226.7	396.8	0.0	623.4	1.73%
Mixed Electric	0.0	43.7	0.0	43.7	0.12%
Total Conventional	**16,078.4**	**13,296.2**	**2,947.3**	**32,322.0**	**89.60%**
Fusion	0.0	413.6	0.0	413.6	1.15%
Emerging Renewables	548.0	351.7	0.0	899.7	2.49%
Waste-to-Energy	404.3	0.1	0.0	404.4	1.12%
Ethanol	538.4	341.0	0.0	879.3	2.44%
Supply Efficiency	0.0	172.1	0.0	172.1	0.48%
End-Use Efficiency	576.3	407.0	0.0	983.3	2.73%
Total Non-Conventional	**2,067.0**	**1,685.3**	**0.0**	**3,752.3**	**10.40%**
Total	*18,145.5*	*14,981.5*	*2,947.3*	*36,074.3*	*100.00%*

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Nuclear energy takes both a conventional form — the fission-based electric power used in commercial power plants — and a non-conventional form — fusion-based power, as yet untried or tested. The bulk of subsides to fission power are from the Price-Anderson indemnification provisions, general tax breaks to capital, the Uranium Enrichment Enterprise, and Department of Energy R&D. In addition, cost overruns and cancellations on nuclear plant construction have generated large losses for the Rural Electrification Administration, the Bonneville Power Administration, and the Tennessee Valley Authority (TVA). Fusion subsidies, of course, are largely limited to R&D programs, since no commercial market exists to take advantage of any other options.

Within renewable energy sources, ethanol and conventional hydroelectric power receive the largest subsidies. Hydropower receives the largest portion of its subsidy through the federal Power Marketing Administrations (PMAs), such as Bonneville Power, and tax-exempt bonds. Subsidies to hydroelectric for Bonneville and TVA are lower than might have been anticipated because of cross-subsidies from this power source to their other activities.

As mentioned above, hydroelectric power users at Bonneville paid for write-offs of large investments in nuclear

Table 8: Energy Sector Tax Benefits in 1989 (Energy-Specific Tax Subsidies vs. Generally-Available Tax Subsidies) *[Millions of 1989$]*

Energy Source	Sector			Total Tax Subsidies	% Targeted to Energy Sector
	Energy	General Capital	Other		
Fossil Fuels					
Coal	1,643.3	2,421.8	44.2	4,109.2	40%
Oil	459.7	3,792.8	454.2	4,706.8	10%
Natural Gas	522.7	2,623.0	2.7	3,148.3	17%
Total Fossil	**2,625.7**	**8,837.5**	**501.1**	**11,964.3**	**22%**
Nuclear					
Fission	1,421.0	2,466.5	0.0	3,887.4	37%
Fusion	0.0	0.0	0.0	0.0	0%
Total Nuclear	**1,421.0**	**2,466.5**	**0.0**	**3,887.4**	**37%**
Hydroelectric	**158.8**	**67.9**	**0.0**	**226.7**	**70%**
Emerging Renewables					
Non-ethanol Biomass	54.8	115.1	91.3	261.2	21%
Solar	24.4	15.0	0.0	39.4	62%
Wind	13.4	27.0	0.0	40.4	33%
Geothermal	136.3	70.6	0.0	206.9	66%
Other Renewables	0.0	0.0	0.0	0.0	0%
Total Emerging Renewables	**228.9**	**227.8**	**91.3**	**548.0**	**42%**
Other Sources of Supply					
Ethanol	505.0	33.4	0.0	538.4	94%
Waste-to-energy	319.6	84.7	0.0	404.3	79%
Supply Efficiency	**0.0**	**0.0**	**0.0**	**0.0**	**0%**
Total Supply Subsidies	**5,259.0**	**11,717.7**	**592.4**	**17,569.2**	**30%**
End-Use Efficiency	**1.3**	**219.2**	**355.8**	**576.3**	**0%**
Total Subsidies in 1989	***5,260.3***	***11,936.9***	***948.2***	***18,145.5***	***29%***

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power. Had these losses not existed, break-even power charges could have been reduced. We net out the effect of these cross-subsidies by charging them to the beneficiary activity (nuclear) and rebating that amount to the existing BPA power mix. This reduces the size of the BPA subsidy to hydroelectric power (see Appendix B for more details).

Ethanol receives as much subsidy as all emerging renewables combined. The largest subsidies to ethanol can be attributed to the partial exemption of alcohol fuels from the federal motor fuels tax and from crop insurance and price supports for corn used to produce ethanol. In contrast to the very large subsidies received by other energy sources, only one subsidy to emerging renewables — R&D for solar energy — received more than $100 million in 1989.

Waste-to-energy facilities do not fall neatly into any of the categories described above. Waste-to-energy received $404 million in federal subsidies in 1989, primarily from the issuance of state and local tax-exempt bonds to construct incinerators.[22]

End-use energy efficiency receives the bulk of its benefits through general tax subsidies to capital and real estate, with additional benefits from grant programs focused on low-income weatherization. Energy supply efficiency subsidies are dominated by R&D expenditures, including some $14 million of the clean coal technology program attributed to efforts to improve the efficiency of coal combustion in power plants.

For more information on the largest federal subsidies in 1989 for each type of energy, Appendix A-11 provides a detailed breakout.

The above discussion allocated subsidies to the primary energy source. Subsidies can also be allocated from the viewpoint of final consumption — the electricity, gasoline and other energy forms consumed daily by households and businesses. In this case, subsidies to the production of electricity are allocated to electricity consumption, as are the subsidies to the production of the coal, oil and natural gas in proportion to their use in electricity generation

With over $22 billion in subsidies, electric energy clearly receives the predominant share of subsidies, 61 percent, when viewed from the point of consumption (see Table 10). This is due both to the large role that electricity plays in energy markets and in part due to several large subsidies to electricity production. In addition, because 85 percent of all coal is used by electric utilities, most of the $4.5 billion in subsidies to coal production is attributed to the electric sector. As shown in Table 10, over 80 percent of the subsidies to electricity support coal and fission plants.

Overall, subsidies to electricity production are split fairly evenly between tax and program benefits. The majority of tax subsidies, however, are due to specific energy tax breaks. These include tax-exempt construction bonds, the tax-exempt status of publicly owned utilities, and utility normalization of excess

deferred taxes following the tax rate reduction in the 1986 Tax Reform Act.[23] The electric sector also is a large beneficiary of accelerated depreciation and ITCs for capital investment.

On the program side, the largest subsidies to electricity production include accrued losses on Rural Electrification Administration (REA) loans and loan guarantees, below-cost operation of the PMAs, R&D programs, and operation of the NRC. In addition, the many subsidies to fission power (of which DOE R&D support and uranium enrichment are the largest) support the electric sector.

Oil receives the next-largest share of subsidies, 22 percent of the total, as measured at the point of end use. Direct consumption of oil accounts for 98 percent of all oil use, mostly in the form of gasoline and heating oil. The Strategic Petroleum Reserve and accelerated depreciation on pipelines, drilling operations and refineries are the major sources of subsidies to direct oil consumption.

End-use energy efficiency subsidies, of course, remain the same whether viewed from the point of view of primary or end use — there simply is no intermediate stage at which subsidies to efficiency can occur.[24]

When adjusted for the amount of energy consumed, nuclear fission, coal, and electricity receive the largest subsidies of all conventional energy sources

The absolute size of subsidies to individual energy resources provides only one indication of the impact of subsidies on each sector. Another way of evaluating subsidies is in terms of the size of the subsidy relative to the overall size of the sector. Each ton of coal or gallon of oil contains a certain amount of energy, measured in terms of British thermal units (Btus). We can use the Btu measure to compare the amount of subsidy to the amount of energy used, a calculation we refer to as "subsidy intensity." We express this in terms of dollars per million Btus and as a percentage of the 1989 weighted average retail market price to non-utility customers.

We examine subsidy intensities from the point of end-use. We are able to calculate intensities for electricity derived from conventional energy sources, for direct consumption of coal, oil, natural gas and ethanol, and for end-use energy efficiency. Unfortunately, the data necessary to measure intensities for emerging energy resources simply do not exist at present.[25]

As shown in Table 11, the subsidy intensity for electricity exceeds all energy forms but ethanol by almost a factor of 10. Fission power drives this number, with a subsidy level of $5.84/MMBtu, equal to $0.02/KwH. Since fission power starts with the highest absolute subsidy value, and comprises only 7 percent of primary energy consumption in 1989, this high subsidy value is not surprising.

Coal and oil-generated electric power show large subsidy intensities as well, at $1.41/MMBtu and $1.16/MMBtu, respectively. Since approximately 85 percent of all coal is used to produce electricity, coal-generated electric subsidy intensi-

Table 9: Agency Program Subsidies in 1989 by Energy Type
(In Millions of 1989$)

Energy Source	*Grants*	*Ownership*	*R&D Support*	*Market Planning*	*Loan/ Guar. & Ins. Progs.*	*Admin/ Regulation*	*Total*	*% of Total*
Fossil Total	3,602.3	826.9	649.4	2,112.5	1,614.8	305.6	9,111.5	60.82%
Coal	1,947.8	100.8	503.3	7.8	1,106.7	267.3	3,933.7	26.26%
Oil	870.5	636.9	99.5	2,096.2	304.6	43.6	4,051.5	27.04%
Natural Gas	784.4	89.2	46.7	8.5	203.4	(5.4)	1,126.8	7.52%
Mixed Oil & Gas	(0.4)	0.0	(0.0)	0.0	(0.0)	0.0	(0.4)	0.00%
Fission	42.2	2,523.2	366.6	58.5	377.1	376.6	3,744.2	24.99%
Hydroelectricity	93.4	208.8	4.3	0.6	92.7	(3.1)	396.8	2.65%
Mixed Electric	0.1	1.2	42.8	2.1	0.0	(2.4)	43.7	0.29%
Total Conventional	**3,738.0**	**3,560.1**	**1,063.2**	**2,173.7**	**2,084.6**	**676.7**	**13,296.2**	**88.75%**
Fusion	0.7	11.1	392.6	0.0	0.0	9.1	413.6	2.76%
Emerging Renewables	46.2	4.8	292.1	1.0	0.3	7.3	351.7	2.35%
Waste-to-Energy	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.00%
Ethanol	10.6	0.0	0.5	0.0	329.8	0.0	341.0	2.28%
Supply Efficiency	0.3	4.3	165.8	1.3	0.5	0.0	172.1	1.15%
End-use Efficiency	164.9	7.1	226.4	1.3	0.1	7.3	407.0	2.72%
Total Non-Conventional	**222.6**	**27.3**	**1,077.3**	**3.7**	**330.7**	**23.7**	**1,685.3**	**11.25%**
Total	*3,960.6*	*3,587.4*	*2,140.5*	*2,177.4*	*2,415.2*	*700.4*	*14,981.5*	*100.00%*

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ties reflect the allocation of 85 percent of the subsidies to coal production and transport to the electric sector, as well as all subsidies benefiting the electric sector directly. High subsidy intensities for oil-generated electricity primarily result from loan defaults in the REA program. An additional driver for large subsidies to the electric sector is generation and transmission losses. As can be seen by comparing the input and output values in Table 11, it takes three Btus of power for every Btu of electricity produced. As a result, subsidies to energy used in the electric sectors are spread over a smaller consumption base.

Direct consumption of coal, oil and natural gas have substantially lower subsidy intensities than does electricity. Prorating oil subsidies to gasoline shows a relatively low subsidy magnitude of about $0.03/gallon. Subsidies to gasohol, an ethanol/gasoline blend, are more than four times as high, at $0.14/gallon.

The subsidy intensity for end-use energy efficiency is calculated by estimating the reductions in energy demand due to investments since 1973 in energy-efficient technologies such as insulation and efficient motors. This method excludes reductions in energy use due to behavioral changes, such as lowering thermostats or driving less. Since the estimate for efficiency improvements is very rough, the subsidy intensity for end-use efficiency should be regarded in a similar manner. Nonetheless, it is clear that per unit of energy saved, end-use efficiency receives substantially less subsidy than any conventional energy source — 30 percent that of the next-lowest level and about one percent the amount received by fission-electric.

Comparing subsidy levels to the cost of particular energy sources is another useful way to compare across energy types. Viewed from this perspective, federal subsidies are more than 8 percent of the retail cost of energy services. On average, subsidies in 1989 were equivalent to about 11 percent of the cost of electricity from all major sources. Both direct coal use and gasohol receive about $0.13 of subsidies for every dollar spent on the fuels themselves.

Subsidy intensities for direct use of natural gas an oil are somewhat lower. There are over $0.05 of natural gas subsidies for every dollar spent on natural gas, and about $0.04 of oil subsidies for every dollar spent on oil (excluding oil defense costs). If the mid-point estimate ($35 billion) for oil defense costs were included in the subsidy estimate, the subsidy intensity would increase to about $0.17/gallon. This amounts to 20 percent of the average cost per gallon of oil in 1989.

Comparing the amount of subsidy to the price of energy provides guidelines when looking for factors which explain current energy use patterns and the effi-

Table 10: Aggregate Energy Subsidies in 1989 by End-Use Sector
[Millions of 1989$]

Subsidies to Fuel	*High*	*Low*	*% High*	*% Low*
Coal	642.9	505.7	1.78%	2.38%
Oil	8,111.5	4,986.9	22.49%	23.49%
Natural Gas	3,279.0	1,594.3	9.09%	7.51%
Ethanol	879.3	533.7	2.44%	2.51%
Emerging Renewables	149.4	129.7	0.41%	0.61%
End-use Efficiency	983.3	566.9	2.73%	2.67%
Total Direct	**14,045.4**	**8,317.1**	**38.93%**	**39.18%**
Subsidies to Electricity				
Electric-Coal	7,399.9	5,051.6	20.51%	23.79%
Electric-Oil	646.7	482.2	1.79%	2.27%
Electric-Gas	996.2	554.4	2.76%	2.61%
Electric-Fission	10,578.9	5,039.1	29.33%	23.74%
Electric-Hydro	623.4	377.1	1.73%	1.78%
Electric-Fusion	413.6	413.6	1.15%	1.95%
Electric-Waste-to-Energy	404.4	274.1	1.12%	1.29%
Electric-Emerging Renewables	750.3	508.9	2.08%	2.39%
Electric-General	43.7	46.9	0.12%	0.22%
Electric-Mixed Fossil	(0.4)	(0.4)	0.00%	0.00%
Supply Efficiency	172.1	165.7	0.48%	0.78%
Total Electric	**22,028.9**	**12,913.1**	**61.07%**	**60.82%**
Total	*36,074.3*	*21,230.2*	*100.00%*	*100.00%*

Note: *We allocated 85.8% of coal subsidies, 3.2% of oil subsidies and 16.2% of natural gas subsidies to the electric sector to reflect the share of fuels in 1989 that were burned to generate electricity.*

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ciency of energy use in the economy. But, as discussed below, they do not present a complete picture.

The size of energy subsidies is only one aspect of the impact of subsidies on energy markets

Whether viewed in total or on an intensity basis, subsidy estimates do not provide a complete picture of the impact of subsidies on energy markets. The assumption that subsidies translate directly into market advantages must be severely modified to account for the fact that subsidies affect market choices in complex ways. To start, not all subsidies are successful. Large subsidies to synthetic fuels, for instance, failed to create a market for the fuels. Some subsidies, however, clearly help tip the balance toward particular energy sources. Subsidies to capital formation, for instance, encourage the use of nuclear- and coal-based electricity by reducing the economic advantage of less capital- and scale-intensive methods.

In addition to whether or not a particular endeavor becomes successful, there are at least four ways in which the impact of subsidies on energy markets is more complex than a simple measure of subsidy intensity would imply:

First, subsidies to conventional energy resources discourage exploration into new energy options. Subsidies to conventional or mature industries can discourage the development of new energy resources by obscuring the costs and risks of continued reliance on a narrow set of existing energy resources. The existence of a Strategic Petroleum Reserve as a buffer against unstable international oil markets makes it much safer for oil users to continue their dependence on oil rather than seek opportunities to diversify their energy choices. If oil consumers were obliged to pay for the protection provided by the SPR, they would be more likely to seek alternative means of hedging against oil market fluctuations, including diversification into alternative energy resources.

Table 11: Subsidy Intensities in 1989 by End-Use of Energy

Fuel	*Subsidy $ million*	*Consumption (Quads) Input*	*Output*	*Subsidy $/mmbtu*	*Subsidy as a % of market price*
Conventional Electricity					
Coal	7,400	16.0	5.3	$1.41 (0.48 cents/kWh)	
Oil	647	1.7	0.6	$1.16 (0.41 cents/kWh)	
Natural Gas	996	2.9	0.9	$1.06 (0.37 cents/kWh)	
Fission	10,579	5.7	1.8	$5.84 (2.00 cents/kWh)	
Hydro	623	2.9	0.9	$0.69 (0.24 cents/kWh)	
All conventional elec.	**20,245**	**29.1**	**9.5**	**$2.14 (0.73 cents/kWh)**	**11.3%**
Direct Consumption					
Coal	643		3.0	$0.22 ($5.20/ton)	13.0%
Oil	8,112		32.5	$0.25 (3.2 cents/gallon)	3.8%
Natural Gas	3,279		16.5	$0.20 (21.1 cents/mcf)	5.2%
Ethanol	879			($1.09/gallon)	
End-use Efficiency	983		15.2	$0.06	
Derived Fuels					
Gasoline	2,584		10.8	$0.24 (3 cents/gallon)	2.8%
Gasohol	1,079		0.9	$1.15 (14 cents/gallon)	13.6%

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Second, most subsidies spread benefits very unevenly. Energy market distortions arise because individual subsidies are not equally available, or equally attractive, to all providers or purchasers of energy services. For example, energy efficiency investments made by households are ineligible for business capital tax benefits or tax deductions. Similarly, a production subsidy is more valuable to an established industry than to an emerging industry, where production is several years in the future or where production rates are highly uncertain.

Conventional sectors are nearly always going to be better positioned to take advantage of any particular subsidy, especially tax subsidies, and to press for conditions which make it advantageous to receive the subsidy. For energy efficiency, the problem is compounded by the fact that energy efficiency is often purchased by small businesses and households which, lacking full-scale accounting and legal departments, are less likely to be aware of the availability of particular subsidies or able to take advantage of them.

Third, government absorption of the risks associated with particular energy sources can promote use of those sources far beyond what is reflected in cash contributions. Access to low-cost financing and insurance, the deferral and shifting of risks or future costs, and the lack of a required rate-of-return on

government-owned enterprises all reduce the cost structure of particular energy services. Incorporating the value of low-cost federal financing is fairly straight forward, and this value was included in our high estimates.

Some of the other areas are more problematic to estimate and therefore are not included, even in our high estimate. The value of loan guarantees are included only when the recipient defaulted and the government had to repay the lender. No imputed charge for simply providing the guarantee was added. Appropriate rates-of-return vary by the riskiness of the enterprise. Federal energy-related enterprises span a range of riskiness, and we were unable to estimate appropriate rate-of-return factors for them.

Finally, our estimates of the value for federal indemnification and the deferral of future clean-up costs provide only a crude proxy for the impact of this risk-bearing on market structure. By placing a monetary value on the Price-Anderson nuclear liability cap, for example, we implicitly assume that the private market would provide the required risk-bearing. This was not the case in the 1950s when Price-Anderson was enacted, and is probably not the case today.[26] In cases such as this, we can conclude that without federal intervention to mitigate long-term, highly uncertain risks, the market would never have developed.

Fourth, past subsidies continue to shape current energy choices. Past subsidies continue to exist through the long-lived infrastructure and capital stock they created. Coal- or nuclear-fired power plants built with subsidies available 20 years ago continue to provide a preference for coal and uranium in electric markets. Some of these coal plants were only built because the Fuel Use Act prohibited construction of oil or natural gas plants; nonetheless, once built, operating them on coal continues to be less expensive than replacing them with new natural gas plants. Early R&D priorities in fission power and oil-and-gas exploration and extraction techniques made these activities less risky and more lucrative for the private sector. The nuclear infrastructure that this R&D helped create remains a large part of the existing electricity supply equation.

There are many other examples. Federal funds used to develop intercoastal waterways and deep water channels make it cheaper to deliver coal and oil to markets that would otherwise have had to pay more for fuel transport. Federal spending under the Rural Electrification Administration paved the way for early development of a rural electricity infrastructure which continues to reduce the cost of electricity vis-a-vis solar, propane and other non-grid alternatives.

General subsidies for capital formation, such as those available through the general ITC, tax-exempt bonds, capital gains differentials, and accelerated depreciation have all long encouraged large capital projects. Tax-exempt bonds, for instance, were a key factor in municipal investment in nuclear power plants in the 1970s. All of these subsidies reduced the incentive for investors to find lower-risk investments which required less capital and a shorter planning horizon — the very characteristics generally associated with demand-side management and other energy efficiency programs. Efficiency and emerging renewables started receiving subsidies only in the last two decades, and on a dramatically smaller scale than other resources.

Taken together, these elements indicate that federal subsidies to energy make it much more difficult for energy efficiency and emerging renewables to compete than a simple comparison of subsidies or subsidy intensities might imply. Fossil and fission power are simply less expensive in the marketplace now than they would have been without government subsidies. Even with these subsidies, however, new investments into conventional energy sources are often more costly than emerging energy technologies. Embedded hurdles to changing energy practices, such as the new skills required to evaluate demand-side management investments, also contribute to slowing the transition.

Because the full impact of energy subsidies is felt gradually over time, the subsidies and subsidy patterns described in this report will influence market choices for decades to come. Infrastructure and capital choices made today affect the relative cost of different energy sources as long as the capital is in use.[27] If the tilt of the energy playing field discourages the full incorporation of energy-efficient features into new buildings, for instance, we will pay for that tilt for decades to come in the form of higher-than-necessary energy bills, and possibly in the form of deferred environmental costs.

R&D subsidies in particular can have a large impact on which energy sources emerge as alternatives to conventional sources, and how quickly they become available. Despite some improvements in recent years, the tilt of R&D expenditures toward energy supply options in general, and nuclear and fossil power in particular, suggests a remaining unwillingness to promote the development of clean, safe and forward-looking energy options.

Existing Subsidy Patterns Encourage Polluting and Environmentally Risky Energy Sources

The subsidy patterns described above — away from energy efficiency and emerging renewable energy resources and toward conventional fossil and nuclear sources — shapes not only our energy choices, but the impact of our energy use on the environment.

Subsidies promoting fossil fuels also promote global warming

The world's increased utilization of fossil fuels which release carbon dioxide into the atmosphere is believed to increase the likelihood of long-term global warming. Our pattern of subsidies promotes fossil fuel utilization. Subsidies of over $21 billion, or 58 percent of total subsidies, promote fossil fuels — eighteen times more than subsidize efficiency, and 23 times more than subsidize emerging renewable technologies.

Of the nearly $21.1 billion in subsidies accruing to fossil fuels, $19.6 billion directly promotes carbon emissions by reducing the cost of producing or consuming fossil fuels (see Table 12). This figure excludes spending with an indirect impact on carbon emissions, such as general agency administrative costs, which were allocated to fossil fuels due to their share of overall program-level activities.

Of this amount, $8.8 billion was in the form of tax subsidies to capital which supported the development of infrastructure to extract, refine and use carbon-emitting fossil fuels. While a portion of this investment may have improved the efficiency of existing processes (by improving the work provided per unit of carbon emissions), much of this subsidy undoubtedly encouraged the expanded use of carbon-intensive fuels as well. Since coal-fired power plants are significantly more capital- and scale-intensive than alternatives such as natural gas power plants, capital subsidies indirectly support increased carbon emissions. We were unable to assess the impact of this subsidy on net carbon emissions more precisely.

Carbon receives more subsidies than fission electric and substantially more than efficiency or emerging renewables. While nuclear power does not emit carbon, subsidies to fission power affect the direction of carbon emissions only if they change utility power plant choices at the margin.

There is no question, however, that federal subsidies encourage carbon emissions over efficiency and renewable alternatives which directly compete with fossil fuels. Carbon subsidies in 1989 amounted to about $3.40 per ton of carbon dioxide emitted from fossil fuel combustion that year. While tax code changes continue to phase out a number of significant subsidies to fossil fuels, the power plants, waterways, and mines these subsidies helped create will continue to encourage carbon emissions for at least another 20 to 35 years. According to a Department of Energy analysis which incorporated into its modeling efforts the impact of the Tax Reform Act of 1986 on investment patterns, the phase out of some carbon subsidies addressed by the Act will not be sufficient to avoid increasing carbon emissions in the future.[28]

As Table 12 illustrates, carbon subsidies favor high-carbon coal and oil over low-carbon natural gas by a 3.7-to-1 margin. Obviously, including the defense costs of oil shipping would increase this ratio still further. Furthermore, on a subsidy intensity basis, subsidies as a percent of price are highest for coal — the most carbon-intensive of the fossil fuels. Other federal interventions have also supported high-carbon fuels. The Fuel Use Act, for example, encouraged the development of coal-fired electricity generating capacity which continues to displace natural gas as a source of electricity generation.

