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Energy Tax Policy: An Economic Analysis

Salvatore Lazzari, Resources, Science, and Industry Division

June 28, 2005

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Summary

This report provides background on the theory and application of tax policy as it relates to the energy sector, particularly with respect to the theory of market failure in the energy sector and suggested policy remedies.

Economic theory suggests that producers of energy-related minerals be taxed no differently than non-mineral producers: Exploration and development costs and other investments in a deposit (including geological and geophysical costs and delay rentals) should be capitalized. In general, competitive mineral producers subject to a pure income tax would not exploit resources as fast (compared with the rate of exploitation under the present system of subsidies). Over the longer term, depletion of fossil fuels and mineral resources leads to higher real energy prices, which would eventually promote the optimal amount of investment in energy efficiency and alternative fuels supply.

Under principles of neutrality of tax policy, there is no purely economic rationale for energy taxes or tax subsidies to (1) raise revenues; (2) conserve energy (with one exception); (3) promote alternative fuels; (4) compensate for any extra market risk; or (5) promote, as an industrial policy, specific industries such as the fossil fuels industry. However, even under a pure income tax, economic efficiency suggests a system of energy taxes (in addition to the income taxes) to correct for any environmental externalities caused by the production, importation, and use of each fuel, and energy taxes in the form of user charges for benefits received, such as the highway trust fund. In the case of energy conservation, market failures in the use of energy in rental housing provide an efficiency rationale for the current gross income exclusion for conservation subsidies provided by electric utilities. There are other market failures in energy use that suggest efficiency standards, energy labeling, or government-provided information, but not necessarily tax subsidies.

Tax subsidies for domestic oil production tend to stimulate domestic supply of petroleum and reduce demand for petroleum imports. This may enhance national and economic security in the short run, but it might damage national and economic security in the long run as domestic energy resources are depleted faster than they otherwise would be. The economically efficient policy to reduce import dependence would impose a tax (or tariff) on imported petroleum based on the per-barrel estimate of these costs (the so-called oil import "premium"). The problem of vulnerability to embargoes and price shocks, which relates to dependence on imported oil from the Organization of Petroleum Exporting Countries (OPEC) and other potentially unstable or unfriendly foreign countries, is more effectively addressed in a policy of stockpiling oil, as is being done with the Strategic Petroleum Reserve.

In terms of environmental protection and management, energy taxes can be a cost-effective and efficient market-based instrument, and they are economically superior to the command and control approach. In sum, energy taxes are generally distortional (except to correct for externalities, or when imposed as user fees for benefits received) and regressive, and may have adverse macroeconomic consequences, particularly sizeable taxes on energy production or oil imports.

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Introduction

Energy tax policy involves the use of the government's main fiscal instruments — primarily tax subsidies (tax credits, deductions, exemptions, and lower tax rates) as financial incentives, and increased taxes as financial disincentives — to alter the allocation or configuration of energy resources and thereby achieve policy objectives. The idea of applying tax policy instruments to the energy markets is not new, but until the 1970s energy tax policy had been little used, except to promote oil and gas development.[1]

Recent Actions in Energy Tax Policy

Recurrent energy-related problems since the 1970s — oil embargoes, oil price and supply shocks, wide petroleum price variations and price spikes, large geographical price disparities, tight energy supplies, rising oil import dependence, as well as increased concern for the environment — have caused policymakers to look toward energy taxes and subsidies with greater frequency. In a typical Congress hundreds of bills are introduced that propose to amend energy tax policy directly, and hundreds of others have indirect effects that either reduce costs (energy tax incentives) or increase costs (energy taxes) in the energy industry. In the 108th Congress, over200 such bills were introduced.

More recently, energy tax incentives and subsidies (and also some reductions in energy taxes) have been the dominant part of comprehensive energy policy legislation — dominant in the sense that the changes in taxes resulting from the incentives produce the greatest economic effects in terms of cost reductions or increases. In the 107th and 108th Congresses, an emerging "energy crisis" — fluctuating oil prices, spiking petroleum product prices, the California energy crisis, spiking natural gas prices, the collapse of Enron in 2001, the northeast electricity blackout on August 14, 2003 — led to several comprehensive energy policy reform bills. These bills proposed to, among other things, stimulate additional production of oil and gas and reduce petroleum import dependence, expand electricity supply and infrastructure, promote energy conservation and efficiency, and expand the supply of alternative (renewable and unconventional) fuels.[2] Sizeable energy tax

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[1] The two major tax subsidies for oil and gas were percentage depletion, and expensing of intangible drilling costs. Percentage depletion has been largely eliminated and expensing has been significantly reduced. See U.S. Senate, *Tax Expenditures: Compendium of Background Material on Individual Provisions*, Committee on the Budget, Committee Print, 108th Cong, 2nd sess. (Washington, GPO, 2004), pp. 77-83.