Subsidies to nuclear fission have other environmental risks

Nuclear fission receives $10.6 billion, or 29 percent of overall subsidies (see Figure 4). While these subsidies do not promote global warming, subsidies promoting nuclear power generate their own environmental concerns. Low-level waste and decommissioning problems have not been fully resolved. Although many nuclear subsidies are directed toward these areas, the subsidies largely do not reduce environmental risks but rather shift them from utilities to taxpayers (through ultimate financial responsibility) and customers (through health risks of accidents and waste transport).[29] This risk-shifting helps make nuclear power appear more economically attractive than it would be in a free market.

Nuclear proliferation and the possibility of low-probability, high-damage accidents continue to generate concerns, and federal subsidies to new and cheaper uranium enrichment technologies may increase the proliferation risks. Subsidies to new reactor designs intended to address these concerns do not necessarily make existing nuclear options more attractive economically, or deal with waste issues.

Table 12: Subsidies to Increased Carbon Emissions in 1989 *[Millions of 1989$]*

Energy Source	*High Est.*	*% of Total*
Coal & Coal Electric	6,986	35.6%
Oil & Oil Electric	8,446	43.1%
Gas & Gas Electric	4,181	21.3%
Total	*19,613*	*100.00%*

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Environmental risks of emerging renewables and efficiency are much lower

Emerging renewables and efficiency also have been associated with some potential environmental concerns. Manufacturing of photovoltaics and efficient lamps, for example, may involve the production of heavy or toxic metals which must be disposed. Biomass production may involve the use of fertilizers, pesti-

cides and scarce irrigation water;[30] and ethanol combustion releases some air pollution (such as aldehydes). Geothermal power production can have mining-related land and water concerns, and it sometimes emits noxious gases.

In general, however, the waste products from renewable energy production are produced on a local level in much smaller volumes and do not generate the same scale of health and accident risks as do conventional energy sources. In addition, efficiency in buildings, which in the past has spurred concerns over indoor air quality, has evolved so that newer designs and practices are not associated with either increased average radon levels or a deterioration in air quality.

Energy use is a major source of environmental degradation and health risks

Energy use is a major source of environmental degradation, and estimates of the damages or potential damages from pollution from conventional energy sources suggest that the environmental costs of subsidizing conventional energy sources may be very high.[31] For example, fossil fuel combustion comprises more than 54 percent of the emissions contributing to global climate change.[32]

The transportation sector alone was responsible for 66 percent of total U.S. carbon monoxide emissions in 1989, 42 percent of volatile organic compound emissions, 40 percent of nitrous oxide emissions, 5 percent of sulfur dioxide emissions, 31 percent of lead emissions, and 20 percent of particulate matter emissions. Adjusting these figures to include power plant emissions as well would increase many of these figures significantly.[33] The annual health and environmental damages from automobile and power plant emissions is estimated at between $24 billion and $284 billion/year.

The Exxon Valdez oil spill recently highlighted the potential environmental damages associated with the production and shipment of oil. While it is difficult put a price tag on damages from an oil spill, the recent $1.13 billion court settlement in the Valdez incident provides one proxy (although the real cost to Exxon is much less since civil penalties are tax-deductible and the fine is payable over a 15-year period). Appendix A-5 contains a more detailed description of externalities and a series of estimates on the cost of environmental damages.

Ignoring the environmental impact of energy choices is foolish. The public absorbs the costs of environmental damages whether or not energy prices reflect those damages. These costs may be paid directly through prices or taxes to cover the corporate or government costs of environmental protection or cleanup, or they may be paid indirectly through health, natural resource and ecosystem damages.

The subsidies measured here include only a portion of these total costs. We include the government-borne costs of reclamation, environmental oversight, and assumption of legal risks for environmental damages where quantifiable. We do not include the costs of unmitigated environmental damages through premature death, health damages, natural resource damage, declines in property values, and the loss of pristine or well-functioning ecosystems.

In addition, although we do include current spending on energy-related reclamation and remediation projects, this may not be a very good proxy for the real costs of the environmental problems created by past energy-related activities. Often, preliminary spending on environmental cleanups is focused on assessing the magnitude of the problem; the real dollars start to flow much later.

Subsidies to the Energy Sector Cost the Taxpayer at Least $20 Billion in 1989

It cost taxpayers at least $20 billion in 1989 to subsidize the energy sector. This $20 billion included two components — $7.7 billion in tax expenditures and $12.7 billion in federal budget outlays. This estimate includes the annualized cost of losses on lending and insurance programs and government ownership of energy-related enterprises. Due to the timing of payment on these taxpayer liabilities, cash actually paid out in 1989 may be more or less than $20 billion.

To keep our estimate for the cost of these subsidies conservative, we rely on our low estimate of subsidy costs for both revenue losses from tax provisions and program expenditures. The higher estimates of the impact of subsidies, which often include factors such as the value of the subsidy to the recipient and not just the cost to the government, were used for the analysis in the section on the effect of government intervention in the market. The Price-Anderson Act, which does not require annual outlays, was excluded from this part of the analysis, although it was included in all other parts of the study.

How much of this $20 billion could taxpayers have saved in 1989? This is difficult to answer because eliminating one subsidy might allow businesses and consumers to re-direct their energy choices toward another subsidy. We have the option, however, of viewing subsidies from a level playing field. If the total level of all subsidies for individual supply-side resources, for instance, were reduced to the level of subsidies for end-use efficiency ($570 million), taxpayers would have saved about $19 billion of the $20.4 billion spent in 1989. Even if the subsides for individual fuels were equalized at the $570 million received by end-use efficiency, taxpayer costs

would have dropped to $8.0 billion, a 60-percent decline in government costs for subsidizing energy. The detailed individual tax and agency subsidies and their costs to the taxpayer are detailed in the low estimate tables (Appendix A-8 and A-9).

Potential savings today

How much of this $20.4 billion could be saved today? Some of the most costly subsidies in 1989, such as accelerated depreciation and the ITC, are no longer in effect for new investments. Reducing the $20.4 billion in government costs by subtracting amounts for provisions no longer in effect or programs no longer operating, and adding new provisions not in effect in 1989, would leave close to $17 billion that theoretically could be saved if today's programs and investment activities mirrored those of 1989. This would in essence stop the operation of all the remaining subsidies in these categories. Table 13 presents the adjustments made to the 1989 data to derive this value.

Using this approach, subsidies to end-use efficiency, given 1993 statutes and tax code, would be about $480 million. If an equal amount were distributed among all of the energy supply options, nearly $16 billion could be saved today.

The opportunity cost of current spending and R&D patterns should not be overlooked

All government outlays, whether program expenditures or tax breaks, have an "opportunity cost" in terms of foregone chances to use those resources for education, private investment, or other productive uses. This opportunity cost includes not only the lost opportunity for spending the government funds another way, but the costs associated with misplaced private resources as well. For example, government risk-bearing or risk-shifting may encourage heavy private investment into commercial nuclear power. Without these actions, investors may have used that money to support or research other ways to provide energy services — ways that might have had lower societal risks and costs.

The influence that subsidies have on energy markets does not mean that all federal spending on energy is mistaken. Many energy program and tax expenditures are worthwhile, and simply eliminating the Department of Energy's budget is unlikely to be a wise strategy. Nonetheless, energy program and tax choices need to be weighed against alternative uses of public resources. Subsidies also have a second order effect in energy markets. By distorting market prices, they can distort production choices and reduce productivity.

Table 13: Taxpayer Cost of Federal Subsidies Given 1993 Statutes and Tax Code *[$Millions]*

Provision	*Taxpayer Funds Benefiting the Energy Sector*	*Share Accruing to*	
		Energy Supply	*End-Use Efficiency*
Provisions Phased Out Since 1989			
Accelerated Depreciation, Machinery & Equipment	2,763	2,736	27
ITCs, New Machinery & Equipment	766	759	8
Nuclear Regulatory Commission, Unrecovered Oversight Costs	287	287	0
Dept. of Labor Black Lung Trust Fund Interest Holiday	260	260	0
Special Treatment of Alaskan Native Corp. Losses	105	105	0
Accelerated Depreciation, Buildings Other than Rental Housing	65	0	65
Accelerated Depreciation, Rental Housing	3	0	3
Commodity Credit Corporation Corn Disaster Payments	3	3	0
Safe Harbor Leasing Arrangements [34]	(79)	(78)	(1)
Total Subsidies From Phased-Out Provisions/Programs	**4,173**	**4,072**	**101**
Provisions Added Since 1989 [35]			
Expansion of Eligibility for Alternative Fuels Production Credit	440	440	0
Oil and Gas Alternative Minimum Tax Relief	172	172	0
Utility Rebate Tax Exemption	12	0	12
Capital Gains Treatment of Coal Royalties	10	10	0
Expansion of Alcohol Fuels Excise Tax Exemption	9	9	0
Total Increases in Tax Subsidies Since 1989	**643**	**631**	**12**
Adjustment to 1989 Subsidies to Approx. 1993 Level	***(3,530)***	***(3,441)***	***(89)***

Alliance to Save Energy and Douglas Koplow, April 1993

Even subsidies which do not appear on the current balance sheet can be costly

Taxpayers must also be leery of subsidies which do not appear on the government balance sheet in any given fiscal year. Subsidies in the form of deferred risks through guarantees, low-cost insurance, and waivers of legal responsibilities, can generate liabilities in years to come — the nation's current savings and loan bail-outs are an obvious non-energy example.

Deferring risks can also mean not responding to current or potential environmental damages. In energy markets, for example, 1989 taxpayers were paying for such deferred risks as the clean-up of energy-related hazardous waste sites and the payment of black lung benefits for coal miners. Often, even when the costs associated with deferred risk are not borne by taxpayers, they are borne by the society at large through environmental damage or foregone opportunities to develop less-risky technologies.

Increasing dependence on fossil fuels, for example, embodies the risk of future costs related to global warming. Ignoring these risks can result in bad decisions which generate huge losses to taxpayers in the future. In some cases, such losses could be mitigated by reflecting risk in current prices rather than by deferring it through guarantees and low-cost insurance, or — in the case of an externality — by simply ignoring the possible result. The bearing of this risk could be ensured, for example, by requiring that utilities purchase insurance against future legal limits on carbon dioxide if they are utilizing fossil fuels for new capacity.

The U.S. Pattern of Skewed Energy Subsidies Has Serious Adverse Consequences for the Economy

Conventional wisdom holds that lower energy prices help the economy grow. In addition, because some subsidies are worth more to the recipients in private markets than they cost the government in outlays (e.g., by making use of the government's ability to borrow funds for less the private entity can), they may look like good bargains at first. Unfortunately, low energy prices and "free" subsidies are not all benign. Government-provided services may reduce the capital available to private markets (either through more borrowing or more taxes), increasing the cost of money to other sectors of the economy.

Low energy prices are also a mixed blessing. As with capital, labor or other materials, low energy prices stimulate economic growth only when they reflect genuinely low costs of producing and using energy, not artificially low prices created through subsidies. In fact, subsidies which reduce energy prices can actually reduce productivity and the prospect for economic growth. This is because distorted prices discourage the development of least-cost energy and efficiency resources. Likewise, subsidies which obscure the relative risks of various energy options encourage reliance on riskier energy sources without regard for potential future costs.

Productivity and economic growth depend on technological development as well as sound investment patterns. Because our energy subsidies are skewed toward conventional energy sources, they discourage innovation in emerging energy technologies. This is especially important when it comes to energy efficiency opportunities in manufacturing, where efficiency gains are often an integral part of improvements in overall productivity.

Two studies published by the Alliance to Save Energy and several other organizations indicate that there is substantial opportunity for investments in energy efficiency and emerging renewable energy resources which rapidly pay for themselves through reduced energy bills.[36] The dollars saved from reducing the overall cost of energy services are, in turn, available for uses elsewhere in the economy. Due to a lower capital-to-labor ratio for energy efficiency versus power generation, and to increases in overall productivity through efficiency investments, the net impact is likely to be an increase in both output and employment.[37]

Subsidies to conventional energy resources hamper improvements in our trade balance

Energy subsidies can hamper competitiveness in several ways. In the near term, subsidies which promote the consumption of oil also promote continued oil imports. Oil imports already account for over 40 percent of our domestic oil consumption and a full two-thirds of our total trade deficit. Imports are expected to rise substantially over the foreseeable future. While some of the existing subsidies to oil encourage domestic production over current imports (e.g., percentage depletion allowance and expensing of intangible development costs for independent oil producers), these same subsidies also help discourage consumers from seeking alternative energy and efficiency resources. Over a longer time frame, domestic production today can reduce the availability of domestic oil in decades to come.

In time, subsidies to conventional energy resources will also make it increasingly difficult for the United States to compete in growing world markets for renewable energy and energy efficiency technologies. By impeding the development of new energy technologies, we not only limit the opportunity for productivity improvements at home, but the opportunity to market these new products abroad. As other industrialized and developing nations move to develop their own renewables and efficiency industries, we could well become importers of the very products we might have sold abroad.

Subsidies to oil in the name of national security are the result of misdiagnosing the problem of oil security

Many people attempt to justify existing and proposed new subsidies for domestic oil production on the grounds of national security and the need to reduce oil imports. This justification ignores the negative impact of the subsidies in discouraging the market from seeking alternatives to oil. A more appropriate response to improve national security should be to begin reducing our overall dependence on oil, and not just to focus on oil imports. Because of the vast existing oil reserves around the world, and particularly in the Middle East, oil will almost certainly be cheaper to find and extract from resources outside the United States. Continued tax subsidies to compete with geology is not a good long-term strategy.

Many subsidies are not well enough designed to provide their intended benefits

Not all subsidies distort market choices or discourage productive investments. In fact, where energy subsidies take the form of valuable government services or help to compensate for existing market failures and imperfections, they can generate new economic opportunities. Weights, measures, standards, and public health and safety regulations are all examples of traditional government services. Subsidies such as tax breaks for pollution control equipment can help address environmental externalities. Likewise, government-sponsored R&D efforts can compensate for the general tendency of private businesses to under-invest in R&D because some portion of the benefits of that investment are shared with competitors.[38]

Although some subsidies can provide economic benefits, they will do so only if they are well-tailored to the particular goal. Even then, a subsidy may not be the most efficient or even the most equitable way to overcome a market imperfection. Effluent charges, for instance, may be more efficient than tax breaks for pollution control equipment, since the latter does not provide any credit for labor-based reduction efforts, fuel switching, or other potentially lower-cost alternatives.

Even when the government service is clearly worth the cost, it may make more economic sense to fund the service with fees from the affected industry. The cost of nuclear safety oversight provided by the Nuclear Regulatory Commission, for instance, is a government service which should be provided. Nonetheless, the cost also reflects some of the risk associated with using nuclear power, risks which do not exist with other electricity-generation technologies. Therefore, the prices for nuclear power should reflect the cost of this safety regulation.

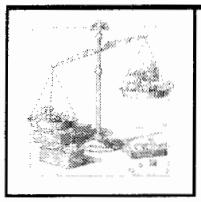
Subsidies may also play a role in compensating for past preferences toward particular energy sources. The substantial subsidies enjoyed by fossil fuels throughout much of this century, as well as the nuclear subsidies of the past four decades, have created a fossil- and nuclear-based infrastructure which can disadvantage the emergence of new energy and energy efficiency resources. Yet even in this case, care must be taken to ensure that new subsidies are effective in changing market behavior and that they represent a least-cost energy market transition.

Not all subsidies bring about the desired market changes. In a study of one application of tax credits for industrial investments into energy efficiency, for example, the Alliance discovered that the particular subsidy had very little impact on the actual decisions being made at industrial plants.[39] As is clear from the subsidy picture in 1989, it is also necessary that any new subsidies, especially when they take the form of general changes to the tax code, be targeted to help ensure that they assist emerging and strategic industries, rather than serve as federal protection for mature and conventional energy sectors.

While subsidies may be warranted under some of the circumstances described above, there is also a danger of these justifications being applied to nearly every proposal. In some cases, the rationale for the subsidy has vanished over time, generally due to changes in external demographics or technological capabilities. Changes in electric generation, for instance, have reduced monopoly conditions in supplying power in that sector. The percentage depletion allowance, enacted to spur mineral production during war time, has also long outlived its original goal. Once given, however, subsidies are generally very difficult to take away.

The presence of widespread energy subsidies must be taken into account in economic analyses of new policy options

Economic analyses of energy policy proposals often conclude that any changes to energy markets are disruptive to the economy. This conclusion is based on an assumption that energy markets are relatively free and competitive. Where subsidies already skew energy choices, however, that assumption simply does not hold and more careful analysis is necessary. To the extent that energy subsidies discourage the use of otherwise cost-effective energy efficiency options, for instance, policies which promote the efficiency investments can have economic as well as environmental and energy benefits. Likewise, to the extent that energy subsidies encourage carbon emissions, policies designed to reduce those emissions also help eliminate or compensate for distortions in energy markets with a net effect likely to be positive for the economy as a whole.



IV. Trends in Federal Energy Subsidies

Energy markets have changed rapidly over the last several decades, as have the federal policies addressing those markets. In many ways, federal intervention in energy markets is on the decline. The days of elaborate price controls for domestic oil and gas production are over, there are fewer restrictions on energy imports from Canada, many fuel use requirements have been eliminated, and several of the largest tax subsidies are being phased out under the 1986 Tax Reform Act. Nonetheless, the full picture is not quite that unidirectional.

Energy Subsidies Appear to Have Fallen Somewhat in the Late 1980s

There have been very few studies undertaken of energy subsidies, and none have been done with the exact methods used here. Nonetheless, a study undertaken by Rick Heede et al. based on 1984 energy outlays provides some opportunity for comparison.[40] The earlier study estimated energy subsidies at $51.6 billion ($44 billion in 1984 dollars), compared to $36 billion in this report.

Table 14 shows that subsidies to all categories other than efficiency and non-hydro renewables have declined. The largest percentage declines were for hydroelectric, fission and fusion. The differences between the 1984 and 1989 estimates are due to three main factors: what spending was included in the study, tax code changes, and changes in market activity.

Spending included. The 1984 study included a number of agencies (listed in Note 13), that were not quantified in this report. In 1984, Heede et al. estimated energy spending from these agencies to be roughly $1.7 billion (1989$). This study, however, includes some spending not present in the Heede report. The largest of these are the Price-Anderson liability cap and Low Income Home Energy Assistance Program. Data on program losses for the Export-Import Bank and the Rural Electrification Administration were also not available for the 1984 estimates.

1989 subsidies that were not available in 1984 also affected the estimates. The largest of these are the Department of Labor's interest holiday on Black Lung Trust Fund debt, and DOE's Clean Coal program.

Tax code changes and market activity. While the Tax Reform Act of 1986 did eliminate some of the most lucrative tax subsidies to energy-related capital formation, such as accelerated depreciation, most facilities being completed in 1989 were still receiving the eliminated tax breaks due to transition rules. Much of the reduction in tax expenditures, therefore, can be explained by the dramatic drop-off in construction spending. Capital investment in the electric utility and oil production sectors in particular fell steadily after 1982, reducing the base from which tax breaks could be taken (see Appendix B).

While new investments would no longer be eligible for many of the capital subsidies that the energy sector received in the 1980s, increased oil and coal production would increase aggregate subsidies noticeably through the many tax provisions that remain for these sectors.

Long-Term Federal R&D Trends Show Historical Bias Against Renewable Energy and Efficiency

Since 1950, fission research has dominated the federal R&D budget (Figure 5). Following the 1973 oil price shock, R&D spending on fossil fuels skyrocketed. Although it fell again early in the

Table 14: Value of Energy Subsidies in 1989 vs. 1984 *[Millions of 1989$]*

Fuel	*1989 Estimate*	*1984 Estimate (1989$)*	*% Change Since 1984*
Coal	4,528	4,378	+3.43%
Crude Oil	8,380	10,441	-19.7%
Natural Gas	3,913	5,407	-27.6%
Fission	10,579	18,245	-42.0%
Fossil Electric	4,256	6,606	-35.6%
Hydroelectric	623	2,753	-77.4%
Efficiency	1,155	1,013	+14.0%
Non-hydro Renewables	2,183	1,989	+9.77%
Fusion	414	711	-41.8%
Mixed Electric	44	N/A	
Total	***36,074***	***51,543***	***-30.0%***

Notes:
- *Non-hydro renewables include biomass (including ethanol), wind, solar, waste-to-energy, geothermal, and other fuels such as hydrogen.*
- *To be consistent across the estimates, the fossil-electric category does not include subsidies to raw fuels which are used to produce electricity.*
- *Estimates are based on different methodologies.*

Alliance to Save Energy and Douglas Koplow. April 1993; Heede, et al, 1985

Reagan administration, fossil R&D has climbed much more rapidly than other energy research since the second oil price shock in the early 1980s. Federal spending on renewables and energy efficiency was virtually non-existent from 1950 through the first oil price shocks, and dropped rapidly again in the early 1980s. Spending on renewables and efficiency increased following the Persian Gulf War, and the combined amount exceeded fission funding for the first time in FY-91. Between 1950 and 1993, almost 50 percent of federal R&D funding supported fission power, versus just over 16 percent for all renewable energy and efficiency technologies combined.

It is equally important to note that R&D dollars are increasingly concentrated in a few large projects, such as the clean coal technology program, and a number of very large, capital-intensive fission and fusion research projects. New initiatives, such as the Superconducting Supercollider, mirror this trend. DOE has taken a positive step in its clean coal program by requiring cost-sharing by the industry. If federal research money continues to be used to support established industries, increased cost-sharing (and potentially equity-sharing) with these industries should be pursued.

Tax Expenditures Have Been Reduced Over the Last Decade

The comprehensive Tax Reform Act of 1986 greatly reduced the tax expenditure provisions benefiting the energy sector, although the residual benefits from transition rules have endured. Special expensing and depletion provisions for oil and gas development have been cut back and restricted to independent producers. The use of tax-exempt bonds has been limited, especially for private purposes. Accelerated depreciation and capital gains benefits have been greatly reduced and the expensing of interest on plant construction costs has been eliminated. These latter provisions had helped capital-intensive industries such as electrical generation.

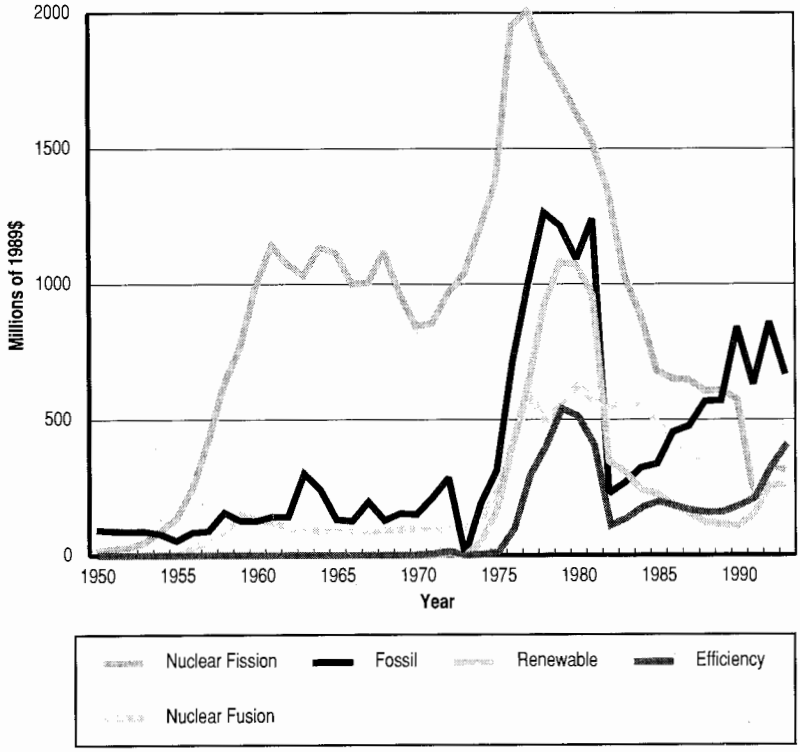
The use of passive losses to offset operating income has also been eliminated in most cases (some oil and gas ventures are the exception), reducing the use of tax benefits as the primary justification for particular forms of economic activity. These are generally positive changes in the tax code which help make taxation a more neutral force in the choice between economic alternatives. However, as our tax subsidy estimates demonstrate, much remains to be done.