[2] In 2002 the energy tax provisions were part of comprehensive energy bill H.R. 4 (107th (continued...)

subsidies (tilted more toward fossil fuel supply) were part of H.R. 6, the comprehensive energy policy bill of the 108th Congress. The conference version of that bill proposed a $23.5 billion ten year energy tax cut.[3]

Failure of the comprehensive energy legislation caused several energy tax incentives to expire in 2003, so the 108th Congress enacted retroactive extension of several of the provisions as part of the Working Families Tax Relief Act of 2004 (P.L. 108-311). Those provisions, which reduced revenues by about $1.3 billion over ten years, were enacted on enacted on October 4, 2004. About $5 billion in energy tax incentives — mostly from the expansion and liberalization of the renewable electricity tax credit — were part of the American Jobs Creation Act of 2004 (P.L. 108-357) enacted on October 22, 2004. That leaves roughly $17 billion in tax breaks embodied in the failed comprehensive legislation H.R. 6 (108th Congress) that have not been enacted.

Many of the energy tax incentives that have not been enacted over the past four or five years have been repackaged as H.R. 6 (109th Congress), which the House approved with its tax title on April 13, 2005. The tax provisions provide about $8.1 billion of energy tax cuts over ten years as compared with $23.5 billion in H.R. 6 in the 108th Congress, and $33.5 billion in House version of H.R. 4 in the 107th. The Senate is expected to vote on an Senate Finance Committee approved bill that provides about $17 billion in energy tax subsidies. This bill is tilted less toward fossil fuel production and more toward energy conservation and alternative fuels than the $8 billion tax incentives package in the House-passed energy bill. President Bush's FY2006 budget request proposed a $6.7 billion, ten-year energy tax incentives package.

Finally, not all of the recent actions in the area of energy tax policy have involved tax subsidies or incentives — some have involved taxation. For example, during the spike in gasoline and diesel prices of spring 2000, there were several proposals (e.g., S. 2285, 106th Congress) to suspend the motor fuels excise taxes to relieve consumers the burden of high and spiking prices.[4] More recently, there are bills to reinstate the crude oil windfall profit tax of the 1980 to reduce the windfall profits allegedly being earned by oil companies from high crude oil and petroleum product prices.

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[2] (...continued)
Congress). H.R. 4 was dropped on November 13, 2002, due to controversy over ANWR development and fuel economy standards. In 2003 and 2004 (the 108th Congress) these provisions were part of H.R. 6. On November 24, 2003, the conference report failed to secure the necessary 60 votes to overcome a Democratic filibuster before Congress's adjournment for the holiday season. This represented the third attempt to pass comprehensive energy legislation, a top priority for Republicans and for President Bush.

[3] CRS Report RL32402, *Energy Tax Incentives in H.R. 6: The Conference Agreement as Compared with the House Bill and Senate Amendment*, by Salvatore Lazzari.

[4] See CRS Report RL30497, *Suspending the Gas Tax: Analysis of S. 2285*, by Salvatore Lazzari.

Issues Raised by Energy Policy Proposals

Proposals to amend the current federal tax treatment of the energy industry, and to either impose energy taxes or provide tax subsidies, raise several important economic and other public policy issues:

- The nature and seriousness of the nation's energy problems, and the appropriate policy instruments to deal with them. What exactly are the problems in U.S. energy markets? Is the problem one of excessive demand for, and consumption of, energy? Is it insufficient supply? Or is it both? Moreover, are the problems an inherent part of the market system — that need a government solution? Or does government interference worsen the situation? Are there market failures, or just simply barriers that could be overcome by the market itself if the economic variables were aligned just right?

- More specifically, what are the various problems in each of the energy markets, the petroleum, natural gas, and electricity markets? How serious is growing petroleum import dependence and what are the tax policy instruments that may be effectively used to address this problem?

- Assuming that energy tax policy instruments are the recommended policy choice, how should the specific change in tax burdens be achieved? Should energy tax burdens be changed by a tax credit, tax deduction or exemption, or by reducing some energy tax rate? What is the relative effectiveness of each of these tax subsidy instruments in achieving policy effectiveness (the most "bang-for-the-buck")?