Due to the Tax Reform Act's transition rules, most of the facilities which came on line in 1989 had the same tax treatment as those coming on line prior to tax reform. This last burst of subsidized capital infrastructure is now entering production. Assuming that the 1986 tax code changes remain in effect, energy tax expenditures should continue to fall somewhat.

The world of tax breaks is lucrative and dynamic, so changes are likely. Many adjustments were included in the recently passed Energy Policy Act of 1992, and some are outlined in Table 15.

Tax policy is not the only area that is changing. Agency program priorities and federal intervention with market access, pricing and terms of sale are continually adjusted. The Energy Policy Act of 1992 contained a number of important changes in these areas. Perhaps the largest of these changes involve the rules of operation in energy markets. Foremost here is the ability

Figure 5: Historical Federal Spending on Energy Research & Development



Based on data from Bowring (note 3), Battelle (note 5), and Fred Sissine, Energy Conservation: Technical Efficiency and Program Effectiveness, Congressional Research Service, 1/6/92 and 10/23/92.

for the Federal Energy Regulatory Commission to promulgate regulations for transmission access for wholesale power sales on existing power lines. Known as "wheeling," this power, if used, could greatly increase electricity transfer between power districts. The result would be much greater price competition between power producers.

Other important changes to market rules include reduced restrictions on natural gas imports and exports, a streamlined licensing procedure for new nuclear plants, and energy efficiency standards for buildings, appliances, motors, transformers and lighting.

The Energy Policy Act of 1992 altered government ownership of the Uranium Enrichment Enterprise by shifting it out of the Department of Energy and preparing for its eventual privatization. The sale of UEE will likely result in a final write-off of much of its accumulated loss since 1969. The legislation also radically altered federal procurement of energy services by allowing federal agencies to enter into agreements with third parties regarding energy and water efficiency improvements, and to retain the cost savings.

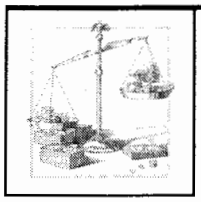
Authorizations for federal research include most energy types, although authorized spending often differs greatly from the manner in which funds are finally appropriated. Interestingly, however, the Act did authorize a National Academy of Sciences study of federal energy subsidies.

Table 15: Tax Subisidies Included in the Energy Policy Act of 1992

Subsidy Type and Description	*Beneficiary Sector [Tax increases denoted by brackets]*	*Total Est. Revenue Loss (Gain) for the 5-Year Period FY 1993-97 ($Millions)*
Tax Credits		
1. Tax credit for electric cars (other clean fuels are ineligible)	Electricity	See Item 3, Altered Tax Base
2. 1.5 cent/kWh production credit for wind energy	Wind	67
3. 1.5 cent/kWh production credit for closed-loop biomass	Biomass	29
4. Permanent extension of solar and geothermal ITCs	Solar and Geothermal	291
5. Extension of non-conventional fuels production credit to 1996	Coal Biomass	290
Altered Tax Rate		
1. Altern. minimum tax relief for indep. oil and gas producers	Oil and Gas	1,023
2. Reduced tax rate on nuclear decommissioning trust funds	Fission-Electric	118
3. Uranium enrichment facility decommissioning assessment (already netted from the Uranium Enrichment Enterprise estimate)	[Fission-Electric]	(745)
Altered Tax Base		
1. Increased tax deduction on employer-provided mass transit benefits to $60/month; capped tax deduction on tax-deductible parking benefits at $155/month	[Auto Transit] Mass Transit	(70)
2. Exclusion of utility demand-reduction payments from taxable income for residential, commercial, and industrial customers [41]	End-use Efficiency	456
3. Deduction for clean-fuel vehicles, refueling stations; tax credit for electric cars	Nat. gas, hydrogen, LNG, LPG, Elec., Ethanol, Meth.	261
4. Tax-exempt bonds for environmental improvements to hydro plants	Hydroelectricity	14
5. Proportional excise tax exemption for alcohol fuels containing less than the current minimum of 10 percent alcohol	Ethanol	151

Alliance to Save Energy and Douglas Koplow, April 1993

Based on data from the Joint Committee on Taxation and the House Committee on Energy and Natural Resources. October 1992.



V. Understanding the Estimates

Estimate Ranges

As discussed earlier, we presented a high and low estimate for many subsidy provisions. This was done, in part, to reflect differences between the cost of the subsidy to the government and its value at market rates. These and other differences in the estimates are explained in more detail in the earlier section.

A "Snapshot" Approach Was Used to Estimate the Magnitude of Energy Subsidies

We selected a "snapshot" approach to estimating the magnitude of subsidies, despite some limitations to this method, primarily because it was the only approach for which the necessary data were largely available. We chose 1989 as our base year because it is the most recent year for which relatively complete data are available.

The snapshot approach does have a several limitations. Government policies may shift on an annual basis. Cash outlays for programs may be spread unevenly over time, as past losses are recognized or long-term capital projects completed. Finally, looking at a single year does not demonstrate the degree to which the installed infrastructure has been subsidized by decades of government support. We have worked to mitigate these drawbacks where possible. We eliminated much of the potential year-to-year volatility by annualizing the costs of capital-intensive and long-term programs. Similarly, cash outlays representing the recognition of past losses were amortized over the period of loss rather than lumped in a single year.

Why We Include Provisions Scheduled for Expiration

By its nature, the snapshot approach freezes a constantly changing picture. Some of the provisions included in this study are now expired and other provisions implemented since 1989 are ignored (Appendix A-8 lists all tax provisions and shows which expiring provisions are included in our estimate). A number of tax provisions were in the process of being phased out in 1989. We included the subsidies from these provisions in our analysis for a variety of reasons.

First, since the provisions are being phased out slowly, they have large residual impacts. Second, the subsidies have permanently affected the cost of capital for the installed infrastructure with which unsubsidized substitutes must now compete, as described earlier. Third, it is useful to understand these provisions in case they or similar measures are re-implemented; this occurred when capital gains differentials were re-established in the early 1990s. Finally, the inclusion of some provisions being eliminated compensates to some degree for the absence of newer subsidies, such as oil spill liability limits (effective in 1990) or alternative minimum tax relief for independent oil and gas producers (effective in 1993).

Enhancements to This Study Could Help Improve the Understanding of Federal Energy Subsidies

Additional information would help to both improve the subsidy estimates presented here and provide a clearer understanding of how they distort energy markets. A more refined allocation of subsidies among energy types would be valuable in those places where we were forced to resort to relatively simplified formulas. Capital subsidies, which were allocated based on shares of capital investment, could be more accurately allocated by an analysis of the difference between the tax and actual service life of the assets in particular energy sectors. Similarly, a number of oil and gas provisions had to be allocated based on drilling activity in the absence of a more precise method.

Averaging multiple years of agency budgets would have allowed us to eliminate any unusual budget swings from one year to the next, although annualizing capital losses and loan defaults eliminated the swings in the most volatile program areas. Aggregate measures of historical market interventions would provide a crude measure of cumulative advantages accruing to each energy type.

This was the approach used in the Battelle Memorial Institute Studies of 1978 and 1981.[42]

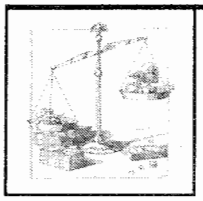
Three other enhancements could help answer important questions about federal intervention. A net present value calculation of existing subsidies would help develop a forward-looking picture of the magnitude of energy subsidies. This approach would be especially useful in evaluating new proposals to assess their total cost to the country. Comparing the subsidies received by non-energy sectors of the economy to those received by other sectors would provide insights on the manner and magnitude of cross-sector distortions in investment. Finally, it would be valuable to trace the impact of energy subsidies on market choices, though this would clearly be extremely difficult and involve a good deal of judgment. All of these areas offer fertile ground for future research.

More Information is Needed About the Actual Magnitude of Individual Subsidies

Total losses to the U.S. Treasury from all tax expenditures — energy and all others—are officially estimated by the Treasury to total over $300 billion/year. While the forecasts of the losses from these provisions provided by the Treasury and Joint Tax Committee are important policy tools, the actual claims under each provision are not made available to the public. With the transition to computerized tax filing, this type of data should be easy to obtain in the very near future and in a timely matter. Widespread availability of this data would be a very important policy tool in developing sound tax policy.

Substantially more information is needed on investments and production in emerging energy sectors. Scattered efforts are under way within the Department of Energy to describe various new energy markets, but full and consistent data are not yet collected and reported. Unfortunately, because of the small size of emerging sectors, even small variations in production or investment estimates, or inconsistencies in the way sectors are defined, can have large impacts on the size of estimated subsidies (although changes in the percentage shares of total subsidies will not be significantly affected).

The federal oversight agencies — the Office of Management and Budget, the General Accounting Office, and the Congressional Budget Office — should also pay particular attention to developing and implementing measures of the value of risk incurred by the federal government.



VI. Conclusions

Our review of federal energy subsidies leads us to highlight a number of important points about energy markets and policy choices in the 1990s.

There is currently no free market in energy. Given the size of federal energy subsidies, now and in the past, it is erroneous to speak of a "free market" in energy. Government intervention in energy markets has much to do with current market structure, in terms of the dominant technologies, the established infrastructure, and even the expected viability of future alternatives.

Subsidy reduction and elimination can help achieve energy, environmental and fiscal policy goals. Because subsidies primarily accrue to conventional and nuclear energy, these are the areas where the greatest savings can be made. These are also the areas with some of the largest environmental concerns, offering significant opportunities for gains in environmental quality and even national security by transitioning to alternative energy resources. Shifting from a backward- to a forward-looking energy strategy would spur the development of new energy and economic opportunities which are likely to offer far more benefits to the nation than a continuation of the current path.

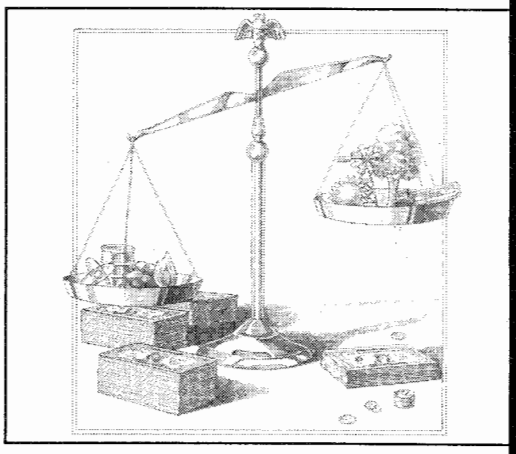
In evaluating a particular subsidy, it is important to weigh the effect of a subsidy on the overall balance of energy policy. Viewing policies in isolation is not enough. Since subsidies often build on subsidies, it may be just as effective to eliminate an existing subsidy as to generate new, counterbalancing subsidies. In addition, new energy and efficiency resources may offer benefits greater than those from the energy type being promoted. While the short term goal of a subsidy might be attractive, it may have serious implications for the future development of energy markets. For example, passive loss exceptions to oil and gas producers were aimed at increasing domestic oil production. However, the tax benefit also slows diversification from oil and encourages earlier domestic production from higher cost reserves.

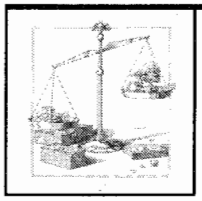
The cost of risk absorption should not be ignored. The transfer of risk to the federal government can look attractive in the short run since it does not require cash outlays. However, the result is often enormous costs down the road. These costs, both in terms of future taxpayer liabilities and in the foregone development of alternative energy resources, must be incorporated into current decisionmaking.

Past subsidies may mean that a "level playing field" isn't very level. The advantage provided to fossil and nuclear energy sources by past subsidies should be taken into account in evaluating future energy options. "Leveling the playing field" through countervailing subsidies or total subsidy elimination would not eliminate the advantages received through previous capital and R&D subsidies to some sectors. Nor is it really possible to determine whether the playing field is level with the frequency and precision necessary to "fine tune" the market.

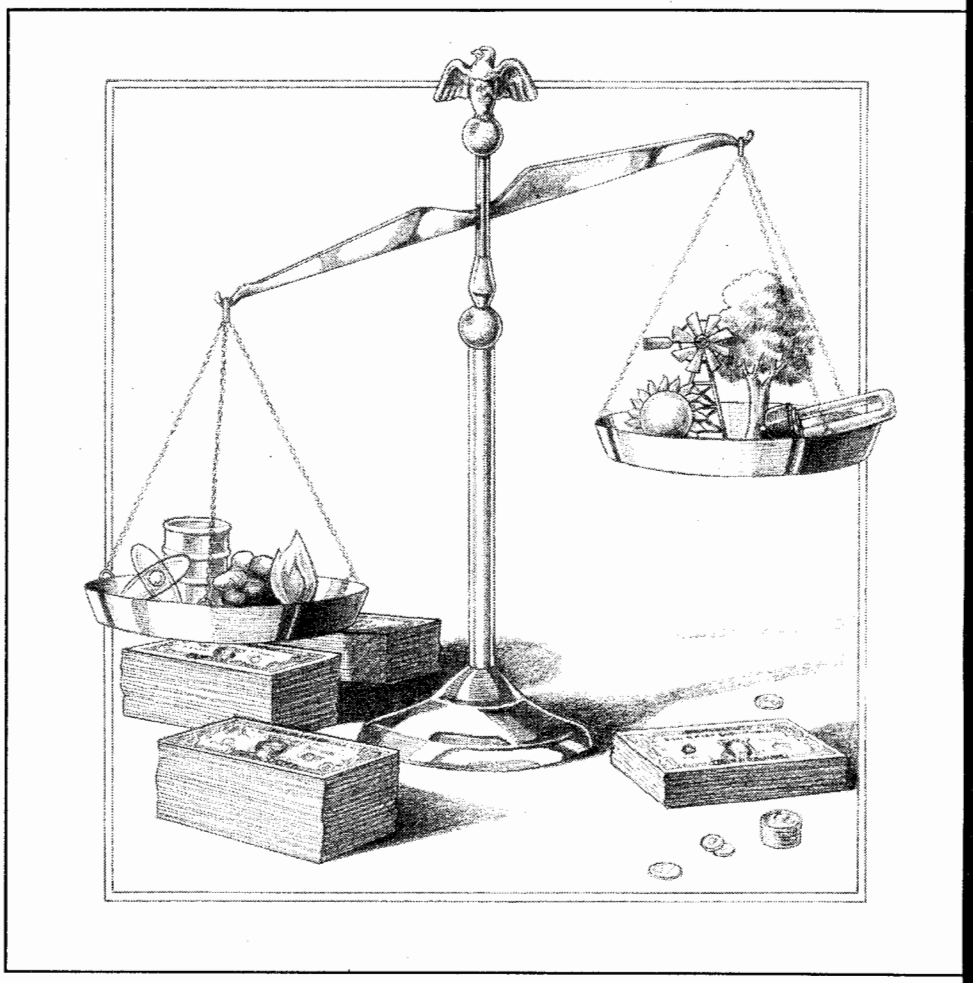
Though the Energy Policy Act of 1992 contains a numbers of positive incentives to increase the reliance on renewables and efficiency (such as production incentives for wind power and the tax-exemption of utility payments for efficiency improvements), additional steps to eliminate market distortions are necessary.

Market distortions from carbon subsidies need to be incorporated into current policy decisions. When estimating the economic cost of proposed policy options, such as carbon emission reduction strategies, subsidy magnitudes and patterns need to be taken into account. These subsidies suggest that we are already using more fossil energy than a free market would have purchased, and more fossil fuel than is best for the economy overall.





VII. Organization of the Detailed Appendices



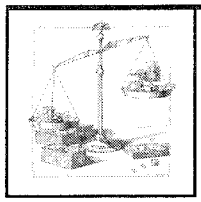
Appendix A is printed in this report. Appendix B comes in two volumes and is printed separately.

Appendix B contains descriptions of each area of government intervention, and presents the derivation of numerical estimates of subsidy magnitude and distribution. Descriptions for each agency program, each tax expenditure, and each direct intervention are provided. A short introductory section precedes each chapter and explains the manner in which the federal government confers benefits (or costs in the case of some provisions presented in the "Other Interventions" section) to particular energy types.

Volume 1 of Appendix B contains three chapters. The Overview is a brief description of the report and contains summary tables for the chapters that follow. Charts presenting the points of intervention in the production cycle, by fuel, are also included in this section. The second chapter is on tax subsidies to the energy sector. This chapter details how each tax provision works, how it is calculated, and a brief historical description. Quantitative estimates and allocations follow for each provision that was included in our subsidy totals. The third chapter examines federal excise fees on energy, and provides qualitative and quantitative information on each provision.

Volume 2 of Appendix B contains four chapters. The first chapter covers Agency Programs and contains detailed information on agency programs related to energy. Text descriptions and quantitative estimates are included. Text descriptions of energy-related activities are included for some agencies for which we did not finalize quantitative estimates. The Other Interventions chapter contains information on the Price-Anderson Act; the under-accrual for nuclear decommissioning; federal restrictions on price setting, or other supply or demand options; and federal procurement of energy for its own use.

The last two chapters in Appendix B provide supporting information for the quantitative calculations generated elsewhere in the report. A background discussion on debt provides details on the historical availability of long-term debt in the United States, and the rationale for the method we used to calculate estimates of interest-rate and financial intermediation subsidies in federal programs. The Statistical Background Data chapter provides numerical spreadsheets of financial inputs; capital spending on energy; energy shares of transport; energy shares of particular environmental problems; a compendium of estimates for the costs of pollution and the costs of environmental regulation; and the derivation of demand-side management and private-sector energy-efficiency estimates.



End Notes

1 *Federal Energy Subsidies in FY 1984: Tax Expenditures*, Draft, (Snowmass, CO: Rocky Mountain Institute, 1989) and *Federal Energy Subsidies in FY 1984: Agency Obligations*, Draft, (Snowmass, CO: Rocky Mountain Institute, 1986).

2 *The Hidden Costs of Energy*, (Washington, DC: Center for Renewable Resources, October 1985).

3 *Federal Subsidies to Nuclear Power: Reactor Design and the Fuel Cycle*, Pre-Publication Draft, (Washington, DC: U.S. Department of Energy, Energy Information Administration, March 1980).

4 *Federal Tax Incentives Affecting Coal and Nuclear Power Economics*, testimony before the U.S. House Subcommittee on Oversight and Investigations of the Committee on Interior and Insular Affairs, October 23, 1981.

5 *An Analysis of Federal Incentives Used to Stimulate Energy Production* and *An Analysis of Federal Incentives Used to Stimulate Energy Consumption*, (Richland, Washington: Battelle Memorial Institute, December 1978 and August 1981 respectively).

6 Energy taxes which finance the alleviation of energy-related problems, or support activities closely tied to the group paying the taxes, are considered user fees rather than taxes and are not subtracted from subsidy totals. See Appendix B for more details.

7 Royalties returned to the Treasury on the sale of federally-owned natural resources constitute a return on the sale of a government asset. These payments are identical in purpose to the payments to private landowners for the rights to extract timber, coal, or oil. We did not find any evidence that federal royalty payments were above market rates and therefore determined that they were not taxes. Nor are royalties counted a program revenues to offset land management costs since in most cases the funds are returned directly to the Treasury and royalty levels do not seem linked to program management costs. Additional research is needed to determine whether federal royalties are less than those charged by the private market, and whether federal natural resource auctions are competitive. This report does not address these issues.

8 The benefits of the subsidies will generally be shared among producers (through higher profits), consumers (through lower prices), employees (through higher wages), and resource owners (through higher rents, royalties, or asset values).

9 Risk-bearing, like any other market good, is often in scarce supply. Since risk-bearing can reduce expected profits, enterprises or individuals often purchase insurance to protect against catastrophic losses. As automobile owners know, insurance for risky activities can be a significant cost.

10 Nations are prohibited from linking their financial support for the Multilateral Development Bank to requirements that the borrowing nation purchase products from them. Nonetheless, U.S. firms have a sizable presence in markets for large-scale power plant equipment and services, and are likely to benefit at least somewhat from the developing nation's ability to purchase energy-sector products and services.

11 U.S. Office of Management and Budget, *Budget of the U.S. Government, Fiscal Year 1992*, p. 3-22.

12 Our high estimate does not necessarily reflect the high*est* estimates in the available literature, but rather the upper range of those estimates we felt are most consistent with our definition of subsidy. Estimates of the value of Price-Anderson indemnification, for instance, range up to $11.7 billion/year. We adopted an estimate of $2.75 billion/year. (The $11.7 billion/year estimate is based on a 1984 National Audubon study, converted to 1989 dollars, and was described in Ken Bossong, *The Price-Anderson Act: A Multi-Billion Dollar Annual Windfall for the Nuclear Industry*, Public Citizen Critical Mass Energy Project, July 1987.)

13 The key areas not included in these totals are energy-related spending by the Environmental Protection Agency, Forest Service, Geological Survey, Bureau of Land Management, Bureau of Indian Affairs, Fish and Wildlife Service, Bureau of Reclamation, National Oceanic and Atmospheric Administration, National Science Foundation, and National Aeronautics and Space Administration.

14 Based on estimates by Rick Heede, *Federal Energy Subsidies: Agency Obligations*, Draft, (Snowmass, CO: Rocky Mountain Institute, 1986); and Rick Heede, Richard Morgan and Scott Ridley, *The Hidden Costs of Energy*, (Washington, DC: Center for Renewable Resources, 1985).

15 Figures include issues for public power facilities, gas utilities, and the energy share of waste-to-energy plants,

pollution control investment, seaports and harbors, and mixed utilities. Advance refundings refer to bonds issued prior to the call dates of earlier issues in order to lock into a favorable interest rate. Since advance refundings yield multiple tax-exempt issues outstanding at the same time, they probably increase the real value of tax losses to the Treasury.

16 Although the interest income from most state and local bonds is not taxed, not all bond uses are tax exempt, and so we treat their availability for energy projects as being energy- rather than capital- related.

17 These calculations exclude mainly federal spending on the Energy Information Administration, the Federal Energy Regulatory Commission, the Mine Safety and Health Administration, the Nuclear Regulatory Commission, and some DOE agency-level overhead, totaling $700 million. Including the spending on safety, health, and the environment (since not all energy options require this oversight) reduces the amount to $225 million, comprised of "general government" administration and oversight.

18 This estimate includes only the costs of building the facility and the interest costs on the oil inventory. It does not include the purchase cost of the actual oil itself, since ostensibly this value will eventually be recovered.

19 Both estimates are cited in Congressional Research Service, *The External Costs of Oil Used in Transport*, June 17, 1992. The low estimate was done by the Department of Defense. The high estimate was done by Earl Ravenal in *Designing Defense for a New World Order: The Military Budget in 1992 and Beyond* (Washington, DC: The Cato Institute, 1991).

20 Mark Hopkins, *Energy Use in Federal Facilities* (Washington, DC: The Alliance to Save Energy, January 1991).

21 While standards may increase the efficiency of automobiles, they also reduce the cost of driving, and the net effect on consumption per automobile (i.e., as opposed to fuel consumption per mile) may be lower than the standard alone would indicate.

22 This figure includes only the energy portion of tax benefits from tax-exempt bond issues. We allocated half of the tax benefits to solid-waste and half to energy to reflect the dual purpose of the facilities.

23 A number of analysts argue that utility normalization of deferred taxes (where the taxes paid by customers are retained by utilities and paid to the government only over many years), is proper because it allows them to benefit from ITCs and other such provisions as intended. However, these analysts do not make the same claim regarding the long-term retention of deferred taxes following a decline in the tax rate, since a portion will never have to be paid to the government.

24 Subsidies to energy efficiency investments made by utilities through their demand-side management programs could be viewed as subsidies to the electric sector. These programs were too small in 1989 to make an appreciable difference in the overall allocation of these subsidies.

25 Existing data on renewables' contribution to aggregate power consumption have two central problems. First, annual consumption data on dispersed, non-grid renewable use (such as Btu equivalents for solar hot water heating) are not well assembled. Second, data on Independent Power Producers (many of which produce electric power using wood, wind, or solid waste) are not included in the existing series from EIA on net electricity generation from renewables.

26 The real dollar value of premium-financed nuclear liability coverage available today is less than was available in 1957. Furthermore, even our subsidy estimates value only a portion of the total federally-provided indemnification to the commercial nuclear industry. See Appendix B for details.

27 This occurs for two reasons. First, capital subsidies often encourage over-investment in capital, leading to supply gluts which take a while to be depleted. Second, regulatory pricing for electric and natural gas utilities, unlike market pricing, is often based on the average cost of providing power in a service district. Thus, if new supply is needed which costs twice as much as the existing supply (since the existing generating plant was heavily subsidized), the consumer will not see a huge jump in electricity prices. The consumer will therefore not realize that the cost of providing additional power is far more expensive than it used to be, and that alternatives (such as improved efficiency) should be sought out where possible.