- What is, and what should be the federal tax treatment of the energy industry, including the tax treatment of investments in oil and gas wells and coal mines, and the tax treatment of other expenses such as exploration and development costs? Does the oil and gas industry receive federal tax subsidies and if so how much? Do these subsidies adversely affect the production, consumption, and importation of energy? Do they also inhibit the development of renewable energy (such as solar, wind, and biomass) and investments in energy efficiency? Should federal tax subsidies for oil and gas and other fossil fuels be increased to stimulate exploration and supply to address our energy problems or would budgetary resources be better used to reduce energy demand by providing tax incentives for energy efficiency and renewable energy?

- How should the tax code allow for depletion of mineral reserves and other mineral production expenses. For example, should it use cost depletion, adjusted cost depletion, percentage depletion, or complete expensing? How would the various tax reform proposals (for example, a cash-flow tax or a consumption tax) affect the treatment of the oil and gas and other energy sectors?

- Is there an economic or policy rationale for energy taxes to raise revenue or energy tax subsidies to encourage greater energy conservation or increased supply of alternative fuels? Further, assuming the policy objective is to promote fossil fuel conservation, would the more effective incentives target energy efficiency or the supply of alternative (including renewable) forms of energy?

- What are the economic effects — the effects on allocational efficiency, distribution of income, macroeconomic effects, effects on energy supply, demand, and imports — of taxing or subsidizing energy?

Purpose of the Report

This report provides background on the theory and application of tax policy as it relates to the energy sector, particularly with respect to the theory of market failure in the energy sector and the possible policy remedies. More specifically, it provides an overview for policymakers on the types of energy tax policy interventions that are likely to improve the functioning of energy markets, and the efficiency with which the general economic system allocates resources (i.e., the general welfare).

Table 1 summarizes the market failures discussion in the report. It lists the types of energy market failures likely to cause economic inefficiencies and the tax policy remedy suggested by economists. It also cites examples in current law that are consistent with this theory — energy tax provisions that enhance economic efficiency. The text following the table discusses each of these failures in detail.[5]

Energy as a Commodity

At the outset, it is important to address the notion that there is something inherently different about energy, or fuels from various energy resources, that requires government intervention through the tax code. Often energy tax proposals are premised on such arguments, that energy is too important to be left to the unfettered private market system.

[5] While there may be other factors, this report addresses those problems and solutions grounded in economic efficiency.

Table 1. Energy Market Failures and Energy Tax Policy Remedies

Type of Market Failure	Description	Distortion	Damage/Benefit	Possible Energy Tax Policy	Examples in Current Law
Environmental Externalitities	Air pollution, discharges of wastes and effluents	Underpricing of energy resources and higher production; excessive use due to uncompensated spillover effects	Harmful to health, property damage, and economic damage	Emission taxes (or energy excise taxes where feasible)	Tax on Ozone Depleting Chemicals under IRC §4681
Oil Import Dependence	Excessive and rising importation of crude oil and petroleum products	Underpricing of crude oil & petroleum products	Harm to national, energy, and economic security; excessive defense spending	Oil Import Tax	none
Energy R&D	Manufacturers do not undertake sufficient R&D activities	Unpriced benefits to free riding firms from R&D activities	Under supply of R&D; costly and insufficient energy efficiency and alternative fuel technologies	Tax subsidies for R&D expenditures	Tax credit under IRC §30, and expensing under IRC §174
Public Goods/Energy Complementarity	Private market fails to provide goods that are consumed collectively and for which exclusion is too costly	Under-supply, or no supply of public goods such as roads, bridges, infrastructure	Unrealized benefits; under-developed economy, and slower productivity growth	Benefit charges, and user fees, but also energy taxes and congestion pricing	Excise taxes of gasoline and other motor fuels under IRC§s 4081-4093
Landlord/Tenant Problem	Landlords, tenants have no incentive to conserve energy	Under investment in energy conservation items in rental housing (over consumption of energy)	Environmental damages, excessive import dependence, and other damages due to excessive energy use	Tax incentives for landlords or tenants for energy efficiency investments	Exclusion of subsidy from gross income under IRC §136

Source: Adaptation based on Fisher, Anthony and Michael H. Rothkopf. *Market Failure and Energy Policy: The Rationale for Selective Conservation.* Energy Policy, v.17, August, 1989.