28 U.S. Department of Energy, *National Energy Strategy: Powerful Ideas for America*, First Edition 1991/1992, Washington, DC 1991.

29 In fact, reducing financial risk-bearing for mistakes and accidents from the utilities, utility contractors, and nuclear waste transporters may reduce their incentive to minimize their controllable risks.

30 Many of the byproducts of biomass production are the result of agricultural policies which inhibit crop rotations, encourage over-production and crop-production on marginal land, and do not regulate agricultural pollution as is done for other industries, rather than from biomass production *per se*.

31 Economists advocate the control of pollution up to the point where the marginal benefit of additional pollution control no longer exceeds the marginal cost of additional controls. As a result, there

will always be some level of pollution which is accepted by the population since the cost of eliminating it would exceed the benefits of doing so (however costs and benefits may be defined). Even though residual, uncompensated damages may remain, they are no longer termed "externalities" if the marginal costs are reflected in market decisions. The cost estimates of environmental damage include total costs, not just costs above the level that the population would be willing to accept given the current costs and benefits of further reduction. In any case, one would be hard-pressed to argue that subsidizing additional pollution with general tax revenues is likely to make any long-term sense.

32 John Holdren, "Population and the Energy Problem," *Population and the Environment: A Journal of Interdisciplinary Studies*, V. 12, #3, Spring 1991, pp. 231-255; and John Holdren, "Energy in Transition," *Scientific American*, September 1990, pp. 157-163.

33 EPA, *National Air Quality and Emissions Trends Report, 1989*; EPA, *National Air Pollutant Emissions Estimates, 1940-1988*; cited in *The External Costs of Oil Used in Transportation*, (Washington, DC: Congressional Research Service, June 17, 1992), p. 37.

34 Tax expenditure estimates for some tax provisions, such as for safe harbor leasing arrangements, are negative, implying that the Treasury is receiving more money with the subsidy than it would have without it. This enigma may be understood in reference to the timing of payments in the following example. A $10 purchase which lasts 5 years would generate a $2 depreciation charge each year, which is tax deductible. If an accelerated depreciation provision allowed the investment to be depreciated in 2 years, rather than 5, the tax deduction in years 1 and 2 would be $5, but would be $0 for years 3 through 5. Thus, accelerated depreciation would yield a tax deduction $3 higher in years 1 and 2, but $2 lower in years 3 to 5. However, the net benefit to the firm is still positive, since it may collect interest on its tax savings from earlier years, if it chose to. In addition, taxes owed in later years may be paid in inflated dollars.

35 Office of Management and Budget, *Budget of the United States Government, Fiscal Year 1993*, pp. 2-25; Joint Committee on Taxation, "Estimated Budget Effects of Conference Agreement for Revenue-Related Provisions of H.R. 776," October 5, 1992 (JCX-37-92).

36 Alliance to Save Energy, American Council for an Energy-Efficient Economy, Natural Resources Defense Council, Union of Concerned Scientists, *America's Energy Choices: Investment in a Strong Economy and a Clean Environment*, Washington, DC 1992 and Alliance to Save Energy, American Gas Association, & Solar Energy Industries Association, *An Alternative Energy Future*, Washington, DC April 1992.

37 *America's Energy Choices*, see note above.

38 Economists regard the shared portion of R&D investments as a public good, or a positive externality. As with all public goods, the private market can be expected to under-invest. This is especially true for newer industries with large numbers of small firms where individual firms are less likely to be able to capitalize on their results.

39 Alliance to Save Energy, *Industrial Investment in Energy Efficiency: Opportunities, Management Practices & Tax Incentives*, Washington, DC 1983.

40 Rick Heede, Richard Morgan, and Scott Ridley, *The Hidden Costs of Energy* (Washington, DC: Center for Renewable Resources, 1985).

41 Commercial and residential customers are not eligible until 1995, and may treat 40 percent of the rebate as tax-exempt in 1995, 50 percent as tax-exempt in 1996, and 65 percent as tax-exempt thereafter.

42 *An Analysis of Federal Incentives Used to Stimulate Energy Production* and *An Analysis of Federal Incentives Used to Stimulate Energy Consumption*, (Richland, WA: Battelle Memorial Institute, December 1978 and August 1981 respectively).

Appendix A-1: Two Regular Folks and Their Encounter with Federal Market Intervention (Subsidies for the Non-Specialist)

Beth and Bob are two regular people. They live next door to each other in identical homes. They are both entrepreneurial and work hard at their jobs. Both have second jobs, too, just to make ends meet. However, there is one difference between Beth and Bob -- one of them always seems to be slightly better off than the other.

Please note that this example illustrates the basic concepts of existing federal market intervention. It does not depict actual federal programs.

Intervention	*Beth's Home and Business*	*Bob's Home and Business*
Tax-Related Interventions		
Tax Credits	Beth put in a redwood hot tub and may deduct 10% of the cost from her federal tax bill due to a 10% domestic large timber tax credit.	Bob's hot tub, made of porcelain, is not eligible for federal tax credits.
Altered Tax Rate	Beth built a turtle racing stadium. Since the construction of stadiums qualifies for tax-exempt bonds, Beth got a lower interest rate.	On weekends, Bob builds nursing homes. While he, too, financed his work with bond issues, his bonds were not tax-exempt. Thus, he paid a higher interest rate.
Altered Tax Basis	Beth deducted all of the interest on her 30-year mortgage in the first 4 years and was able to put her tax savings in the bank.	Bob must deduct mortgage interest from his taxes over the 30-year life of the mortgage.
Altered Taxable Entity	Beth invested $10,000 in a California artichoke farm to build a nest egg for her kids. The farm is rapidly losing money. However, under special passive loss provisions for artichoke farmers, Beth can deduct $20,000 per year from other income to reflect her artichoke losses -- even though she put no more money into the venture.	Poor Bob chose to invest in his nursing homes project. Unlike the artichoke industry, nursing home losses are limited to the funds actually put at risk.
Federal Agency Interventions		
Grants	Since Beth painted her house purple, the government gave her $4,000.	Bob carelessly chose taupe and got nothing from the feds.
Direct Federal Ownership of Facilities / Service Operations, Net of User Charges	Prior to buying her own house, Beth lived in a government-owned mansion and paid a monthly rent of only $5.	Bob paid market rents prior to his home purchase.
Research and Development Support	Beth needed a new machine to remove the radon from her basement. To solve her problem, the federal Office of New Machines designed, built and tested it for her.	Though Bob had no radon problems, he did have some unmarked metal drums that kept surfacing in his kid's sandbox. The Office of New Machines was too busy with radon removal R&D to have time for unmarked drum R&D.

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Intervention	Beth's Home and Business	Bob's Home and Business
Market Planning	Beth sells pet rocks. Because her pet rocks came from a single quarry, she would be in trouble if supplies were cut off. Luckily, the Office of Strategic Stones and Stuff had done scenario planning to locate alternative sources of supply and had stockpiled key rocks for such an emergency.	Bob runs a retail magazine franchise. When Bob's main magazine supplier cut him off for not selling enough "Pewter World" subscriptions, he was forced to make 47 phone calls over a two-month period before he located a new source of supply.
Subsidized loans, loan guarantees, and insurance programs	Because she lives in a Quarry Development Region, Beth got a below-market fixed-rate mortgage from the government. In addition, the government promised to make good on any unpaid principal should Beth not be able to make her payments.	Bob had a bank mortgage which fluctuated with the prime rate. Should he fail to make any payments, the bank could seize his home.
Administrative and Regulatory Costs	Beth created a great deal of work for the government. Somebody had to plan and manage her radon cleanup, legal suit and mortgage. These people worked very hard, but Beth wasn't the one who had to pay them.	Bob paid for all of the work his activities created through his mortgage rates, taxes, and of course, lawyers' fees for the little mess in his backyard sand box.
Other Interventions		
Assumption of Legal Risks/Indemnification	Prior to discovering her radon problem, Beth had rented her basement room to a couple that was now experiencing health problems. Luckily, she had received blanket federal indemnification for all accidents, spills, etc. associated with her home or business. She told the couple to sue the federal government.	Bob was not so lucky. He was responsible for mitigating all pollution associated with the mysterious drums in his back yard.
Changes in Market Rules Governing Access to Markets, Prices or Terms of Sale	Beth built an addition to her home using whatever contractor and construction material she wished.	Not Bob. Since his house was taupe and not purple, he had to use Henry's House Builders and pay a significant price premium. Furthermore, the "Regulations for Owners of Taupe Homes" stipulated that he could sell his home only in an even-numbered year.
Federal Procurement Policies	When Beth lived in her government-subsidized mansion, she was a government employee responsible for purchasing all necessary food items for her department. In accordance with the "Truffle Promotion Act of 1832," she purchased hundreds of truffles per month from the nation's four truffle manufacturers.	When Bob needed food, he bought it at market rates in the neighborhood Quick Mart.

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Appendix A-2: Federal Intervention in Energy Markets (by Energy Type and Point of Intervention)

To better illustrate the point that federal intervention is pervasive in energy markets, we have summarized this intervention by energy type and point in the energy development process on the following charts. These charts provide a qualitative illustration of the frequency and point of government intervention into the markets for particular fuels.

These charts represent a "best effort" to identify and categorize federal intervention. However, due to the scope and duration of intervention in energy markets, these charts should not be viewed as all-inclusive. Oil, coal and natural gas that is converted into electricity are subject to all the interventions contained both on their respective fuel charts and on the one for fossil electric. Subsidy items are shown preceded by a dash (-), cost-increasing government intervention (for reasons unrelated to health or environmental externalities, or management of support programs) is denoted by a plus sign (+), and interventions which are likely to have a neutral net effect are preceded by an asterisk (*). Neutral items are primarily trust funds to deal with energy-related externalities which are financed by fuel excise taxes.

The categories across the top of the charts refer to the primary activities of the enterprise during the entire product life cycle. The support activities, listed vertically, correspond to functional activities of the firm during every stage of product development. The rows represent major components of industry cost-structure. Procurement involves the purchase cost of production inputs, or the sale price of outputs. Technological development includes both product and process innovation. Cost of labor, capital or operations is self-explanatory. The industry infrastructure category includes federal intervention through ownership or infrastructure construction which radically alters the operating environment and cost structure for that sector of the energy industry (e.g. tax-exemption of some utilities but not others). Risk reduction includes federal risk absorption and shifting, or federal market planning functions. Externality control includes federal involvement to assess and mitigate externalities created by the particular energy type.

Note that these charts, as was true for the main report, do not list externalities which the federal government is not spending money on. Items listed as "pending" were passed in the Energy Policy Act of 1992 and will be implemented in the near future.

While a variety of government interventions may be used to support each stage of the product life cycle, there are some fairly intuitive patterns that become apparent. Research support is the strongest prior to product introduction, and tax benefits are most common during the procurement of capital for the production or transportation infrastructure. Since toxic emissions may occur throughout exploration, extraction, production, transportation and closure, government intervention for health, safety, and environmental protection occurs across many of these categories. Many of the items listed on the following charts may have incremental benefits to the recipient through the use of the federal government as an intermediary.

While the number of items on a chart gives some indication of the "messiness" of the markets, this conclusion should be tempered by a number of caveats. First, the frequency of intervention and the magnitude of subsidization are not necessarily correlated. In addition, the inclusion of some expired provisions to show how strong a role the federal government has played historically makes the charts look more cluttered even where intervention is less severe today. Finally, the chart for fission-electric comprises extraction through the conversion to electricity, while the fuel cycles for oil, gas and coal are spread onto two sheets as mentioned above. The charts should be viewed as a starting point for the examination of the more important questions of the magnitude of intervention.

Federal Intervention in the Market for Oil

Cost Factor Affected	Primary Activities				
	Exploration or Pre-production Phase	*Extraction, Refinement and Production*	*Transport and Distribution*	*Marketing, Sales, Service and Consumption*	*Post-Operational Closure and By-Product Disposal*
Procurement	-USGS Surveys -NOAA mapping of energy resources -BIA resource development support	-Small refinery preference on sales from the Naval Petroleum and Oil Shale Reserves	+Jones Act restrictions on the use of foreign-built vessels -MARAD operating differential subsidies to U.S. fleets -Pipeline rate setting -Highway construction (net of Highway Trust Fund) -Foreign tax credit reduction via transfer pricing (narrowed) -Oil shipping subsidiary-related tax deferrals (repealed)	-Eximbank subsidized loans, loan guarantees, and defaults on export loans for oil equipment and services -Low Income Energy Home Assistance Program +Portion of excise tax used for general revenues -Oil import quotas and allocations (expired 1973) +Oil price controls and oil overcharge legal suits (expired) +Windfall profits tax -Higher tax exemption of automobile parking allowances than mass transit +Gas guzzler tax on inefficient automobiles	
Technological Development	-DOE R&D on oil extraction technologies -R&D tax credit -Expensing long-term R&D expenses -DOE/NSF materials R&D	-DOE fossil fuel research -EPA emissions control research -Enhanced oil recovery tax credits -Expensing of tertiary injectants	-EPA bioremediation research for spills -Federal Highway Administration R&D	-EPA research into vapor recovery systems for gas stations	
Cost of Labor, Capital or Operations		-Expensing intangible development costs -Excess of percentage over cost depletion -Oil exception to passive loss restrictions -Special benefits to Alaskan Native Corporations -General ITCs, ACRS, and tax-exempt debt issues for pollution control impact (residual impact) -Rapid amortization of pollution control expenditures (expired) -Capital gains benefits -Expensing of construction-period interest (expired) -AMT relief for indpendent oil producers (pending)	-Deferral of tax on shipping companies -General ITCs and accelerated cost recovery (residual impacts) -Tax-exempt debt for docks, wharves and highways -Deduction of intangible motor carrier operating rights (expired)	-Special benefits for Alaskan Native Corporations -Grants and loans from the Multilateral Development Banks to the poorest developing countries to develop oil industry	
Industry Infrastructure	-BLM leasing decisions on oil tracts		-FERC pipeline regulation -Army Corps waterways construction and maintenance -St. Lawrence Seaway development corporation -Army Corps. construction of deep water ports & harbors -Coast Guard bridge alterations and navigation aids -NOAA/NASA/DOD global positioning system and other navigational aids	-EIA data collection -Interstate highway and other road construction not paid for by road users (supporting oil-consuming vehicles) +Use of a portion of motor fuels excise tax receipts for mass transit	
Risk Reduction	-Study of the environmental impact of drilling in the Arctic National Wildlife Refuge (Fish & Wildlife Service)		-Maritime safety -Provisions of war risk insurance -Military protection of Gulf oil shipping lanes -Cap on oil spill liability	-Strategic Petroleum Reserve -DOE emergency preparedness	
Externality Control		-OSHA regulation of drilling and refinery operations	-NOAA Damage Assessment and Restoration fund -F&WS, Coast Guard, and Navy oil spill response -DOT Office of Pipeline Safety oversight and user fees -Army Corps aquatic plant control in waterways -EPA dredge disposal permits -F&WS review of dredge disposal permits +NHTSA efficiency standards making and enforcement	-EPA auto emissions compliance -Global climate change, acid deposition, and air pollution research by DOE, EPA, NOAA, NASA and F&WS -NIH research on lung ailments -EPA regulation of leaky underground storage tanks *Leaking underground storage tank fuel tax and trust fund	-Bevill waste exclusion for oil drilling waste *Oil spill excise tax and Oil Spill Liability Trust Fund -EPA regulation of underground injection of drilling wastes -Oil-related Superfund sites

KEY: "-" = Subsidy to Industry; "+" = Cost-Increasing to Industry; "*" = Net Effect Probably Neutral

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Federal Intervention in the Market for COAL

Cost Factor Affected	Primary Activities				
	Exploration or Pre-production Phase	*Extraction, Refinement and Production*	*Transport and Distribution*	*Marketing, Sales, Service and Consumption*	*Post-Operational Closure and By-Product Disposal*
Procurement	-USGS Surveys -BIA resource development support		+Jones Act restrictions on the use of foreign-built vessels -MARAD operating differential subsidies to U.S. fleets	-Eximbank subsidized loans, loan guarantees and defaults on export loans for coal mining equipment and services -Low Income Home Energy Assistance Program -MMS leasing costs and delinquent royalties -DOD coal purchase requirements -Tax deduction for methanol fueled vehicles (pending)	
Technological Development	-BOM mineral research	-DOE R&D on coal production techniques such as underground gasification -BOM mining systems R&D -DOE Clean Coal program	-FRA R&D		
Cost of Labor, Capital or Operations		-General ITCs, accelerated cost recovery system, and tax exempt debt issues for pollution control equipment (residual impact) -Rapid amortization of pollution control expenditures (expired) -Capital gains treatment of coal royalties -Expensing intangible development costs -Excess of percentage over cost depletion -DOE Alternative Fuels Program (residual)	-General ITCs and accelerated cost recovery (residual impacts) -Tax-exempt debt for docks and wharves -Railroad retirement benefits subsidies -Rapid amortization of railroad rolling stock (expired)	-Grants and loans from the Multilateral Development Banks to developing nations for utilizing coal deposits	-Expensing mine closure and reclamation reserves
Industry Infrastructure	-Access to, and bidding for, coal leases		-Granting of rail rights-of-way -Army Corps of Engineers construction and maintenance of locks and dams -St. Lawrence Seaway development corporation -Construction and maintenance of ports by the Army Corps -Coast Guard bridge alternations and navigation aids	-EIA data collection	
Risk Reduction		-Limited enforcement of subsidence damage liability	-Maritime safety -Rail safety regulation	-DOE emergency preparedness	
Externality Control	-OHSA regulation of drilling operations	-NIH lung research -Mine health and safety programs: BOM, OSHA, OSMRM, MSHA -Reclamation requirements exemption for small mine operators -Inadequate bonding requirements for leases on federal lands -Interest forgiveness on Black Lung Trust Fund -SSA direct payments to black lung victims -Tax exemption of black lung payments +Excise tax on coal partially supporting Black Lung Trust Fund	-Army Corps aquatic plant control in waterways -EPA dredge disposal permits -Fish and Wildlife Service review of dredge disposal permits	-Global climate change, acid deposition and air pollution research by DOE, EPA, NOAA, NASA and F&WS -NIH research on lung ailments	-Bevill waste exclusion for mining wastes -Abandoned mine reclamation fund and excise tax -DOE cleanup of coal sites: Western Superfund, and Rocky Mountain underground coal gasification sites

KEY: "-" = Subsidy to Industry; "+" = Cost-Increasing to Industry; "*" = Net Effect Probably Neutral

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Federal Intervention in the Market for NATURAL GAS

Cost Factor Affected	Primary Activities				
	Exploration or Pre-production Phase	*Extraction, Refinement and Production*	*Transport and Distribution*	*Marketing, Sales, Service and Consumption*	*Post-Operational Closure and By-Product Disposal*
Procurement	-USGS surveys -NOAA mapping of energy resources -BIA resource development support		-Pipeline rate setting	-Eximbank subsidized loans, loan guarantees, and defaults on export loans for gas extraction equipment and services -Low Income Home Energy Assistance Program -MMS leasing costs and delinquent royalties +Gas price controls through 1983 -Federal purchase preference for alternative fueled vehicles, including natural gas -Tax deduction for natural gas fueled vehicles (pending)	
Technological Development	-DOE R&D on gas extraction technologies -R&D tax credit -Expensing long-term R&D expenses	-DOE fossil fuel research -Enhanced gas recovery tax credit -Expensing of tertiary injectants			
Cost of Labor, Capital or Operations		-Expensing intangible development costs -Excess of percentage over cost depletion -Gas exception to passive loss restrictions -Special benefits to Alaskan Native Corporations -General ITCs, accelerated cost recovery system, and tax-exempt debt issues for pollution control equipment (residual impact) -Rapid amortization of pollution control expenditures (expired) -Capital gains benefits -Expensing of construction-period interest (expired) -Alternative minimum tax relief for independent gas producers (pending)	-General ITCs and accelerated cost recovery (residual impacts)	-Special benefits for Alaskan Native Corporations -Retention of excess deferred taxes by gas utilities following the decrease in tax rates in 1986 -Grants and loans from the Multilateral Development Banks to developing nations to develop gas reserves	
Industry Infrastructure	-BLM leasing decisions on oil and gas tracts	-Tax-exempt status of some mutual, cooperative and municipal utilities	-FERC pipeline regulation -Federal Power Commission prohibition of intrastate gas flowing in interstate pipelines (expired)	-EIA data collection -Clean Air amendment requirements for introduction of natural gas vehicles	
Risk Reduction	-Study of the environmental impact of drilling in the Arctic National Wildlife Refuge (Fish & Wildlife Service)			-DOE emergency preparedness	
Externality Control		-OSHA regulation of drilling operations	-DOE Liquefied Gaseous Fuels test facility -DOT Office of Pipeline Safety oversight and user fees -Alaskan gas pipeline inspector		-Bevill waste exclusion for oil and gas drilling wastes -EPA regulation of underground injection of drilling wastes

KEY: "-" = Subsidy to Industry; "+" = Cost-Increasing to Industry; "*" = Net Effect Probably Neutral

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Federal Intervention in the Market for FOSSIL ELECTRIC

Cost Factor Affected	Primary Activities				
	Exploration or Pre-production Phase	*Extraction, Refinement and Production*	*Transport and Distribution*	*Marketing, Sales, Service and Consumption*	*Post-Operational Closure and By-Product Disposal*
Procurement			-Below-cost sales of power from TVA to DOE's Uranium Enrichment Enterprise	-Low Income Home Energy Assistance Program -PURPA-required purchases from fossil-fed cogeneration facilities -Tax credits and deduction for electric cars (pending) -Eximbank subsidized loans, loan guarantees, and defaults on exports of U.S. fossil-electric equipment and services	
Technological Development	-NIST materials research -DOE R&D on oil extraction technologies -R&D tax credit -Expensing long-term R&D expenses	-NIST manufacturing research	-R&D on superconductivity		
Cost of Labor, Capital or Operations		-Tax-exempt debt for public power construction -ITC, accelerated cost recovery system, and tax-exempt debt for pollution-control equipment (residual impact) -Safe harbor leasing (residual) -REA subsidized loans, loan guarantees and defaults -Tax-exempt dividend reinvestment for cooperatives (expired) -Exclusion of payments in aid of construction from taxable income (expired)	-ITC and accelerated cost recovery system for transmission construction (residual impact) -REA subsidized loans, loan guarantees and defaults	-Utility retention of excess deferred taxes following the 1986 drop in tax rates -Grants and loans to electric sector in developing countries through the Multilateral Development Banks	
Industry Infrastructure	-NIST standards setting	-Tax-exempt operation of mutuals, cooperatives, and public power +Fuel use act of 1978 restrictions on the use of oil and gas for electric generation (helped coal) (expired)	+FERC power to require wheeling (pending) -Transmission rights-of-way	+Wholesale power regulation using average cost rather than marginal cost pricing -EIA data collection	
Risk Reduction	-USGS earthquake assessments				
Externality Control		-DOE clean coal research -Global warming, acid deposition and air pollution research by DOE, EPA, NOAA, NASA and F&WS -NIH research on lung ailments	-Research into health effects of electromagnetic fields		-Bevill waste exclusion on crtain slag and combustion ash

NOTE: Fossil electric also greatly benefits from reduced fuel costs due to federal subsidies to the coal, natural gas and oil input fuels
KEY: "-" = Subsidy to industry; "+" = Cost-Increasing to Industry; "*" = Net Effect Probably Neutral

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Federal Intervention in the Market for FISSION ELECTRIC

Cost Factor Affected	Primary Activities				
	Exploration or Pre-production Phase	*Extraction, Refinement and Production*	*Transport and Distribution*	*Marketing, Sales, Service and Consumption*	*Post-Operational Closure and By-Product Disposal*
Procurement	-BLM uranium leasing -USGS uranium surveys	-UEE below-cost purchases of TVA power -Bonus payments for new uranium discoveries (expired) -10-year price guarantees for uranium ore (expired)		-Low Income Home Energy Assistance Program -UEE below-cost sales of enriched uranium, and resulting losses -UEE overcompensation and stockpiling of uranium (expired) +Import ban on uranium ore (expired) -Tax credit and deduction for electric cars (pending) -Eximbank subsidized loans, loan guarantees, and defaults on exports of U.S. fission-electric equipment and services (mostly in the 1970s)	
Technological Development	-NIST materials research -DOE reactor research and R&D spillover from defense reactor programs -DOE basic sciences and advanced materials research -DOE R&D on oil extraction technologies -R&D tax credits -Expensing long-term R&D expenses	-DOE alternative enrichment technology research (AVLIS) -NIST manufacturing research -DOE fission research -DOE joint research with other nations	-R&D on superconductivity -DOE research on nuclear waste shipping containers		-DOE research into nuclear waste vitrification and cleanup technologies -Extensive research and site assessment for commercial waste site
Cost of Labor, Capital or Operations		-ITCs, accelerated cost recovery, tax exempt debt for pollution control eqiupment and safe harbor leasing (residual impact) -Tax-exempt bonds and REA subsidized loans, loan guarantee and defaults (through partnerships with coops) -Cooperative tax-exempt dividend reinvestment (expired) -Exclusion of payments in aid of construction (expired) -Expensing of construction-period interest (expired)	-ITC and accelerated cost recovery system for transmission construction (residual impact) -REA subsidized transmission loans, loan guarantees, and defaults	-Utility retention of excess deferred taxes following the 1986 drop in tax rates	-Reduced tax rate on nuclear decommissioning, trust funds (pending)
Industry Infrastructure	-NIST standard setting -DOE ownership of research facilities -Atomic Energy Commission construction of access roads to uranium mines (expired)	-Tax-exempt operation of mutuals, cooperatives and public power -Government ownership and operation of UEE, with associated tax-exemptions and no rate of return -Allowance of private ownership of fissionable materials -Fuel Use Act restricting new oil and gas electric plants (expired) -Accelerated plant licensing (pending)	+FERC power to require wheeling (pending) -Transmission rights-of-way	+Export restrictions on nuclear technologies and fissionable materials +Wholesale rate regulation using average cost rather than marginal cost pricing -EIA data collection	-Potential under-accrual for decommissioning costs -Construction and operation of waste disposal site at Yucca Mountain -Office of Nuclear Waste Negotiator
Risk Reduction	-USGS earthquake assessments	-Price Anderson cap on liability for nuclear accidents -Government absorption of all operating liabilities associated with UEE	-Price Anderson indemnification of all transporters of uranium or radioactive wastes	-No risk sharing with private industry on UEE long-term power purchase contracts with TVA	-Government chain of control over nuclear waste from point it leaves the utility -Government absorption of all risks associated with waste transport and disposal, and the construction and operation of the disposal facility in return for a small tax now (Nuclear Waste Fund)
Externality Control		-DOE and EPA radiological research -NRC oversight of nuclear plants -FEMA radiological emergency preparedness	-Research into health effects of electromagentic fields	-IAEA nuclear non-proliferation efforts, supported through the Department of State -IAEA safety training	-Decommissioning and decontamination at enrichment facilities and other DOE facilities at least partly serving commercial sector -Shippingport reactor decommissioning -Cap on utility share of D&D costs

KEY: "-" = Subsidy to Industry; "+" = Cost-Increasing to Industry; "*" Net Effect Probably Neutral

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Federal Intervention in the Market for HYDROELECTRIC

Cost Factor Affected	Primary Activities				
	Exploration or Pre-production Phase	*Extraction, Refinement and Production*	*Transport and Distribution*	*Marketing, Sales, Service and Consumption*	*Post-Operational Closure and By-Product Disposal*
Procurement				-PURPA-required purchases of small-scale hydropower -Eximbank subsidized loans, loan guarantees, and defaults on export loans for hydroelectric equipment and services -Tax credit and deduction for electric vehicles (pending)	
Technological Development			-R&D on superconductivity	-Low Income Home Energy Assistance Program +Power repayment of irrigation assistance	
Cost of Labor, Capital or Operations		-Subsidized loans and long debt repayment periods for the Power Marketing Administrations -Tax-exempt bonds for environmental improvements to hydro facilities (pending)		-No required rate of return on government-owned capacity	
Industry Infrastructure	-Bureau of Reclamation and Army Corps of Engineers site and modification assessments -FERC licensing of hydro facilities	-Initial construction and continued maintenance of the dams by BuRec and Army Corps of Engineers -Cost allocation decision regarding power repayment on federal dams -Dam repair and rehabilitation by the Fish and Wildlife Service -Government ownership and operation of hydro capacity, with associated tax-exempt operations	+FERC power to require wheeling -FERC transmission line licensing and approval	-Wholesale rate regulation using average cost rather than marginal cost pricing -EIA data collection +Cross subsidies to irrigation and fission power by hydro users at Power Marketing Administrations and TVA -Grants from Multilateral Development Banks to developing countries for constructing hydroelectric infrastructure	
Risk Reduction		-Government assumption of all liability of operations for PMAs			
Externality Control		-Fish and wildlife protection -FERC oversight -F&WS flow assessments			

KEY: "-" = Subsidy to Industry; "+" = Cost-Increasing to Industry; "*" Net Effect Probably Neutral

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Federal Intervention in the Market for ALL RENEWABLES AND WASTE-TO-ENERGY

Cost Factor Affected	Primary Activities				
	Exploration or Pre-production R&D	*Extraction, Refinement and Production*	*Transport and Distribution*	*Marketing, Sales, Service and Consumption*	*Post-Operational Closure and By-Product Disposal*
Procurement	-USGS surveys for geothermal deposits	-Water, energy and agricultural subsidies regarding production inputs to biomass fuels, such as ethanol from corn (biomass)		-PURPA-required renewables purchases (some biomass) -Alcohol fuels excise tax exemption for mixtures with at least 10% alcohol, and pro-ration for mixtures of less than 10% (biomass) -Federal purchase preference for gasohol or alternate fueled vehicles -Exceptions to CAFE requirements for alternate fueled vehicles -Tax deductions for ethanol and hydrogen fueled vehicles (pending)	
Technological Development	-DOE renewables research				
Cost of Labor, Capital or Operations		-DOE Geothermal Resources Development fund -Tax-exempt debt for waste-to-energy plants -Business energy supply ITCs (solar and geothermal) -Excess of percentage over cost depletion for geothermal energy -Alternative fuel production tax credit (ethanol) -Alcohol fuel income tax credit -Expensing of multi-period timber growing costs -Capital gains treatment of standing timber -General ITC and accelerated depreciation (residual impact) -1.5-cent/KwH production credit for wind and closed-loop biomass power generation (pending)		-Residential energy supply credits (expired)	-Rapid amortization of reforestation expenses (biomass)
Industry Infrastructure	-Licensing of geothermal plants -Allowance of free firewood removal from certain national forests -Forest Service and BLM timber leasing		-Forest Service subsidized road construction (biomass)	-EIA data collection	
Risk Reduction	-USDA and DOE loans and loan guarantees for ethanol production facilities	-Commodity Credit Corporation price supports and disaster payments for ethanol feedstocks -Federal Crop Insurance Corporation subsidized insurance for ethanol feedstocks		-Forest service forgiveness of high-priced timber contracts when the market declined (biomass)	
Externality Control				-EPA wood stove emissions regulation (biomass)	

KEY: "-" = Subsidy to Industry; "+" = Cost-Increasing to Industry; "*" Net Effect Probably Neutral

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Federal Intervention in the Market for END-USE AND SUPPLY EFFICIENCY

Cost Factor Affected	Primary Activities				
	Exploration or Pre-production Phase	*Extraction, Refinement and Production*	*Transport and Distribution*	*Marketing, Sales, Service and Consumption*	*Post-Operational Closure and By-Product Disposal*
Procurement				-Government purchase of efficiency services -Bonneville Power Administration's purchases of efficiency -Mortgage interest rate deduction -Accelerated depreciation for buildings and rental housing (residual impact) -LIHEAP weatherization spending -Allocation of part of the court settlements on oil overcharge cases to weatherization -Exclusion of utility DSM payments from personal taxable income (pending)	
Technological Development	-DOE efficiency and conservation research	-Clean coal program: fluidized bed and combined-cycle technologies (supply efficiency)	-Superconductivity research -DOT transportation systems research	-Residential energy conservation ITCs (expired) -Business energy conservation ITCs (narrowed)	
Cost of Labor, Capital or Operations		-Utility expensing of DSM purchases with multi-year lives (IRS trying to restrict)			
Industry Infrastructure			-Corporate Average Fuel Economy standards	-Appliance efficiency standards	
Risk Reduction		-Multilateral Development Bank grants and loans to improve supply efficiency and utility management in developing nations			
Externality Control		-EPA fuel efficiency standards enforcement			-DOE and EPA indoor air pollution and radon research

KEY: "-" = Subsidy to Industry; "+" = Cost-Increasing to Industry; "*" Net Effect Probably Neutral

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Federal Intervention in the Market for FUSION

Cost Factor Affected	Primary Activities				
	Exploration or Pre-production Phase	*Extraction, Refinement and Production*	*Transport and Distribution*	*Marketing, Sales, Service and Consumption*	*Post-Operational Closure and By-Product Disposal*
Procurement					
Technological Development	-DOE fusion research -NIST materials research				
Cost of Labor, Capital or Operations					
Industry Infrastructure	-NIST standards setting				
Risk Reduction					
Externality Control					-DOE radioisotope and waste R&D

KEY: "-" = Subsidy to Industry; "+" = Cost-Increasing to Industry; "*" Net Effect Probably Neutral

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Appendix A-3: Differences Between High and Low Estimates

Differences Between High and Low Estimates	
Low Estimate (Cost to the Government)	***High Estimate (Value at Market Rates)***
Tax Benefits	
(1) The lower of Joint Committee on Taxation or Treasury estimates of revenue loss	(1) Treasury outlay-equivalent estimates (2) Joint Tax estimates if Treasury did not estimate the provisions
Agency Programs	
(1) Low estimates of program losses and loan defaults (2) Outlays for operating expenses (3) Interest rate subsidies based on the government's cost of borrowing	(1) Higher estimates of program losses and loan defaults (2) Outlays for operating expenses (3) Interest rate subsidies based on the private sector cost of borrowing (4) Imputed rates-of-return added only to crop insurance programs and Naval Petroleum Reserve due to data inavailability (5) Tax-exempt status of operations included only for publicly owned power and Naval Petroleum Reserve, again due to data inavailability
Other Interventions	
(1) Low estimate for Price-Anderson indemnification (assuming that the government acts as a captive insurer, setting aside some funds each year to cover expected losses)	(1) Higher estimate for Price-Anderson indemnification (2) Includes taxpayer share of under-accrual for nuclear decommissioning

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Appendix A-4: Federal Market Intervention and Transportation Choices

The federal government has long been involved with developing and maintaining the transportation infrastructure of the nation. In addition, numerous policies have increased or decreased the costs of particular transportation modes. As with intervention in energy markets, issues arise over the distribution of costs and benefits, and whether particular modes are given the edge over others. Since different modes of transportation are more or less energy-efficient, federal intervention in transport can have important implications for national patterns of energy consumption.

We made an explicit choice to limit the scope our research on transportation to the key subsidies affecting energy transportation, leaving issues of intermodal subsidies and impacts on energy consumption patterns of transport for other researchers. As a result, our primary focus was on Army Corps of Engineers construction and maintenance of the intercoastal waterways and ports, modes on which both bulk coal and oil transport depend. This presentation simply lists a few of the other key transport-related interventions.

Tax Subsidies

The largest tax subsidies for transport are tax-exempt bond issues which are allowed for the purchase of mass-commuting vehicles ($45 million) and for state and local road construction ($13.4 billion in 1989, including bond issues for sewers and schools). Parking benefits are another area of federal tax policy distortions. Historically, employers could provide employees with parking benefits and exclude such costs from the firm's taxable income. Tax deductions for employer-provided mass transit benefits, however, were limited to $21/month per employee. The 1992 Energy Bill narrowed this discrepancy by capping automobile parking deductions at $155/month per employee and increasing mass transit deductions to $60/month per employee.

Cross-subsidies between modes exist via two excise taxes. A portion of the proceeds from the motor fuel tax on oil supports mass transit spending. In 1989, $1.7 billion supported mass transit. Another excise tax, the gas guzzler tax, is levied on the least efficient automobiles to provide a disincentive to consumers considering such a purchase. Collections in 1989 were $110 million.

Agency Programs

We did not comprehensively survey federal transportation-related programs. The key subsidies, however, include operating subsidies to federally-owned commuter railroads, some high-speed train R&D, mass transit subsidies, and federal highway spending which exceeds excise tax collections. Some federal absorption of the retirement costs of railroad workers above the levels of available pensions may also be an issue. For water transport, more research would be useful to help evaluate whether the development of deep-water ports was borne by the main beneficiaries of that development (such as oil supertankers). Finally, federal provision of rights-of-way for both rail and highways were necessary conditions for the development of the transportation infrastructure at all. If these rights were provided unevenly between modes, prevailing transportation options today could have been significantly affected.

Other Interventions

Automobile fuel efficiency, emission, and auto safety standards increase the purchase price of automobiles. From the consumer's perspective, these costs are offset by lower gasoline expenditures during the life of the automobile and reduced auto insurance rates, since drivers incur less damage in accidents. The relative intensity of energy subsidies will also affect the operating costs of oil-based or electricity-based transit. Were fuel costs not subsidized, the costs of some transport options would increase more than others. Finally, many costs at the state and local levels, such as highway patrols and accident response, may be borne by the general taxpayer rather than by the beneficiaries of the mode of transport. As transportation fuels are currently the least flexible part of the domestic equation, and the one most vulnerable to foreign disruption, intermodal transit subsidies should be evaluated in detail in the future.

Appendix A-5: The Issue of Externalities

"Externality" is the economic term describing the side effects of production or consumption which generate costs or benefits to society but for which the producer is not held accountable. The most applicable example is pollution. A factory may be able to reduce its production costs by simply discharging its wastewater without treatment. However, this activity reduces the welfare of the population using that water without compensating them for their loss. These losses to general welfare may take many forms, including illness or death, declines in fishery or agricultural productivity, and destruction of recreational or ecological sites.

In a perfect world, all polluters would pay the costs of damages associated with their activities and the recipients of that pollution would be able to make informed decisions regarding how much damages to accept. In our own imperfect world, two other outcomes are far more likely — though both may exist in different areas at the same time.

Polluters may be under-regulated. In such a case, they may receive the rights to pollute air, water, or land, or expose their workers to hazardous conditions, without properly compensating those parties. This is a *de facto* subsidy.

Polluters may be over-regulated. This may result from two possible scenarios. Government intervention may force reductions in pollution which are greater than that the affected parties would want, given knowledge about the costs and benefits of the reduction. More commonly, the polluter may be over-regulated, not in the *amount* of pollution reductions called for, but in the *manner* that those reductions must be obtained. Inefficient pollution reduction strategies or technologies may be mandated. Or, the implementation and oversight of the reductions may be done by an inefficient government bureaucracy, increasing the overall cost of a given level of reductions. The extent to which firms are over-regulated or subject to costs beyond those necessary for pollution reduction is a *de facto* tax.

It is important to remember that environmental externalities include the risk of environmental damages, such as the risk of nuclear accidents, as well as more visible problems such as combustion emissions.

Energy Use is a Large Source of Environmental Risk

Energy extraction, refinement, transportation, and consumption all generate prodigious amounts of pollutants. These pollutants, in turn, have significant negative externalities which are borne by society but not reflected in the cost of the fuel. Although virtually all energy sources are associated with environmental or health damages, concerns are substantially greater with regard to fossil energy.

The externalities of concern include health risks (cancer and non-cancer, acute poisonings and chronic conditions); damages to other industries or human activities (agriculture, forestry, fisheries, materials damages, impaired visibility); and ecological damages (species die-off or poisonings, destruction of natural fertility, oil spills, contribution to global climate change).

The combustion of fossil fuels contributes volatile organic compounds, nitrous oxides, sulphur dioxide, carbon monoxide, and carbon dioxide in various proportions depending on the type of fuel and its use. The risk of radioactive release from nuclear power facilities, however small,[1] also falls in this category. The quality of water and land resources are affected by oil spills and leaks, discharges from processing all fossil fuels, ecological changes from hydroelectric facilities, the potential for discharge of low-level radioactive waste or release of radiation from reactors, runoff of fertilizers and pesticides used in biomass production, and, potentially, discharge of some solvents and heavy metals from the production of photovoltaic cells.

Electromagnetic fields created by high voltage electric transmission lines have also generated health concerns, although evidence to date is inconclusive. The effect of weatherization on indoor air quality, including radon, has generated concerns, although weatherization is by no means the only (or even the largest) source of indoor air pollution.[2]

Neither the *de facto* subsidy associated with unimpeded or under-regulated pollution or the *de facto* taxes associated with potential over- or inefficient regulation are quantified in detail here. Studies estimating the environmental and health impacts of energy use typically focus on one or two types of emissions, often in a limited geographic region. Taken together, however, they suggest that annual damages could be in the range of hundreds of billions of dollars (see table on page 59) for the nation as a whole, surpassing all of the other subsidies quantified in this report combined. Most of these studies focus on health impacts and none are comprehensive in reflecting all economic and ecological damages.

A recent estimate of the cost of environmental regulations, both those which represent incorporation of externalities and those which exceed them, place costs in the $90 billion to $105 billion range. The study

does not try to determine what portion of these costs are warranted by the need to compensate for environmental damages. Nor does it net out items such as consumer fuel savings from automobile efficiency standards from the aggregate total. Our sense, then, is that *de facto* taxes associated with unwarranted or inefficient environmental regulations are outweighed by remaining environmental risks and that, on net, environmental externalities represent an additional subsidy to energy production and consumption.

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[1]Risk has two components: the probability of occurrence (frequency) and the magnitude of damage. Risk assessment often converts these two measures into a single measure of expected damage, which is equal to the frequency x magnitude. Thus, although the risk of a nuclear accident is very low, the magnitude of damage should one occur is very high. The expected damage, which is used by actuaries to set insurance premiums, may therefore be significant.

[2]The development of technology to measure air exchange rates in homes has eliminated most of the remaining concerns over the impact of weatherization on indoor air quality.

Do We Clean Too Much or Clean Too Little?

Category	Cost per year (Billions of 1989$) Low Estimate	Cost per year (Billions of 1989$) High Estimate	Notes	Comments or Study Cited	Source Used
The Partial Cost of Not Cleaning Up					
Emissions from Electricity Generation					
Coal	14.9	73.0	(3)	Compilation	Yim, Evans and Wilson; GAO / RCED-92-13
Oil	2.7	6.4	(3)	Compilation	Yim, Evans and Wilson
Natural Gas	1.7	3.3	(3)	Compilation	Yim, Evans and Wilson
Nuclear	0.1	0.8	(3)	Compilation	Yim, Evans and Wilson
All Automotive Air Pollutants	4.6	200.0		DeLuchi et al; Sperling and DeLuchi	Cannon; MacKenzie
Pollution from Agriculture					
Erosion, Offsite Impacts	2.2	8.6		Clark et al; USDA (1987)	Proj. '88, Rnd. I; NRC (1989)
Erosion, Onsite Impacts	0.5	19.4		NRC (1989); Pimental; USDA (1987)	NRC (1989)
Honeybee Industry Damage from Pesticides	0.2	0.2		Pimental (1980)	NRC (1989)
Air Toxics	3.0	3.0	(4)		GAO / RCED-91-143
Total Costs for Environmental Problems Listed	**29.9**	**314.7**			
Total Global Costs of Stratospheric Ozone Depletion	**$6.3 trillion by 2075 if no action taken**				EPA, Ozone, p. 3
The Cost of Cleaning					
All Federal Environmental Regulation	89.3	89.3		Hopkins	Hopkins
Aggregate Pollution Control Costs	104.7	104.7		EPA, Cost of Clean	EPA, Cost of Clean, 2-2
Examples of Cost-Increasing Regulation (Included in above two line items)					
Oil Overcharge Funds ($Millions)	293.4	293.4		Taxes oil; benefits efficiency	Appendix B-5
Gas Guzzler Tax ($Millions)	109.7	109.7		Taxes large cars	Appendix B-3
Auto Fuel Efficiency & Emissions Standards ($Millions)	2,848.5	15,220.4		Increases car price	GAO / RCED-92-100; Green and Liu

Notes:
(1) Estimates of the costs of pollution do not include all pollution problems. For example, costs of global climate change, stratospheric ozone depletion, forest losses and water pollution from excess timbering, as well as many others, are not included.
(2) Estimates for both categories should be taken with a grain of salt. The assumptions one makes about the value of damage to human health, and especially the discount rate chosen to convert future damages into present costs, can dramatically affect the resultant cost or benefit.
(3) This data was provided as a cost per KwH and converted to annual totals using 1989 net generation data.
(4) The source ascribed 3,000 additional fatal cancers each year to air toxics, a $3 billion cost at $1 million per life. While some air toxics come from power plants and refineries, most do not. Thus, double counting should not be significant.

Sources of Citations and References:

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(9) "Project 88: Harnessing Market Forces to Protect Our Environment," Washington DC: Dec. 1988.
(10) Sperling, Daniel and M. DeLuchi, "Transportation Energy Futures," Annual Review of Energy, 1989, 14: 375-424.
(11) U.S. Department of Agriculture, "Agricultural Resources – Cropland, Water and Conservation – Situation and Outlook Report," AR-8. Economic Research Srvice, 1987.
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(14) US GAO. "Air Pollution: EPA's Strategy and Resources May Be Inadequate to Control Air Toxics," June 1991. GAO / RCED-91-143.
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Appendix A-6: International Aspects of Energy Subsidies

Energy markets are, to a great extent, international. Both coal and oil are shipped worldwide in large volumes. Liquefied natural gas and enriched uranium are also exported, although in smaller volumes. Electricity crosses national borders, and power imports may be a significant source of supply in certain regions of the country, such as New England. Finally, capital flows used to finance foreign power plant construction and energy extraction and refining are all international in nature.

These trade flows suggest that some aspects of government support may also flow across national borders. In a number of cases, the U.S. taxpayer supports energy activities in other countries. For example, subsidized lending programs of the Export-Import Bank support both U.S. energy capital equipment producers and foreign energy producers and consumers. Port facilities which are subsidized by the Army Corps of Engineers benefit foreign oil producers and shippers as well as the domestic consumer. About 15 percent of the losses of DOE's Uranium Enrichment Facility accrued to foreign utilities via prices which were set too low to recover DOE's investment.

Government support for international agencies also sends U.S. taxpayer funds abroad. Financial support to the International Atomic Energy Agency and the United Nations Environmental Program pay, in part, for problems related to energy production and use in other countries. Financial and institutional support for the Multilateral Development Banks, such as the World Bank, also provide an impetus for foreign energy development. As with domestic spending, virtually all Development Bank lending has historically supported energy supply expansion over efficiency, although this is changing a bit now. If the federal government is to continue to contribute to these institutions, the types of projects it supports can have a significant impact on the types of projects that get built - with important implications for global pollution levels.

Energy imports into the United States can carry with them embedded subsidies from the recipient country. If both the subsidies in the home country and the amount of power imported are significant, foreign subsidies can distort the domestic market, competing with substitute energy sources and efficiency improvements. Energy imports do have significant market share in parts of the U.S. For example, foreign electricity supplied about 9 percent of total demand in New England and 12 percent in New York in 1986. (GAO/RCED-89-51, 15). In such regions, research to ensure that imports are not subsidized may be warranted.

These examples demonstrate leverage points for ensuring that foreign aid supports environmentally-sound projects, and that foreign imports do not hinder the adaption of environmentally-sound technology domestically.

Sources

Philips, Michael, *The Least Cost Energy Path for Developing Countries: Energy Efficient Investments for the Multilateral Development Banks* (Washington, DC: International Institute for Energy Conservation, September 1991).

U.S. GAO, *Canadian Power Imports: Update on Electricity Imports in the Northeast,* March 1988, GAO/RCED-89-51.