According to economists, energy is a commodity that is produced to provide utility to consumers or end users, and, in general, is no different than any other economic good. Three features of energy as an economic good, however, differentiate it from other commodities. First, most energy is derived from depletable mineral resources: Petroleum products are derived from crude oil, natural gas resides in depletable reservoirs or deposits (such as coal mines), and electricity is (currently) mostly derived from coal. While this does not necessarily impede the smooth functioning of the competitive market system, it does mean that production decisions have to be made functioning of the competitive market system, it does mean that production decisions have to be made in an inter-temporal framework. That raises the important inter-generational question: Do markets optimally deplete resources over time, or do they exploit them for short run gain at the expense of the long-term benefits of the future generation of consumers?

The second distinguishing feature of energy is that the activities required to produce it generate adverse environmental effects, and the process of transforming it to do work involves combustion, which also generates pollution from emissions. In the presence of such pollution — or externalities as discussed below — markets generally fail to produce and use the optimal quantities of energy — they produce and use too much energy, i.e., more than the optimal amounts that maximize social well-being.

Finally, energy is different from other commodities (say, e.g., food, clothing or housing) in that both at the micro and macroeconomic level it enters the production process of many firms and industries in an important extent — it is a major factor of production, just as are labor, capital, and managerial ability. This has important implications for the macro-economy: It means that changes in energy prices, particularly crude oil prices which are benchmarks for all energy prices, have the potential to move the markets, and the macro-economy, in a major way. Fluctuations in energy prices could have major effects on the business cycle, affecting aggregate output (GDP), employment, interest rates, and prices (i.e., inflation). Two examples of this are the recession of 1974-75, which was caused by the 1973 oil embargo, and the stagflation of the late 1970s, which was caused by the sharp run-up of crude oil prices of the 1970s.

Neutral Income Tax Treatment of Fossil Fuel Producers

Under generally accepted economic and accounting principles, producers of depletable resources (such as oil, gas, or coal), who attempt to maximize profits over a finite stock of a resource, should be taxed in the same manner as non-energy producers not subject to the finite resource constraint. Under a pure income tax, depreciation deductions would be based on economic depreciation; exploration and development drilling expenditures would be subject to cost depletion (capitalized) instead of expensed (entirely deducted from current-year taxable income) as is currently done; and depletion allowances would be based on the actual decline in economic value of the mineral deposit (or approximated by indexed cost depletion instead of percentage depletion).[6] A neutral tax system would also generally capitalize dry hole costs, the intangible costs of drilling unsuccessful wells, as such expenses may be viewed as part of the cost of developing successful wells — essentially the costs of creating an asset of value. In the event that there are no successful wells, then a deduction for such costs in the year incurred is appropriate under a neutral income tax system. Such an income tax would be neutral; i.e., it would not distort resource allocation, the optimal allocation that would otherwise result in a competitive market.[7]

The current tax treatment of mineral producers — which permits expensing of intangible drilling costs and dry hole costs, percentage rather than cost depletion for smaller companies and for some royalty owners, exemption from passive loss limitation rules that apply to other industries, and special tax credits and other subsidies (such as the tax credit for oil and gas produced from marginal wells) — differs from this neutral tax treatment in that it provides several tax subsidies for oil and gas.[8] While the magnitude and value of the subsidies in the aggregate are not large relative to the size of the oil and gas industry, this can still lead to increased investments in locating reserves (increased exploration), more profitable production, and some acceleration of oil and gas production (increased rate of extraction) and excessively rapid depletion of the resource (i.e., they provide an unambiguous incentive to deplete sooner rather than later). It also would lead to a channeling of resources into these activities that otherwise would be used for oil and gas activities abroad or for other economic activities in the United States.

While a change from the present tax system of tax subsidies to a neutral tax system would have a heavy adverse effect on many smaller oil and gas companies, particularly those that concentrate on onshore exploration, if the theory is correct, it would be more than offset by the positive welfare effect on the country generally as market distortions are reduced, and resources would be allocated more efficiently.

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[6] An income tax is only neutral if, with equity-financed projects, the cost of capital goods is expensed rather than depreciated. However, as long as depreciation is consistently applied to all sectors, then economic depreciation would not distort resource allocation among sectors.

[7] The only exception to the efficiency of a competitive market in energy production is the case of a production externality arising out of a common property resource. If oil and gas reservoirs lay beneath the property of several different owners, each one has the incentive and the legal right to open wells on his property and extract as much oil and gas as he can before the other owners do so. This leads to excessive production and resource depletion, which may suggest some type of regulatory or perhaps tax policy, if the problem were of sufficient national magnitude.

[8] See, e.g., U.S. Senate, *Tax Expenditures: Compendium of Background Material on Individual Provisions*, pp. 71-89.