Appendix A-7: Summary of Provisions with the Largest Differences Between High and Low Estimates

Provisions with the Largest Differences Between High and Low Estimates		
High Estimate	*Low Estimate*	*Explanation for Differential*
Accelerated Depreciation (Plant and Equipment)		
9,568.2	2,763.0	(1) Different estimators (Joint Committee on Taxation vs. Treasury) (2) High estimate measures outlay equivalent rather than revenue loss
Price-Anderson Cap on Nuclear Accident Liability		
2,750.0	832.0	Different studies
Investment Tax Credit (Plant and Equipment)		
1,969.3	766.4	Same as for accelerated depreciation
Uranium Enrichment Enterprise		
1,026.8	279.1	Estimates differ in the underlying assumptions regarding the capital loss and pending costs for facility decontamination and decommissioning
Utility Normalization of Excess Deferred Taxes		
996.2	0.0	Low estimate assumes that state utility regulators will serve as a competitive force to return some of the excess to the current ratepayers
Under-accrual for Nuclear Decommissioning		
197.3	0.0	High estimate incorporates more realistic scenarios regarding utility ability to pay for decommissioning without government help
Nuclear Waste Fund		
181.7	0.0	High estimate incorporates less optimistic scenarios regarding the cost of constructing a waste facility and handling the wastes
Naval Petroleum and Oil Shale Reserves		
136.0	0.0	High estimate measures the difference in value of the reserves in private vs. government ownership and management
Tennessee Valley Authority		
126.9	3.4	High estimate includes the value of federal financial intermediation

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Appendix A-8: Tax Benefit Subsidy Allocations for FY-89 -- High and Low Estimates

Tax Benefit Subsidy Allocations for FY-89 -- HIGH ESTIMATE

Subsidy	Status	Target Sector	Total Energy	Coal	Oil	Gas	Solar (non-grid)	Ethanol	Biomass (non-grid)	Efficiency		Electric										
										Supply	End-use	Coal	Oil	Gas	Fission	Hydro	WTE	Geotherm	Biomass	Wind	Solar	Fusion
TAX CREDITS																						
Alcohol Fuel Income Tax Credit	Active	Energy	20.0					20.0														
Alternative Fuel Production Credit	Active	Energy	20.0	5.0	5.0	5.0			5.0													
Enhanced Oil and Gas Recovery Credit	Began '90	Energy	N/A																			
ITCs: New Machinery & Equipment	Residual	GenCap	1,969.3	167.3	616.8	435.1	0.8	5.8	2.6	0.0	37.9	195.3	5.5	12.8	427.0	11.7	14.7	12.2	17.3	4.7	1.8	0.0
ITCs: Busines Energy Credits - Conservation	Narrowed	Energy	1.3								1.3											
ITCs: Business Energy Credits - Supply	Narrowed	Energy	110.0				6.0											90.7			13.3	
ITCs: Residential Energy Credits - Conservation	Expired	Energy	N/A																			
ITCs: Residential Energy Credits - Supply	Expired	Energy	N/A																			
ITCs: Rehabilitation of Structures	Active	Other	2.7								2.7											
Research & Development Tax Credit	Active	Other	72.0		72.0																	
Tax Credit for Reforestation Expenses (includes 7-year amortization as well)	Active	Other	36.2						4.7										31.5			
OTHER REDUCTIONS IN THE EFFECTIVE TAX RATE																						
Activities or Products Exempt from Taxation																						
Alcohol Fuels Excise Tax Exemption	Active	Energy	485.0					485.0														
Tax-Exempt Bond Issues - Use-of-Proceeds Category																						
Public Power Facilities	Narrowed	Energy	1,387.5	0.0								406.4	23.3	7.9	820.1	45.2	24.5	20.4	28.9	7.8	3.0	0.0
Gas Utilities	Narrowed	Energy	40.9			40.9																
Pollution Control	Residual	GenCap	562.7	2.6	181.5	25.8						325.1	17.3	10.4	0.0	0.0						
Waste-to-Energy Plants, Energy Share	Narrowed	Energy	276.8														276.8					
Multiple Utilities	Narrowed	Energy	40.3	0.0								11.8	0.7	0.2	23.8	1.3	0.7	0.6	0.8	0.2	0.1	0.0
Seaports,Harbors, Wharves	Narrowed	Other	78.7	25.2	53.5																	
Tax-Exempt Dividend Reinvestment, Pub. Util.	Expired	Energy	N/A																			
Exclusion of Construction Pmts., Gas & Elect. Utilities	Repealed	Energy	N/A																			
Exclusion of Mortgage Int., Owner-Occupied Homes	Active	Other	139.8								139.8											
Tax-Exempt Black Lung Benefits	Active	Energy	180.0	180.0																		

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Tax Benefit Subsidy Allocations for Fy-89 -- HIGH ESTIMATE (continued)

Subsidy	Status	Target Sector	Total Energy	Coal	Oil	Gas	Solar (non-grid)	Ethanol	Biomass (non-grid)	Efficiency		Electric									
										Supply	End-use	Coal	Oil	Gas	Fission	Hydro	WTE	Geotherm	Biomass	Wind	Solar	Fusion
Entities Exempt from Taxation																						
Tax Exculusion, Electric & Telephone Coop. Income	Active	Energy	564.7									416.1	29.9	56.9	59.3	1.9	0.7					
Tax-Exempt Publicly Owned Utilities	Active	Energy	282.6									112.9	41.4	12.5	18.9	96.9						
Reduced Tax Rates																						
Capital Gains Exclusion on Coal Royalties	Reactivate	Energy	N/A																			
Capital Gains Exclusion on StandingTimber	Reactivate	Other	N/A																			
Graduated Corporate Income Tax	Active	Other	N/E																			
Reduced Tax on Capital Gains (other than agricultural, timber, iron ore and coal)	Reactivate	GenCap	N/A																			
REDUCTIONS IN THE EFFECTIVE TAXABLE BASIS																						
Expensing of Costs Normally Capitalized																						
Expensing of Construction Period Interest	Repealed	GenCap	N/A																			
Expensing of Long-Term R&D	Active	Other	79.2		79.2																	
Expensing of Oil & Gas Explor./Dev. Costs	Narrowed	Energy	(300.0)		(204.5)	(95.5)																
Expensing of Other Fuels Explor./Dev. Costs	Narrowed	Energy	35.0	33.4											0.8			0.8				
Expensing of Mine Closure & Reclamation Reserves	Narrowed	Energy	50.0	48.8											1.2							
Expensing of Multi-period Timber Growing Costs	Active	Other	55.2							7.2									48.0			
Expensing of Tertiary Injectants	Active	Energy	20.0		20.0																	
Accelerated Depreciation of Certain Assets																						
7-year Amortization of Reforestation Expenses	Active	Other	Included in "Tax Credit for Reforestation Expenses" line item.																			
ACRS/Accel. Dep. of Machin. & Equip.	Residual	GenCap	9,568.2	812.7	2,996.6	2,114.1	3.9	28.1	12.8	0.0	184.4	948.9	26.7	62.0	2,074.8	57.1	71.2	59.4	84.1	22.7	8.7	0.0
Accel. Deprec., Rental Housing	Residual	Other	9.9								9.9											
Accel. Deprec., Other Bldgs.	Residual	Other	203.5								203.5											
Rapid Amortization of Railway Cars	Expired	Other	N/A																			
Rapid Amortization of Pollution Control Equip.	Expired	GenCap	N/A																			
Deferral of Required Income Tax Payments																						
Deferral of Tax on Shipping Companies	Active	Other	76.4	16.4	60.0	0.0											0.0					
Special Deductions																						
Percentage of Depletion Benefits: Oil & Gas	Narrowed	Energy	530.0		333.1	196.9																
Percentage of Depletion Benefits: Other Fuels	Narrowed	Energy	220.0	202.9											7.5			9.6				
Utilities Normalization of Tax Overcharges	Active	Energy	996.2			187.6					0.0	225.9	6.4	14.8	489.3	13.6	17.0	14.1	20.0	5.4	2.1	0.0
Deduction for Motor Carrier Operating Rights	Expired	Other	N/A																			

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Tax Benefit Subsidy Allocations for Fy-89 -- HIGH ESTIMATE (continued)

Subsidy	Status	Target Sector	Total Energy	Coal	Oil	Gas	Solar (non-grid)	Ethanol	Biomass (non-grid)	Efficiency		Electric									
										Supply	End-use	Coal	Oil	Gas	Fission	Hydro	WTE	Geotherm	Biomass	Winds	Solar	Fusion
SPECIAL DEFINITIONS OF THE TAXABLE ENTITY																						
Benefits Due to Special Congressional Exemptions																						
Gas & Oil Restriction to Passive Loss Restrictions	Active	Energy	300.0		204.5	95.5																
Special Treatment of Alaskan National Corps.	Residual	Other	194.8		186.9							2.7	2.7	2.7								
Foreign Research Expen. Offset of Domestic Income	Active	Other	0.1		0.1																	
Domestic International Sales Corps.	Expired	Other	N/A																			
Western Hemisphere Trade Corps.	Expired	Other	N/A																			
Benefits Due to Transfer Pricing																						
Foreign Tax Credits - Oil & Gas Only	Narroed	Other	N/E																			
Exclusion of Income, Foreign Sales Corps.	Active	Other	N/E																			
Oil Shipping Subsidiaries	Repealed	Energy	N/A																			
Safe Harbor Leasing	Residual	GenCap	(163.3)	(13.9)	(51.2)	(36.1)	(0.1)	(0.5)	(0.2)	0.0	(3.1)	(16.2)	(0.5)	(1.1)	(35.4)	(1.0)	(1.2)	(1.0)	(1.4)	(0.4)	(0.4)	0.0
Total			18,145.	1,480.9	4,553.4	2,969.4	10.6	538.4	32.0	0.0	886.3	2,628.9	153.3	179.0	3,887.4	226.7	404.3	206.9	229.2	40.4	28.6	0.0
Percent of Total Shares			100.0%	8.16%	25.09%	16.36%	0.06%	2.97%	0.18%	0.00%	4.44%%	14.49%	0.84%	0.99%	21.42%	1.25%	2.23%	1.14%	1.26%	0.22%	0.16%	0.00%

See notes following low estimate.

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Tax Benefit Subsidy Allocations for Fy-89 -- LOW ESTIMATE

Subsidy	Status	Target Sector	Total Energy	Coal	Oil	Gas	Solar (non-grid)	Ethanol	Biomass (non-grid)	Efficiency		Electric									
										Supply	End-use	Coal	Oil	Gas	Fission	Hydro	WTE	Geotherm	Biomass	Winds	Solar	Fusion
TAX CREDITS																						
Alcohol Fuel Income Tax Credit	Active	Energy	1.3					1.3														
Alternative Fuel Production Credit	Active	Energy	10.0	2.5	2.5	2.5			2.5													
Enhanced Oil and Gas Recovery Credit	Began '90	Energy	N/A																			
ITCs: New Machinery & Equipment	Residual	GenCap	766.4	65.7	242.4	171.0	0.3	2.3	1.0	0.0	7.5	76.7	2.2	5.0	167.6	4.6	5.6	4.8	6.8	1.8	0.7	0.0
ITCs: Busines Energy Credits - Conservation	Narrowed	Energy	1.3								1.3											
ITCs: Business Energy Credits - Supply	Narrowed	Energy	80.0				4.4															
ITCs: Residential Energy Credits - Conservation	Expired	Energy	N/A															66.0			9.7	
ITCs: Residential Energy Credits - Supply	Expired	Energy	N/A																			
ITCs: Rehabilitation of Structures	Active	Other	1.3								1.3											
Research & Development Tax Credit	Active	Other	28.3		28.3																	
Tax Credit for Reforestation Expenses (includes 7-year amortization as well)	Active	Other	24.1					3.1											21.0			
OTHER REDUCTIONS IN THE EFFECTIVE TAX RATE																						
Activities or Products Exempt from Taxation																						
Alcohol Fuels Exemption from Taxation	Active	Energy	300.0					300.0														
Tax-Exempt Bond Issues - Use-of-Proceeds Category																						
Public Power Facilities	Narrowed	Energy	1,137.5									333.2	19.1	6.5	672.3	37.0	20.1	16.7	23.7	6.4	2.5	0.0
Gas Utilities	Narrowed	Energy	33.6			33.6																
Pollution Control	Residual	GenCap	461.3	2.1	148.8	21.1						266.5	14.2	8.5	0.0	0.0						
Waste-to-Energy Plants, Energy Share	Narrowed	Energy	226.9														226.9					
Multiple Utilities	Narrowed	Energy	33.1									9.7	0.6	0.2	19.6	1.1	0.6	0.5	0.8	0.7	0.2	0.0
Seaports,Harbors, Wharves	Narrowed	Other	64.5	24.8	52.6																	
Tax-Exempt Dividend Reinvestment, Pub. Utils.	Expired	N/A	N/A																			
Exclusion of Construction Pmts., Gas & Elect. Utilities	Repealed	Energy	N/A																			
Exclusion of Mortgage Int., Owner-Occupied Homes	Active	Other	75.5								75.5											
Tax-Exempt Black Lung Benefits	Active	Energy	110.0	110.0																		

Alliance to Save Energy and Douglas Koplow, April 1993

Tax Benefit Subsidy Allocations for Fy-89 -- LOW ESTIMATE (continued)

Subsidy	Status	Target Sector	Total Energy	Coal	Oil	Gas	Solar (non-grid)	Ethanol	Biomass (non-grid)	Efficiency		Electric									
										Supply	End-use	Coal	Oil	Gas	Fission	Hydro	WTE	Geotherm	Biomass	Wind	Solar	Fusion
Entities Exempt from Taxation																						
Tax Exclusion, Electric & Telephone Coop. Income	Active	Energy	403.3									297.2	21.4	40.6	42.4	1.3	0.5					
Tax-Exempt Publicly Owned Utilities	Active	Energy	282.6									112.9	41.4	12.5	18.9	96.9						
Reduced Tax Rates																						
Capital Gains Exclusion on Coal Royalties	Reactivate	Energy	N/A																			
Capital Gains Exclusion on StandingTimber	Reactivate	Other	N/A																			
Graduated Corporate Income Tax	Active	Other	N/E																			
Reduced Tax on Capital Gains (other than agricultural, timber, iron ore and coal)	Reactivate	GenCap	N/A																			
REDUCTIONS IN THE EFFECTIVE TAXABLE BASIS																						
Expensing of Costs Normally Capitalized																						
Expensing of Construction Period Interest	Repealed	GenCap	N/A																			
Expensing of Long-Term R&D	Active	Other	50.9		50.9																	
Expensing of Oil & Gas Explor./Dev. Costs	Narrowed	Energy	(65.0)		(44.3)	(20.7)																
Expensing of Other Fuels Explor./Dev. Costs	Narrowed	Energy	20.0	19.1												0.5		0.4				
Expensing of Mine Closure & Reclamation Reserves	Narrowed	Energy	40.0	39.0												1.0						
Expensing of Multi-period Timber Growing Costs	Active	Other	54.3						7.1										47.2			
Expensing of Tertiary Injectants	Active	Energy	20.0		20.0																	
Accelerated Depreciation of Certain Assets																						
7-year Amortization of Reforestation Expenses	Active	Other	Included in "Tax Credit for Reforestation Expenses" line item.																			
ACRS/Accel. Dep. of Machin. & Equip.	Residual	GenCap	2,763.0	237.0	873.8	616.4	1.1	8.2	3.7	0.0	26.9	276.4	7.8	18.1	605.0	16.6	20.8	17.3	24.5	6.6	2.5	0.0
Accel. Deprec., Rental Housing	Residual	Other	2.5								2.5											
Accel. Deprec., Other Bldgs.	Residual	Other	64.9								64.9											
Rapid Amortization of Railway Cars	Expired	Other	N/A																			
Rapid Amortization of Pollution Control Equip.	Expired	GenCap	N/A																			
Deferral of Required Income Tax Payments																						
Deferral of Tax on Shipping Companies	Active	Other	10.4	0.5	6.3	0.3											3.2					
Special Deductions																						
Percentage of Depletion Benefits: Oil & Gas	Narrowed	Energy	390.0		245.1	144.9																
Percentage of Depletion Benefits: Other Fuels	Narrowed	Energy	135.0	124.5											4.6			5.9				
Utilities Normalization of Federal Tax Overcharges	Active	Energy	0.0																			
Deduction for Motor Carrier Operating Rights	Expired	Other	N/A																			

Alliance to Save Energy and Douglas Koplow, April 1993

Tax Benefit Subsidy Allocations for Fy-89 -- LOW ESTIMATE (continued)

Subsidy	Status	Target Sector	Total Energy	Coal	Oil	Gas	Solar (non-grid)	Ethanol	Biomass (non-grid)	Efficiency		Electric									
										Supply	End-use	Coal	Oil	Gas	Fission	Hydro	WTE	Geotherm	Biomass	Wind	Solar	Fusion
SPECIAL DEFINITIONS OF THE TAXABLE ENTITY																						
Benefits Due to Special Congressional Exemptions																						
Gas & Oil Restriction to Passive Loss Restrictions	Active	Energy	135.0		92.0	43.0																
Special Treatment of Alaskan National Corps	Residual	Other	104.7		102.4							0.8	0.8	0.8								
Foreign Research Expen. Offset of Domestic Income	Active	Other	0.0		0.0																	
Domestic International Sales Corps.	Expired	Other	N/A																			
Western Hemisphere Trade Corps.	Expired	Other	N/A																			
Benefits Due to Transfer Pricing																						
Foreign Tax Credits - Oil & Gas Only	Narrowed	Other	N/E																			
Exclusion of income, Foreign Sales Corps.	Active	Other	N/E																			
Oil Shipping Subsidiaries	Repealed	Energy	N/A																			
Safe Harbor Leasing	Residual	GenCap	(78.8)	(6.8)	(24.9)	(17.6)	(0.0)	(0.2)	(0.1)	0.0	(0.8)	(7.9)	(0.2)	(0.5)	(17.2)	(0.5)	(0.6)	(0.5)	(0.7)	(0.2)	(0.1)	0.0
Total			7,687.2	614.3	1,787.2	994.5	5.8	311.5	17.2	0.0	179.1	1,365.9	107.1	91.7	1,514.7	157.1	274.0	111.2	122.5	14.9	16.4	0.0
Percent of Total Shares			100.0%	7.99%	23.25%	12.94%	0.08%	4.05%	0.22%	0.00%	2.33%	17.77%	1.39%	1.19%	19.70%	2.04%	3.56%	1.45%	1.59%	0.19%	0.20%	0.00%

Notes to and Sources of High and Low Estimates:
(1) This table is a summary of data contained in the Tax Expenditures chapter of this report. The primary source data for most of these estimates are from the Tax Expenditures Section of OMB, "Budget of the United States Government, Fiscal Year 1991," pp. AA-59 -- A-76, and the Joint Committee on Taxation, "Estimate of Federal Tax Expenditures for the Fiscal Years 1989-1993." OMB prints estimates prepared by the U.S. Treasury, Office of Tax Analysis. See individual sections for details on each estimate and allocation.
(2) Negative values denote increased revenues for the Treasury over the collections with no provisions. These are nominal gains and reflect lower tax deductions at the end of an asset's life, offsetting higher-than-normal deductions earlier on. The net present value of such provisions to the Treasury are negative.
(3) High and low estimates do not differ for every provision. Differences are due either to the measurement of pre-tax values (revenue loss) versus after-tax values (outlay equivalents), or to differing assumptions and estimation approaches used by Treasury and JCT.
(4) Estimates of $1.3 million reflect Treasury estimates of "<$2.5 million." The midpoint between $2.5m and $0 (with rounding) was chosen as a best-guess of the true value. A similar approach was used for Joint Committee on Taxation estimates of "less than $50 million," with $25 million used as a proxy. Where JCT provided values for multiple years, but not individually for 1989, the average annual value was used.
(5) Status codes: "Residual" means provision was repealed or expired, but tax losses continued through 1989 due to transition rules or stored credits. "Narrowed" refers to provisions still in effect, for which eligibility has been tightened. All other codes are self-explanatory.
(6) "N/A" refers to "Not Active" and describes expired, pending or inactive provisions. "N/E" refers to active provisions with some benefit to the energy sector, but which were not estimated.

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Appendix 9: Summary of Agency Spending, Loans and Loan Guarantees – High and Low Estimates

Summary of Agency Spending, Loans and Loan Guarantees -- High Estimate

Subsidy	Total Energy (3)	Coal	Oil	Gas	Solar (non-grid)	Ethanol	Biomass (non-grid)	Efficiency		Electric											Other Renew. (5)	Fusion	Electric General (5)	Percent Shares
								Supply	End-use	Coal	Oil	Gas	Fission	Hydro	WTE (4)	Geotherm	Biomass	Wind	Solar	Fossil (5)				
Department of Agriculture																								
Agricultural Research Service	N/E																							0.0%
Commodity Credit Corporation	326.5					326.5																		21.8%
Federal Crop Insurance Corporation	3.3					3.3																		0.02%
Conservation Reserve Program	10.6					10.6																		0.07%
Forestry Incentives Program	N/E																							0.00%
Forest Service	N/E																							0.00%
Rural Electrification Administration	1,183.9									607.3	193.5	58.4	321.6	3.2										7.90%
Soil Conservation Service	N/E																							0.00%
Executive Branch, Miscellaneous Functions																								
Council on Environmental Quality	N/E																							0.00%
Office of the U.S. Trade Representative	N/E																							0.00%
Office of Management and Budget	N/E																							0.00%
Office of Science and Technical Policy	N/E																							0.00%
International Development Assistance																								
Agency for International Development	N/E																							0.00%
Support for Multilateral Development Banks	179.1		14.3	14.3					0.8	42.2	9.7	5.2	1.9	89.5		0.9				0.0		0.0		1.20%
Department of Commerce																								
International Trade Administration	N/E																							0.00%
Export Administration	N/E																							0.00%
National Oceanic and Atmospheric Admin.	N/E																							0.00%
Nat'l. Institute of Standards and Technology	N/E																							0.00%
Department of Defense																								
Army Corps of Engineers Civil Program	643.0	199.6	417.7											25.6										4.29%
Navy Supervisor of Salvage	18.5		18.5																					0.12%

Alliance to Save Energy and Douglas Koplow. April 1993

Summary of Agency Spending, Loans and Loan Guarantees -- High Estimate (continued)

Agency	Total Energy (3)	Coal	Oil	Gas	Solar (non-grid)	Ethanol	Biomass (non-grid)	Efficiency		Electric											Other Renew. (5)	Fusion	Electric General (5)	Percent Shares
								Supply	End-use	Coal	Oil	Gas	Fission	Hydro	WTE (4)	Geotherm	Biomass	Wind	Solar	Fossil (5)				
Department of Energy																								
Energy R&D, Waste Mgmt., & Admin.	2,782.4	385.4	120.8	49.3	32.5	0.6	5.9	156.7	240.1	36.3	3.2	4.9	1,012.6	5.6	0.0	45.4	70.3	23.7	103.9	0.0	23.9	413.3	47.7	18.57%
Clean Coal Program	190.0							13.6		176.4														1.27%
Strategic Petroleum Reserves	2,061.9		2,061.9																					13.76%
Energy Information Administration	52.7	3.1	31.0	5.4				1.3	1.3	3.6	0.4	0.6	5.4	0.6										0.35%
Federal Energy Regulatory Commission	(17.8)		(0.4)	(9.0)										(4.3)									(4.0)	-0.12%
Naval Petroleum and Oil Shale Reserves	136.0		103.9	32.1																				0.91%
Nuclear Waste Fund	181.7												181.7											1.21%
Power Marketing Administrations																								
Alaska Power Administration	7.9													7.9										0.05%
Bonneville Power Administration	441.7								9.8				381.5	50.4										2.95%
Southeastern Power Administration	71.3													71.3										0.48%
Southwestern Power Administration	42.4													42.4										0.26%
Western Area Power Administration	53.1													53.1										0.35%
Uranium Enrichment Enterprise	1,026.8												1,026.8											6.85%
Department of Health and Human Services																								
Centers for Disease Control	N/E																							0.00%
National Institutes of Health																								
National Cancer Institute	N/E																							0.00%
National Heart, Lung and Blood Institute	N/E																							0.00%
National Institute of Environ. Health Sciences	N/E																							0.00%
Social Security Administration, Black Lung	892.0	892.0																						5.95%
Family Support Admin: LIHEAP	1,513.0	44.3	347.7	751.9			44.3	0.0	163.8	87.9	9.3	15.7	31.3	15.6	0.1	1.0	0.1	0.0	0.0		0.0		0.0	10.10%
Department of Housing and Urban Development	N/E																							
Department of the Interior																								
Bureau of Indian Affairs	N/E																							0.00%
Bureau of Land Management	N/E																							0.00%
Bureau of Mines	N/E																							0.00%

Alliance to Save Energy and Douglas Koplow. April 1993

Summary of Agency Spending, Loans and Loan Guarantees -- High Estimate (continued)

Agency	Total Energy (3)	Coal	Oil	Gas	Solar (non-grid)	Ethanol	Biomass (non-grid)	Efficiency		Electric											Other Renew. (5)	Fusion	Electric General (5)	Percent Shares
								Supply	End-use	Coal	Oil	Gas	Fission	Hydro	WTE (4)	Geotherm	Biomass	Wind	Solar	Fossil (5)				
Bureau of Reclamation	N/E																							0.00%
Fish and Wildlife Service	N/E																							0.00%
Minerals Management Service	167.7		93.1	74.6																				1.12%
Office of Surface Mining Reclamation & Enforcement	878.7	878.7																						5.86%
U.S. Geological Survey																								0.00%
Department of Labor																								
Black Lung Program	348.7	348.7																						2.33%
Mine Safety and Health Administration	116.7	116.6											0.1											0.78%
Occupational Safety and Health Administration	N/E																							0.00%
Department of State																								
International Atomic Energy Agency	48.0												48.0											0.32%
United Nations Environmental Program	N/E																							0.00%
Department of Transportation																								
Coast Guard	484.5	78.3	406.2																					3.23%
Maritime Administration	143.7	32.9	111.3																	(0.4)				0.96%
St. Lawrence Seaway Development Corp.	N/E																							0.00%
Federal Highway Administration	N/E																							0.00%
National Highway Traffic Safety Administration	N/E																							0.00%
Federal Railroad Administration	17.6	16.1	1.5																				0.0	0.12%
Independent Agencies																								
Environmental Protection Agency	N/E																							0.00%
Export-Import Bank	498.9	51.9	98.7	24.9				0.5		62.7	9.4	117.6	55.1	78.1		0.0	0.0	0.0	0.1	(0.0)	0.0	0.0		3.33%
Federal Emergency Management Agency	N/E																							0.00%
Federal Maritime Commission	N/E																							0.00%
Federal Mine Safety and Health Review Comm.	N/E																							0.00%
International Trade Commission	N/E																							0.00%
National Aeronautics and Space Administration	N/E																							0.00%
National Institute of Building Sciences	N/E																							0.00%

Alliance to Save Energy and Douglas Koplow, April 1993

Summary of Agency Spending, Loans and Loan Guarantees -- High Estimate (continued)

Agency	Total Energy (3)	Coal	Oil	Gas	Solar (non-grid)	Ethanol	Biomass (non-grid)	Efficiency		Electric											Other Renew. (5)	Fusion	Electric General (5)	Percent Shares
								Supply	End-use	Coal	Oil	Gas	Fission	Hydro	WTE (4)	Geotherm	Biomass	Wind	Solar	Fossil (5)				
National Transportation Safety Board	N/E																							0.00%
National Science Foundation	N/E																							0.00%
Nuclear Regulatory Commission	347.4												347.4											2.32%
Occupational Safety and Health Review Comm.	N/E																							0.00%
Railroad Retirement Board	N/E																							0.00%
Tennessee Valley Authority	129.6								(8.8)	(132.1)		(18.8)	331.3	(42.0)										0.87%
Legislative Branch																								
Commission on Catastrophic Nuclear Accidents	0.04												0.04											0.00%
Commission on Railroad Retirement Reform	N/E																							0.00%
Congressional Budget Office	N/E																							0.00%
Congressional Research Service	N/E																							0.00%
General Accounting Office	N/E																							0.00%
Joint Committee on Taxation	N/E																							0.00%
Office of the Nuclear Waste Negotiator	Begins 1990																							0.00%
Office of Technology Assessment	N/E																							0.00%
Total Covermant Support	**14,381**	**3,047.4**	**3,826.2**	**943.5**	**32.5**	**341.0**	**50.2**	**172.1**	**407.0**	**886.2**	**225.2**	**183.4**	**3,744.2**	**396.8**	**0.1**	**46.9**	**70.3**	**23.7**	**104.0**	**(0.4)**	**23.9**	**413.6**	**43.7**	**100.0%**
Percent Shares	**100.0%**	**20.34%**	**25.54%**	**6.30%**	**0.22%**	**2.26%**	**0.34%**	**1.15%**	**2.72%**	**5.92%**	**1.50%**	**1.22%**	**24.99%**	**2.65%**	**0.0%**	**0.31%**	**0.47%**	**0.16%**	**0.69%**	**0.0%**	**0.16%**	**2.76%**	**0.29%**	

Notes:
(1) This is a summary spreadsheet of data contained in the individual agency listings in the Agency intervention chapter. Refer there for questions. Negative numbers reflect cross-subsidies between fuels or net gains on licensing fees.
(2) High and low estimates reflect differences in assumptions, data, third party estimates, or estimating methods. Not every agency has high and low estimates.
(3) "N/E" signifies agencies wwith some energy-related spending, but which were not estimated in this report.
(4) Waste-to-Energy estimates include energy share of spending only.
(5) "Other renewables" include hydrogen, ocean thermal, and spending which could not be broken out into constituent fuels. General- and fossil-electric also contains cross-cutting spending.

Alliance to Save Energy and Douglas Koplow, April 1993

Summary of Agency Spending, Loans and Loan Guarantees -- Low Estimate

Subsidy	Total Energy (3)	Coal	Oil	Gas	Solar (non-grid)	Ethanol	Biomass (non-grid)	Efficiency		Electric										Other Renew. (5)	Fusion	Electric General (5)	Percent Shares
								Supply	End-use	Coal	Oil	Gas	Fission	Hydro	WTE (4)	Geotherm	Biomass	Wind	Solar	Fossil (5)			
Department of Agriculture																							
Agricultural Research Service	N/E																						0.0%
Commodity Credit Corporation	208.4					208.4																	1.64%
Federal Crop Insurance Corporation	3.0					3.0																	0.02%
Conservation Reserve Program	10.2					10.2																	0.06%
Forestry Incentives Program	N/E																						0.00%
Forest Service	N/E																						0.00%
Rural Electrification Administration	1,123.2									569.8	179.8	54.2	316.5	2.9									8.84%
Soil Conservation Service	N/E																						0.00%
Executive Branch, Miscellaneous Functions																							
Council on Environmental Quality	N/E																						0.00%
Office of the U.S. Trade Representative	N/E																						0.00%
Office of Management and Budget	N/E																						0.00%
Office of Science and Technical Policy	N/E																						0.00%
International Development Assistance																							
Agency for International Development	N/E																						0.00%
Support for Multilateral Development Banks	179.1		14.3	14.3					0.8	42.2	9.7	5.2	1.9	89.5		0.9							1.41%
Department of Commerce																							
International Trade Administration	N/E																						0.00%
Export Administration	N/E																						0.00%
National Oceanic and Atmospheric Admin.	N/E																						0.00%
Nat'l. Institute of Standards and Technology	N/E																						0.00%
Department of Defense																							
Army Corps of Engineers Civil Program	643.0	199.6	417.7											25.6									5.06%
Navy Supervisor of Salvage	0.0		0.0																				0.00%

Alliance to Save Energy and Douglas Koplow, April 1993

Summary of Agency Spending, Loans and Loan Guarantees – Low Estimate (continued)

Agency	Total Energy (3)	Coal	Oil	Gas	Solar (non-grid)	Ethanol	Biomass (non-grid)	Efficiency		Electric											Other Renew. (5)	Fusion	Electric General (5)	Percent Shares
								Supply	End-use	Coal	Oil	Gas	Fission	Hydro	WTE (4)	Geotherm	Biomass	Wind	Solar	Fossil (5)				
Department of Energy																								
Energy R&D, Waste Mgmt., & Admin.	2,782.4	385.4	120.8	49.3	32.5	0.6	5.9	156.7	240.1	36.3	3.2	4.9	1,012.6	5.6	0.0	45.4	70.3	23.7	103.9	0.0	23.9	413.6	47.7	21.89%
Clean Coal Program	40.9							7.3		33.6														0.32%
Strategic Petroleum Reserves	1,736.7		1,736.7																					13.66%
Energy Information Administration	52.7	3.1	31.0	5.4				1.3	1.3	3.6	0.4	0.6	5.4	0.6		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.41%
Federal Energy Regulatory Commission	(17.8)		(0.4)	(9.0)										(4.3)									(4.0)	-0.14%
Naval Petroleum and Oil Shale Reserves	0.0		0.0	0.0																				0.00%
Nuclear Waste Fund	0.0												0.0											0.00%
Power Marketing Administrations																								
Alaska Power Administration	6.1													6.1										0.05%
Bonneville Power Administration	297.5								(4.9)				354.4	(52.1)										2.34%
Southeastern Power Administration	59.4													59.4										0.47%
Southwestern Power Administration	33.7													33.7										0.27%
Western Area Power Administration	30.6													30.6										0.24%
Uranium Enrichment Enterprise	279.1												279.1											2.20%
Department of Health and Human Services																								
Centers for Disease Control	N/E																							0.00%
National Institutes of Health																								0.00%
National Cancer Institute	N/E																							0.00%
National Heart, Lung and Blood Institute	N/E																							0.00%
National Institute of Environ. Health Sciences	N/E																							0.00%
Social Security Administration, Black Lung	892.0	892.0																						7.02%
Family Support Admin: LIHEAP	1,513.0	44.3	347.7	751.9	0.0	0.0	44.3	0.0	163.8	87.9	9.3	15.7	31.3	15.6	0.1	1.0	0.1	0.0	0.0	0.0	0.0		0.0	11.90%
Department of Housing and Urban Development	N/E																							
Department of the Interior																								
Bureau of Indian Affairs	N/E																							0.00%
Bureau of Land Management	N/E																							0.00%
Bureau of Mines	N/E																							0.00%

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Summary of Agency Spending, Loans and Loan Guarantees – Low Estimate (continued)

Agency	Total Energy (3)	Coal	Oil	Gas	Solar (non-grid)	Ethanol	Biomass (non-grid)	Efficiency		Electric											Other Renew. (5)	Fusion	Electric General (5)	Percent Shares
								Suppiy	End-use	Coal	Oil	Gas	Fission	Hydro	WTE (4)	Geotherm	Biomass	Wind	Solar	Fossil (5)				
Bureau of Reclamation	N/E																							0.00%
Fish and Wildlife Service	N/E																							0.00%
Minerals Management Service	167.7		93.1	74.6																				1.32%
Office of Surface Mining Reclamation & Enforcement	878.7	878.7																						6.91%
U.S. Geological Survey	N/E																							0.00%
Department of Labor																								
Black Lung Program	260.1	260.1											0.1											2.05%
Mine Safety and Health Administration	116.7	116.6																						0.92%
Occupational Safety and Health Administration	N/E																							0.00%
Department of State																								
International Atomic Energy Agency	48.0												48.0											0.38%
United Nations Environmental Program	N/E																							0.00%
Department of Transportation																								
Coast Guard	484.5	78.3	406.2																					3.81%
Maritime Administration	143.7	32.9	111.3																	(0.4)				1.13%
St. Lawrence Seaway Development Corp.	N/E																							0.00%
Federal Highway Administration	N/E																							0.00%
National Highway Traffic Safety Administration	N/E																							0.00%
Federal Railroad Administration	13.5	12.5	0.8	0.0																			0.0	0.11%
Independent Agencies																								
Environmental Protection Agency	N/E																							0.00%
Export-Import Bank	434.4	43.8	85.1	21.5				0.4	0.0	54.7	8.1	102.6	47.8	70.5		0.0	0.0	0.0	0.1	(0.0)	0.0	0.0		3.42%
Federal Emergency Management Agency	N/E																							0.00%
Federal Maritime Commission	N/E																							0.00%
Federal Mine Safety and Health Review Comm.	N/E																							0.00%
International Trade Commission	N/E																							0.00%
National Aeronautics and Space Administration	N/E																							0.00%
National Institute of Building Sciences	N/E																							0.00%

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Summary of Agency Spending, Loans and Loan Guarantees -- Low Estimate (continued)

Agency	Total Energy (3)	Coal	Oil	Gas	Solar (non-grid)	Ethanol	Biomass (non-grid)	Efficiency		Electric											Other Renew. (5)	Fusion	Electric General (5)	Percent Shares
								Supply	End-use	Coal	Oil	Gas	Fission	Hydro	WTE (4)	Geotherm	Biomass	Wind	Solar	Fossil (5)				
National Transportation Safety Board	N/E																							0.00%
National Science Foundation	N/E																							0.00%
Nuclear Regulatory Commission	287.2												287.2											2.26%
Occupational Safety and Health Review Comm.	N/E																							0.00%
Railroad Retirement Board	N/E																							0.00%
Tennessee Valley Authority	3.4								(13.4)	(199.9)		(28.4)	306.6	(63.5)										0.03%
Legislative Branch																								
Commission on Catastrophic Nuclear Accidents	0.04												0.04											0.00%
Commission on Railroad Retirement Reform	N/E																							0.00%
Congressional Budget Office	N/E																							0.00%
Congressional Research Service	N/E																							0.00%
General Accounting Office	N/E																							0.00%
Joint Committee on Taxation	N/E																							0.00%
Office of the Nuclear Waste Negotiator	Begins 1990																							0.00%
Office of Technology Assessment	N/E																							0.00%
total Goverment Support	**12,711.**	**2,948.9**	**3,364.6**	**906.0**	**32.5**	**222.2**	**50.2**	**165.7**	**387.7**	**630.1**	**210.2**	**154.5**	**2,692.4**	**220.0**	**0.1**	**46.9**	**70.3**	**23.7**	**104.0**	**(0.4)**	**23.9**	**413.6**	**43.7**	**1.0**
Percent Shares	**100.0%**	**23.18%**	**26.47%**	**7.14%**	**0.26%**	**1.75%**	**0.40%**	**1.30%**	**3.05%**	**4.96%**	**1.65%**	**1.22%**	**21.18%**	**1.73%**	**0.0%**	**0.37%**	**0.55%**	**0.19%**	**0.82%**	**0.0%**	**0.19%**	**3.25%**	**0.34%**	**100.0%**

Notes:
(1) This is a summary spreadsheet of data contained in the individual agency listings in the Agency Intervention chapter. Refer there for questions. Negative numbers reflect cross-subsidies between fuels or net gains on licensing fees.
(2) High and low estimates reflect differences in assumptions, data, third party estimates, or estimating methods. Not every agency has high and low estimates.
(3) "N/E" signifies agencies wwith some energy-related spending, but which were not estimated in this report.
(4) Waste-to-Energy estimates include energy share of spending only.
(5) "Other renewables" include hydrogen, ocean thermal, and spending which could not be broken out into constituent fuels. General- and fossil-electric also contains cross-cutting spending.

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Appendix A-10: Summary of Federal Intervention in Energy Markets through Regulations on Pricing, Access, Terms of Sale, or through Energy Procurement for Internal Use** (listed by point of intervention)

Direct Federal Market Intervention	*Fuels Affected*	*Current Status*	*Impact on Market*
Supply-Side Interventions Other Than Price			
Federal ownership of natural resources	Coal, oil, gas, uranium, geothermal, electricity	Active	Variable
Licensing and rights of way			
Licensing of fuel minerals	Coal, oil, gas	Active	Variable
Licensing of hardrock minerals	Uranium, synfuels	Active	Decreases costs due to antiquated law
Licensing of hyrdoelectric facilities	Hydroelectric	Active	Variable
Land grants for rights-of-way	Coal, oil, gas, electric	Active	Facilitated market development; current impacts centered on transmission line and pipeline rights-of-way
Licensing of patents from government energy research	All fuels and efficiency; likely to be correlated with R&D spending mix	Active	Decreases cost of innovation
Interference with Rights and Options of Private Suppliers			
Export Restrictions			
Restriction on nuclear exports	Fission	Active	Increases costs by reducing utilization of economies of scale
Restriction on timber exports	Wood	Active	Negligible
Restriction of crude oil exports	Oil	Active	May slightly reduce domestic oil prices regionally
Restrictions on Production Decisions			
Connally Hot Oil Act restrictions on intrastate production	Oil	Inactive	Decreased long-term costs by maintaining drilling pressures; increased short-term energy costs
Jones Act restrictions on use of foreign shipping vessels	Oil, coal	Active	Increases cost of transport

KEY:
Inactive Status refers to interventions that have expired, been eliminated, or were one-time grants.
Variable Impact means that the intervention can increase or decrease prices, market certainty, or market interest depending on how it is applied.
Facilitated Market Development refers to interventions which, had they not occurred, would have made widespread use of the fuel unlikely.

***Since these interventions affect the market clearing conditions, each may potentially also affect the market for energy efficiency as a substitute for increased competition*

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Direct Federal Market Intervention	*Fuels Affected*	*Current Status*	*Impact on Market*
Restrictions on choice of fuels for electric utilities	Oil, gas, coal	Inactive	Increased costs of electricity production
Transport restrictions on gas pipelines	Gas	Inactive	Increased costs of electricity production
Contractual abrogation during natural gas shortage in 1973	Gas	Inactive	Increased costs by increasing market uncertainty
Monopoly problems with electric wheeling	Electricity	Active**	Increases costs by precluding arbitrage between power districts
Restrictions on organization form of utilities	Electricity	Active	Prevents monopoly pricing; may also increase costs by reducing administrative economies of scale
Residential conservation service provision of efficiency audits	Efficiency	Inactive	Potentially decreases costs through demand reduction
Performance Thresholds			
Automobile and appliance efficiency standards	Efficiency	Active	May increase cost of manufacture and of purchase; will generally reduce life-cycle costs of ownership
CAFE exceptions for multi-fueled vehicles	Methanol, ethanol	Active	May decrease efficiency improvements of automobile fleet
Required conservation efforts to get access to federal power from WAPA	Efficiency	Active	Will probably decrease utility operating costs
Direct Ownership of Capacity			
Release of fission power technology to private industry	Fission	Inactive	Facilitated market development
Direct federal ownership of uranium enrichment services	Fission	Active	Decreases costs through below-cost sales
Direct federal ownership of electric generation	Electricity	Active	Decreases regional costs through subsidized infrastructure development
Demand-Side Interventions Other Than Price			
Import restrictions			
Import restrictions on uranium	Fission	Inactive	Protects domestic producers; increases costs to industry
Oil import quotas and allocations	Oil	Inactive	Increased domestic production in short term; will reduce it in long run; increases prices by restricting lower-cost supply

** Although the Energy Policy Act of 1992 gives FERC the power to force utilities to wheel power.

KEY:
Inactive Status refers to interventions that have expired, been eliminated, or were one-time grants.
Variable Impact means that the intervention can increase or decrease prices, market certainty, or market interest depending on how it is applied.
Facilitated Market Development refers to interventions which, had they not occurred, would have made widespread use of the fuel unlikely.

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Direct Federal Market Intervention	*Fuels Affected*	*Current Status*	*Impact on Market*
Price Controls			
Required Purchases of Particular Energy Services			
PURPA-required purchases	Gas, coal, renewables	Active	Increases market access for small-scale power
Oil Overcharge Fund allocation to efficiency projects	Efficiency	Active	Increases demand for efficiency services
Petroleum price controls and oil overcharge settlements	Oil	Inactive	Reduced domestic prices, reduced domestic production, created supply shortages; overcharge payments subsidize low-income energy purchases, alternative fuels and efficiency
Oil pipeline rates	Oil	Inactive	Facilitated markets in early years; after established, impact depends on actual prices set and monopoly characteristics of the line
Natural gas price controls	Gas	Inactive	Led to shortages from below-market pricing
Average cost pricing for wholesale power rates and power marketing administrations	Natural gas and electricity	Active	Avoids monopoly pricing; reduces pressures to improve cost efficiency; distorts price signals regarding need for marginal capacity
Federal Procurement of Energy Services for Internal Use			
Procurement of energy services for government use	All fuels	Active	Variable; can create markets
Energy efficiency requirements in government buildings and vehicles	Efficiency	Active	Moves energy procurement practices closer to behavior in a competitive market
Federal procurement preference for gasohol	Gasohol	Active	Increases demand for gasohol
Federal procurement preference for alternative-fueled vehicles	Gasohol, natural gas	Active	Increases demand for alternative-fueled vehicles; increases costs of federal fleet procurement
Implementation of energy efficiency efforts in federal power projects	Efficiency	Active	Increases demand for efficiency services; may decrease energy costs to government
Required purchases of coal by Department of Defense	Anthracite coal	Active	Protects domestic hard coal miners; increases energy costs to DOD
Overpurchase of uranium	Fission	Inactive	Protects domestic producers; increases costs to taxpayers

KEY:
Inactive Status refers to interventions that have expired, been eliminated, or were one-time grants.
Variable Impact means that the intervention can increase or decrease prices, market certainty, or market interest depending on how it is applied.
Facilitated Market Development refers to interventions which, had they not occurred, would have made widespread use of the fuel unlikely.

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Appendix 11: Largest Subsidies by Fuel

Largest 1989 Subsidies to Oil (Millions of 1989$)		
Subsidy	*High Estimate*	*Low Estimate*
Direct		
Program		
Strategic Petroleum Reserve	2,061.9	1,736.7
DOE R&D	120.8	120.8
Army Corps of Engineers	417.7	417.7
LIHEAP	347.7	347.7
Coast Guard	406.2	406.2
Maritime Administration	111.3	111.3
Naval Petroleum and Oil Shale Reserves	103.9	0.0
Eximbank	98.7	85.1
Total Program	*3,666.2*	*3,225.2*
Tax (General Capital and Other)		
General ITC (machinery and equipment)	616.8	242.4
Accelerated Depreciation (machinery and equipment)	2,996.6	873.8
Total General Tax	*3,613.4*	*1,116.2*
Tax (Energy)		
Tax-exempt Bonds, Pollution Control	181.5	148.8
Percentage Depletion	333.1	245.1
Passive Loss Exception	204.5	92.0
Special Treatment of Alaskan Native Corporations	186.9	102.4
Total Energy Tax	*906.0*	*588.3*
Total All Tax Direct	*4,519.4*	*1,704.5*
Grid		
Program		
REA Losses	193.5	179.8
Total Program	*193.5*	*179.8*
Tax (General Capital)	**small**	**small**
Total General Tax	*0.0*	*0.0*
Tax (Energy)	**small**	**small**
Total Energy Tax	*0.0*	*0.0*
Total All Tax Grid	*0.0*	*0.0*
All Oil		
Total Large Program Subsidies	3,861.7	3,405.3
Total General Tax	3,613.4	1,116.2
Total Energy Tax	906.0	588.3
Total Large Tax Subsidies	4,519.4	1,704.5
Total All Large Subsidies	*8,381.1*	*5,109.8*
All Other Subsidies to Oil	377.1	359.2
TOTAL SUBSIDIES TO OIL IN 1989	8,758.2	5,469.0

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Largest 1989 Subsidies to Coal (Millions of 1989$)

Subsidy	High Estimate	Low Estimate
Direct		
Program		
DOE R&D	385.4	385.4
Army Corps Waterways Projects	199.6	199.6
SSA Black Lung Benefits	892.0	892.0
Department of Labor Black Lung Trust Fund	348.7	260.1
OSMRE Mine Regulation and Abandoned Mineland Trust Shortfall	878.7	878.7
Total Program	***3,024.6***	***2,876.0***
Tax (General Capital and Other)		
General ITC (machinery and equipment)	167.3	65.7
Accelerated Depreciation (machinery and equipment)	812.7	201.3
Total General Tax	*980.0*	*267.0*
Tax (Energy)		
Tax-exempt Black Lung Benefits	180.0	110.0
Percentage Depletion	202.5	124.5
Total Energy Tax	*382.5*	*234.5*
Total All Tax Direct	***1,362.5***	***501.5***
Grid		
Program		
REA Losses	607.3	569.8
DOE Clean Coal Program	176.4	33.6
Total Program	***783.7***	***746.2***
Tax (General Capital and Other)		
General ITC (machinery and equipment)	195.3	76.7
Accelerated Depreciation (machinery and equipment)	948.9	276.7
Total General Tax	*1,144.2*	*353.4*
Tax (Energy)		
Tax-Exempt Public Power Bonds	406.4	333.2
Tax-Exempt Pollution Control Bonds	325.1	266.5
Tax Exclusion for Cooperative Utilities	416.1	297.2
Tax-Exempt Public Utilities	112.9	112.9
Utility Retention of Excess Deferred Taxes	225.9	0.0
Total Energy Tax	*1,486.4*	*1,009.8*
Total All Tax Grid	***2,630.6***	***1,363.2***
All Coal		
Total Large Program Subsidies	3,808.3	**3,622.2**
Total General Tax	*2,124.2*	620.4
Total Energy Tax	*1,868.9*	*1,244.3*
Total Large Tax Subsidies	3,993.1	**1,864.7**
Total All Large Subsidies	7,801.4	5,486.9
All Other Subsidies to Coal	241.4	70.4
TOTAL SUBSIDIES TO COAL IN 1989	8,042.8	5,557.3

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Largest 1989 Subsidies to Natural Gas (Millions of 1989$)

Subsidy	High Estimate	Low Estimate
Direct		
Program		
Low Income Home Energy Assistance Program	*751.9*	*751.9*
Total Program	***751.9***	***751.9***
Tax (General Capital)		
General ITC (machinery and equipment)	*435.1*	*171.0*
Accelerated Depreciation (machinery and equipment)	*2,114.1*	*616.4*
Total General Tax	2,549.2	787.4
Tax (Energy)		
Percentage Depletion	*196.9*	*144.9*
Utility Retention of Excess Deferred Taxes	*187.6*	*0.0*
Total Energy Tax	384.5	144.9
Total All Tax Direct	***2,933.7***	***932.3***
Grid		
Program	**small**	**small**
Total Program	***0.0***	***0.0***
Tax (General Capital)	**small**	**small**
Total General Tax	0.0	0.0
Tax (Energy)	**small**	**small**
Total Energy Tax	0.0	0.0
Total All Tax Grid	***0.0***	***0.0***
All Natural Gas		
Total Large Program Subsidies	**751.9**	**751.9**
Total General Tax	*2,549.2*	*787.4*
Total Energy Tax	*384.5*	*144.9*
Total Large Tax Subsidies	**2,933.7**	**932.3**
Total All Large Subsidies	***3,685.6***	***1,684.2***
All Other Subsidies to Natural Gas	589.5	464.5
TOTAL SUBSIDIES TO NATURAL GAS IN 1989	**4,275.1**	**2,148.7**

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Largest 1989 Subsidies to Fission (Millions of 1989$)

Subsidy	High Estimate	Low Estimate
Direct and Grid		
Program		
Uranium Enrichment Corporation	*1,026.8*	*279.1*
DOE R&D and Waste Management	*1,012.6*	*1,012.6*
Bonneville Power Administration	*381.5*	*354.5*
NRC Regulation	*347.4*	*287.2*
REA Losses	*321.6*	*316.5*
Nuclear Waste Fund	*181.7*	*0.0*
TVA Cross-Subsidies	*331.3*	*308.6*
Total Program	***3,602.9***	***2,558.5***
Tax (General Capital and Other)		
Accelerated Depreciation (machinery and equipment)	*2,074.8*	*605.0*
General ITC (machinery and equipment)	*427.0*	*167.8*
Total General Tax	2,501.8	772.8
Tax (Energy)		
Tax-exempt Public Power Bonds	*820.1*	*672.3*
Utility Retention of Excess Deferred Taxes	*489.3*	*0.0*
Total Energy Tax	1,309.4	672.3
Total All Tax	***3,811.2***	***1,445.1***
Other (Indemnification)		
Price-Anderson	*2,750.0*	*832.0*
Underaccrual for Nuclear Decommissioning	*197.3*	*0.0*
Total Other	***2,947.3***	***832.0***
All Fission		
Total Large Program Subsidies	3,602.9	2,558.5
Total General Tax	*2,501.8*	*772.8*
Total Energy Tax	*1,309.4*	*672.3*
Total Large Tax Subsidies	3,811.2	1,445.1
Total Other Subsidies	2,947.3	832.0
Total All Large Subsidies	10,361.4	4835.6
All Other Subsidies to Fission	217.5	203.5
TOTAL SUBSIDIES TO FISSION IN 1989	**10,578.9**	**5,039.1**

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Largest 1989 Subsidies to End-Use Efficiency (Millions of 1989$)

Subsidy	*High Estimate*	*Low Estimate*
Direct		
Program		
DOE R&D	240.1	240.1
Low Income Home Energy Assistance Program	163.8	163.8
Total Program	***403.9***	***403.9***
Tax (General Capital and Other)		
Mortgage Interest Exclusion	139.8	75.5
Accelerated Depreciation (machinery and equipment)	184.4	26.9
Accelerated Depreciation (buildings)	203.5	64.9
Total General Tax	*527.7*	*167.3*
Tax (Energy)	**small**	**small**
Total Energy Tax	*0.0*	*0.0*
Total All Tax Direct	***527.7***	***167.3***
All End-Use Efficiency		
Total Large Program Subsidies	**403.9**	**403.9**
Total General Tax	527.7	167.3
Total Energy Tax	0.0	0.0
Total Large Tax Subsidies	**527.7**	**167.3**
Total All Large Subsidies	***931.6***	***571.2***
All Other Subsidies to End-Use Efficiency	51.7	(4.3)*
TOTAL SUBSIDIES TO END-USE EFFICIENCY IN 1989	983.3	566.9

*The negative value is due to cross-subsidies from end-use efficiency to nuclear fission through the Tennessee Valley Authority. These cross-subsidies act as a tax on end-use efficiency.

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Largest 1989 Subsidies to Ethanol (Millions of 1989$)

Subsidy	High Estimate	Low Estimate
Direct		
Program		
Commodity Credit Corp.	326.5	208.4
Total Program	***326.5***	***208.4***
Tax (General Capital)	**small**	**small**
Total General Tax	*0.0*	*0.0*
Tax (Energy)		
Excise Tax Exemption	485.0	300.0
Total Energy Tax	*485.0*	*300.0*
Total All Tax Direct	***485.0***	***300.0***
All Ethanol		
Total Large Program Subsidies	**326.5**	**208.4**
Total General Tax	0.0	0.0
Total Energy Tax	485.0	300.0
Total Large Tax Subsidies	**485.0**	**300.0**
Total All Large Subsidies	***811.5***	***508.4***
All Other Subsidies to Ethanol	67.8	25.3
TOTAL SUBSIDIES TO ETHANOL IN 1989	**879.3**	**533.7**

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Largest 1989 Subsidies to Emerging Renewables: Wind, Solar, Geothermal, Non-Ethanol Biomass (Millions of 1989$)

Subsidy	*High Estimate*	*Low Estimate*
Direct		
Program	**small**	**small**
Total Program	***0.0***	***0.0***
Tax (General Capital)	**small**	**small**
Total General Tax	*0.0*	*0.0*
Tax (Energy)	**small**	**small**
Total Energy Tax	*0.0*	*0.0*
Total All Tax Direct	***0.0***	***0.0***
Grid		
Program		
DOE Solar R&D	103.9	103.9
DOE-Biomass R&D	70.3	70.3
Total Program	***174.2***	***174.2***
Tax (General Capital)	**small**	**small**
Accelerated Depreciation (biomass electric)	84.1	24.5
Accelerated Depreciation (geothermal electric)	59.4	17.3
Total General Tax	*143.5*	*41.8*
Tax (Energy)		
ITC for Solar and Geothermal	110.0	80.0
Total Energy Tax	*110.0*	*80.0*
Total All Tax Grid	***253.5***	***121.8***
All Emerging Renewables		
Total Large Program Subsidies	**174.2**	**174.2**
Total General Tax	143.5	41.8
Total Energy Tax	110.0	80.0
Total Large Tax Subsidies	**253.5**	**121.8**
Total All Large Subsidies	***427.7***	***296.0***
All Other Subsidies to Emerging Renewables	472.0	342.5
TOTAL SUBSIDIES TO EMERGING RENEWABLES IN 1989	899.7	638.5

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Largest 1989 Subsidies to Other Energy Types (Millions of 1989$)

Subsidy	*High Estimate*	*Low Estimate*
Supply Efficiency		
DOE R&D Support	156.7	156.7
All Other Supply Efficiency	15.4	9.0
TOTAL ALL SUBSIDIES TO SUPPLY EFFICIENCY IN 1989	**172.1**	**165.7**
Hydroelectricity		
Tax-exempt Public Utilities	96.9	96.9
Losses on Power Marketing Administrations	225.1	77.7
Losses on Eximbank Loans and Guarantees	78.1	70.5
Grants to Multilateral Development Banks	89.5	89.5
Total Large Subsidies	***489.6***	***334.6***
All Other Subsidies to Hydro	133.8	42.5
TOTAL SUBSIDIES TO HYDROELECTRICITY IN 1989	**623.4**	**377.1**
Waste-to-Energy		
Tax-exempt Bond Issues	276.8	226.9
Accelerated Depreciation (machinery and equipment)	71.2	20.8
All Other Subsidies to Waste-to-Energy	56.4	26.4
TOTAL SUBSIDIES TO WASTE-TO-ENERGY IN 1989	**404.4**	**274.1**
Fusion Energy		
DOE R&D	413.6	413.6
Fusion received no other federal subsidies in 1989		

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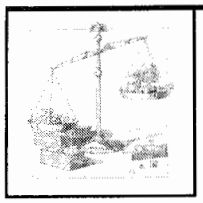

IX. Glossary of Terms and Acronyms

Accelerated Cost Recovery System (ACRS) - The range of asset lives and depreciation methods instituted in the Economic Recovery Tax Act of 1981. ACRS allowed capital assets to be depreciated far faster than their expected useful lives. ACRS was replaced by the asset depreciated range system in 1986, although transition rules slowed the phase-out.

accelerated depreciation - See amortization.

accrual basis - Accounting method by which income and expense items are recognized as they are earned or incurred even though they may not have been actually received or paid in cash. The alternative is cash basis accounting.

ADR - See asset depreciation range.

ALVIS - Atomic vapor laser isotope separation process under development by DOE to reduce the unit cost of uranium enrichment.

AML - Abandoned Mine Land Trust Fund financed through an excise tax on coal to pay for the reclamation of abandoned mines around the country.

amortization - Accounting procedure that gradually reduces the cost value of a limited life or intangible asset through periodic charges to income. This charge reduces the taxable income of the asset owner. A number of specialized terms describe types of amortization.

Depreciation: The term used to describe the amortization of fixed assets over the asset life.

-Accelerated Depreciation: Depreciation which occurs more quickly than the expected asset life. This may result either from a shorter depreciation period, or from a depreciation method which allows a higher percentage of asset value to be written off in the early years of asset ownership.

-Straight-line Depreciation: Depreciation method whereby the annual depreciation charge is equal to the asset purchase price divided by the expected (or statutorily-defined) asset life.

-Double-Declining Balance Depreciation Method and the 150% Declining-Balance Depreciation Method: Also called the 200 percent declining balance method. An asset worth $100 with a life of 5 years would be depreciated at a rate of 100/5 = 20% per year. The double-declining balance method allows a 40%/year depreciation schedule. The 150% method works similarly. Using the above example, this method would allow a maximum of 150% x 20% = 30% of the asset value to be depreciated each year.

-Sum-of-the Years' Digits Method: Another accelerated depreciation method which works in the following manner. For the 5 year asset life in the above example, the sum of the digits is 15 (5+4+3+2+1). This become the denominator of the annual depreciation charge. The numerator is equal to the year of asset life, in reverse order. Thus, in the first year, 5/15 (or 1/3) of the asset value could be written off. In year 2, 4/15 could be written off, and so on.

Depletion: The term used to describe the amortization of natural resources.

-Cost depletion allows the acquisition price of natural resource properties to be written off over the life of the property, generally on a percentage-of-resources-removed basis (e.g., if 20 acres of a 40 acre timber stand is cut, 50% of the acquisition cost may be deducted from taxable income.

-Percentage Depletion allows the property owner to deduct a certain percentage of gross income from resource sales (the actual percentage is set by statute and varies by mineral) from taxable income. The size of the deductions is not related to the cost of acquiring the property.

APA - Alaska Power Administration, one of the federal Power Marketing Administrations created to provide flood control and electricity to the nation.

Arms-length transaction - A transaction that is conducted as though the parties were unrelated, and is equal to the amount that a willing buyer would pay to a willing seller when both have all the relevant information. The alternative gives rise

asset depreciation range system (ADR) - The range of asset lives allowed by the Internal Revenue Service used to determine the rate at which capital costs could be deducted from taxable income. ADR was replaced by the Accelerated Cost Recovery System in the Economic Recovery Tax Act of 1981, but reinstated in the 1986 Tax Reform Act. Asset lives used for calculating tax deductions are almost always shorter than the expected service life of the asset in question.

asset life - The expected service life of an asset, usually measured in years. The value of this asset is written down over the expect life to reflect the decrease in expected future service.

bbl - Abbreviation for "barrel."

BIA - Bureau of Indian Affairs, a branch of the Department of Interior.

BLM - Bureau of Land Management, a branch of the Department of Interior.

BOM - Bureau of Mines, a branch of the Department of Interior.

bond - An interest bearing corporate or government security that requires the holder to pay a set rate of interest and principal over a pre-set schedule.

bond rating - Method of evaluating the possibility of default by a bond holder. The lower the bond rating, the higher the probability of default, and the higher the interest rate that borrowers will have to pay.

BPA - Bonneville Power Administration, one of the federal power marketing administrations created to provide flood control and electricity to the nation.

Btu - Btu, or British Thermal Unit, is a standard measure of heat energy and is equal to the quantity of heat required to raise the temperature of 1 pound of water 1 degree Fahrenheit.

BuREC - Bureau of Reclamation, a branch of the Department of Interior.

CAFE Standards - Corporate Average Fuel Economy Standards governing the minimum fleet average fuel efficiency for automobile manufacturers.

call feature - Part of the agreement a bond-holder makes with the lender which allows the debt to be paid off prior to the scheduled maturity. Call features partially protect the borrower from interest rate declines during life of a bond.

capital gains or capital losses - The difference between the selling price and the purchase price of a capital asset. Positive differences are capital gains; negative differences are capital losses. Generally, capital assets include land, buildings, plant and equipment, and, under IRS definitions, security investments (such as stocks) as well.

capitalization - Process by which a current expenditure is converted into a asset rather than written off immediately (expensed). Capitalization reflects the multi-year use of the purchase and seeks to match the cost of the asset with its useful service life. The value of the asset is reduced using one of the capital recovery methods listed above.

CBO - Congressional Budget Office.

cogeneration - The process of supplying steam and electricity needs of an industrial plant using a single boiler.

cooperative utilities - Utilities that are owned by their members.

cost depletion - See amortization.

decommissioning - Process by which nuclear power plants are stored, protected, and disassembled once they cease operations. The high levels of residual radioactivity in the plants makes nuclear plant closure much more technically difficult than most other productive enterprises.

deficiency payment - Government payment made to farmers who participate in feed grain, wheat, rice, or cotton programs. The payment rate is based on the difference between a target price and the higher of either the market price or the loan rate.

depreciation - See entry under amortization.

Devonian shale - A type of shale formation containing oil and gas, and characterized by low permeability. Rock fracturing is necessary to recover energy deposits.

dividends - Distribution of corporate earnings to stockholders in the form of cash or additional stock. Dividends must normally be declared as income to the stockholder in the year in which they are received.

DOD - Department of Defense.

DOE - Department of Energy.

EIA - Energy Information Administration, a branch of the Department of Energy.

EPA - Environmental Protection Agency.

expense - To deduct an expenditure from income during the current period. The alternative would be to capitalize a purchase and deduct it from taxable income over the service life of the purchase.

equity - Ownership interest in a corporation.

ERTA - Economic Recovery Tax Act of 1981.

F&WS - Fish and Wildlife Service, a branch of the Department of Interior.

FEMA - Federal Emergency Management Agency.

FERC - Federal Energy Regulatory Commission, a branch of the Department of Energy.

FFB - Federal Financing Bank.

flow through - Method by which tax benefits to utilities are immediately and totally recognized by the utility and returned to customers in the form of lower rates. The alternative is tax normalization.

FPC - Federal Power Commission, later replaced by the Federal Energy Regulatory Commission (see above).

FRA - Federal Railroad Administration, a branch of the Department of Transportation.

FSC - Foreign sales corporations. These are sales divisions of U.S. corporations to market U.S.-made products abroad. FSCs receive special tax treatment.

FY - Fiscal year. Generally refers to the federal fiscal year which runs from October to September.

GAO - General Accounting Office.

gasohol - A blend of gasoline and alcohol (usually ethanol), containing at least 10 percent alcohol. Gasohol receives special tax breaks.

GATT - General Agreement on Trade and Tariffs, an international agreement aimed at reducing and eliminating barriers to free trade.

grandfather provisions - Provisions of new laws or rules which exempt pre-existing facilities from having to comply with the new restrictions.

IAEA - International Atomic Energy Agency, to which the U.S. is a major contributor.

IDBs - Industrial Development Bonds, a type of municipal tax-exempt bonds issued to finance industrial activity and development.

indemnification - An agreement to compensate the indemnified party for damage or loss. Where the indemnified party pays something for this agreement, we classify it as insurance. The conditions of indemnification (maximum amount, duration of coverage, conditions covered) are usually set out in detail.

intermediary - Person or institution empowered to make investment decisions for others. Intermediaries provide benefits through their specialized knowledge of finance, their lower transactions costs (due to the large volume of transactions), and by their ability to diversify risk. Examples include banks and insurance companies.

IRS - Internal Revenue Service.

ITC - Investment Tax Credit, which allow a tax payer to deduct certain expenses from the taxes they owe.

JCT - Joint Committee on Taxation.

kWh - Abbreviation for kilowatt-hour, which is equal to 1000 watts of power supplied for one hour.

LIHEAP - Low Income Home Energy Assistance Program, run by the Family Support Administration in the Department of Health and Human Services.

limited partnerships - Organizational form consisting of a general partner and a group of limited partners. The general partner is responsible for managing the venture. The limited partners invest money but have limited liability and are not involved with the day-to-day management of the venture. Losses are usually limited to the initial contribution.

loan guarantee - A transaction in which a third party guarantees that they will repay any money owed if the borrower defaults on payment.

MARAD - Maritime Administration, a branch of the Department of Transportation.

maturity date - Date on which the principal amount of a debt instrument becomes due and payable, or which the last installment of debt principal is paid off.

MMBtu - Million British thermal units. See "Btu" for additional information.

MMS - Minerals Management Service, a branch of the Department of Interior.

MSHA - Mine Safety and Health Administration, a branch of the Department of Labor.

multimodal - Generally refers to transportation containers which are standardized across trucks, rails, and ships.

mutual company - A corporation whose ownership and profits are distributed among members in proportion to the amount of business they do with the company.

Mw - Megawatts. Usually used in reference to electrical generating capacity.

NASA - National Aeronautics and Space Administration.

net present value - method of evaluating investments by discounting all future returns and all future costs backwards to the present using a given discount rate (such as the required rate of return or the cost of capital).

NGLs - Natural gas liquids.

NIH - National Institutes of Health, a branch of the Department of Health and Human Services.

NIST - National Institute of Standards and Technology, a branch of the Department of Commerce.

NOAA - National Oceanic and Atmospheric Administration, a branch of the Department of Commerce.

NOLs - Net operating losses refer to an excess of business expenses over income in a tax year. These losses may be used to offset taxes paid (or owed) in past (or future) years under some circumstances.

normalization - Process by which tax benefits are amortized over the life of the investment on which they were earned, reducing the annual cost of taxes a bit during each period. The alternative approach is to "flow-through" the tax benefits, recognizing them immediately in the first year.

NOSR - Naval Oil Shale Reserves.

NPR - Naval Petroleum Reserves.

NPV - Net Present Value. See definition above.

NRC - Nuclear Regulatory Commission.

OBRA - Omnibus Budget Reconciliation Act of 1990.

oil shale - Deposits of shale rock containing relatively high concentrations of petroleum.

OMB - Office of Management and Budget.

OSHA - Occupational Safety and Health Administration, a branch of the Department of Labor.

OSMRE - Office of Surface Mining Reclamation and Enforcement, a branch of the Department of Interior.

OTA - Office of Technology Assessment.

passive income or loss - Income or loss from activities which the taxpayer does not materially participate. Material participation includes such income as wages from direct labor or active trade or business or investment income such as dividends and interest. The Tax Reform Act of 1986 prohibited the use of passive losses to offset active income.

patent provisions - Component of the Mining Law of 1872 which transfers title of federal land to a citizen for a small fee ($5/acre) so long as a minimal amount of mining is done each year.

percentage depletion - See definition under "amortization."

PMA - Power Marketing Administrations, federally-owned electric generating facilities which include the Alaska, Bonneville, Southeastern, Southwestern, and Western Power Administrations.

Price-Anderson Act - Federal law which caps private sector liability for nuclear accidents for nuclear power plants, contractors, and transporters.

PUHCA - Public Utility Holding Company Act of 1935.

PURPA - Public Utility Regulatory Policy Act.

PV - Present value, see definition below.

present value - A measure of the current value of a future payment or stream of payments. The present value is calculated by discounting the future payments by an appropriate interest rate.

R&D - Research and Development. R&D generally describes the process of study and testing to discover new knowledge and apply it in a commercial application.

REA - Rural Electrification Administration, a branch of the Department of Agriculture.

recapture - Repayment of special tax benefits taken on an investment to the government if the investment does not meet a statutorily-defined minimum performance life or level. **refinancing** - Retiring existing debt by issuing new securities to reduce the interest rate, extend the maturity date, or both. Also called refunding in reference to refinancing bonds.

refunding - Replacing old debt with a new one, generally at more favorable conditions for the borrower.

renewables - Energy sources which are replenished over a relatively short time frame through natural cycles. Renewables include solar (thermal, photovoltaic, and solar-hydrogen), hydroelectric, wind, geothermal, biomass, and waste-to-energy.

royalties - Payments to the holder of a finite resource for the right to use that resource. Generally refers to payments to natural resource owners for taking and using that resource, although royalties may also be paid for the use of intellectual property rights (such as music recordings) as well.

sale and leaseback - A leasing arrangement by which one party sells a capital asset to another and then leases it back. The arrangement provides two benefits. First, it may enable tax benefits to be used (if the first party had no income to offset) or used by a taxpayer in a higher tax bracket. Often, the tax savings are shared by the two parties. Second, it enables a large capital purchase to be treated as an annual expense, although the annual lease payments are generally very similar to the cost of financing the purchase directly.

safe harbor leasing - Mechanism by which a company unable to use all of its tax benefits transfers them to a company that can. Generally done using a sale and leaseback arrangement.

SEPA - Southeastern Power Administration, one of the Power Marketing Administrations.

SMCRA - Surface Mining and Reclamation Act of 1977.

SPR - Strategic Petroleum Reserve, managed by the Department of Energy.

SSA - Social Security Administration, a branch of the Department of Health and Human Services.

stock - Ownership of a corporation represented by shares that are a claim on the corporation's earnings and assets. Specific types of stock may have additional restrictions and benefits.

subsidy - Traditionally-defined as government-provided goods or services which would otherwise have been purchased by the producer or consumer themselves. We expand this definition to include government activities, insurance, or guarantees which reduce the risks of doing business.

SWPA - Southwestern Power Administration, one of the Power Marketing Administrations.

SWUs - Separative Work Units, a measure of the quantity of uranium enrichment services provided.

synfuels - "Synthetic" gas or oil derived from coal or oil shale.

tax basis - Portion of investment or asset value, or of earnings which is subject to income or capital gains tax.

tax carryback - Use of current operating losses (or currently-earned tax credits) to offset taxable income in past years.

tax carryover - Use of current operating losses (or currently-earned tax credits) to offset taxable income in future years.

tax exempt - Activities or organizations which generate income which is not taxed.

tax expenditures - Estimates of the loss in revenue to the U.S. Treasury from special provisions in the tax code. A tax expenditures budget is prepared by the Office of Tax Analysis at Treasury and by the Joint Committee on Taxation, and is included in the Federal Budget prepared annually by the Office of Management and Budget.

TEFRA - Tax Equity and Fiscal Responsibility Act of 1982.

tight formation - Refers to natural gas found in formations of sandstone, siltstone, silty shale and limestones — formations that are characterized by their low permeability. Gas is recovered by fracturing the rock.

TRA of 1986 - Tax Reform Act of 1986.

transition rules - Special rules which phase in new government requirements or regulations to reduce the economic shock of the change.

trust fund - Special funds held and managed for a specific purpose by a trustee. Unless specifically limited by contract, the trustee use or dispose of the property as he sees fit.

TVA - Tennessee Valley Authority.

UEE - Uranium Enrichment Enterprise, overseen by the Department of Energy.

underaccrual - When a corporation does not put aside enough funds to finance a known future activity which is a cost associated with current production (e.g., employee pensions) so that the liability can be paid at the time it becomes due.

user fees - Government taxes on certain activities to generate funds which are earmarked to solve problems or finance activities associated with that activity. An example is a tax on gasoline that support the cleanup of leaking underground storage tanks.

USGS - United States Geological Survey, a branch of the Department of Interior.

UST - Underground storage tank, generally holding gasoline.

WAPA - Western Area Power Administration, one of the Power Marketing Administrations.

waste-to-energy - Technology which converts municipal garbage into electricity.

watt - The electrical unit of power or rate of doing work. 1 kilowatt = 1000 watts; 1 megawatt = 1 million watts.

watt-hour - The power consumed by a load over a one-hour period. Usually used as kilowatt hour (KwH).

WHTC - Western Hemisphere Trade Corporation.

WPTA - Windfall Profit Tax Act of 1980.

Yucca Mountain - Site in Nevada that DOE is targeting for its permanent depository for commercial nuclear waste.

Sources: Many of the definitions for financial terminology are from John Downes and Jordan Elliot Goodman, Dictionary of Finance and Investment Terms, 2nd Edition. (New York: Barron's, 1987). All others are taken from the text and appendices of this report.