Externalities and Other Market Failures, and the Rationale for Energy Taxes and Subsidies

Perhaps more than other markets, the energy markets have characteristics which can lead to market failure and thus a misallocation of resources. Production, importation, and use of energy frequently generate non-market costs or benefits not accounted for by the producers, importers, or consumers (and therefore not measured in the marketplace) that spill over to people who are not a party to the transaction. These spillovers — or externalities — are an energy market shortcoming because they are uncompensated, not reflected in the equilibrium market prices for the fuel (because without government intervention there are no economic incentives to do so).

With externalities operating, markets can fail to establish energy prices equal to marginal costs of supply. With inaccurate cost/price signals, a competitive free-market system may fail to achieve the socially optimal mix — the allocationally efficient mix — of output. The presence of externalities does not alter the economic argument that competitive mineral producers should be taxed under the same income tax rules as the competitive non-mineral producers, but it does suggest either a separate energy tax (in the case of a negative production externality, where production and use of energy generates costs) or an energy tax subsidy (in the case of a positive production externality, where the firm's competitive free market output generates benefits to third parties).

Environmental Pollution Externalities

Environmental damage is perhaps the major negative externality created as a result of energy production and consumption activities. This consists mostly of air pollution resulting from mining, transportation and transmission, and refining and industrial use of oil, gas, and coal, but also includes discharges of effluents into the water, runoff from streets, and damages to the land from mining. For example, coal mining can be the source of external costs such as black lung disease (from underground mining), destruction of landscape, and water pollution from acid drainage. Combustion of coal in coal-fired powerplants produces large emissions of harmful gases, fine particulate matter, and urban smog linked to a wide range of health and environmental damages.[9] The use (or combustion) of fossil fuels at the final consumer level by households, motorists, and businesses is also a significant source of air pollution and other environmental damages that impose uncompensated costs on society (those not paying for the use of the fuel directly). While much of the air pollution is from the combustion of fossil fuels (gasoline and diesel) in transportation, it also includes industrial and residential fuels such as natural gas, heating oil, and coal.

[9] CO_2 (linked to possible global warming), SO_2 (linked to acid deposition, which is harmful to rivers, streams, wildlife, and infrastructure), NOx (linked to acid rain, and an ozone precursor, which when it reacts with volatile organic compounds creates smog, which is linked to lung and other health problems), and mercury contamination (that pollutes lakes rivers, and streams, and harms wildlife and human health).

The Emissions Tax. Most public finance and environmental economists argue that a market-based instrument such as a tax, e.g., an emissions tax in the case of air pollution from the combustion of fossil fuels, would be an economically preferred instrument to correct for the market distortions caused by the pollution externality.[10] The tax would be equal to the monetary value, per unit of emissions, of the damages to third parties, and structures, and other damages resulting from the harmful emission. While current federal tax law does not provide an example of a theoretically pure pollution tax, the tax on ozone-depleting chemicals resembles such a tax.[11] This tax, which is part of Internal Revenue Code (IRC) §4681 and §4682, assesses a per-pound tax on the sale or use of a variety of chlorofluorocarbons (CFCs) and other chemicals that have been proven to be harmful to the Earth's ozone layer. The tax varies based on the degree of harm of each of the taxed chemicals, being lowest for methyl chloroform and highest for Halon-1301.[12] Another example might be the black-lung excise tax on domestically mined coal.[13]

Energy Taxes Aa Pollution Taxes. Some have proposed energy taxes based on the assumption that there is roughly a direct proportional relationship between emissions and the quantity of the fuel used. This tax would be imposed on the quantity of polluting fuel used, with rates varying directly with the amount of external cost generated by each fuel based on estimates of the monetary value of the harm to third parties. Thus, it would be highest on coal, then oil, then gas, and any non-polluting renewable energy resources such as hydropower would be either taxed at very low rates or tax exempt, depending on the degree of environmental damage.[14] Two example of such a tax are the carbon tax and the British Thermal Unit or Btu tax. While a carbon tax in theory should be a charge on the emissions of CO_2, in practice this tax is conceived of as an energy tax on the quantity of three fossil fuels burned — coal, petroleum, and natural gas — with the tax rate based on the carbon content, in the ratio of 1.0 to 0.8 to 0.6 respectively. An example of an energy tax that approximates the effects of a theoretically pure environmental tax might be a tax on vehicle fuel as proxy for the pure tailpipe emissions tax. This could be

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[10] Thomas Sterner, *Policy Instruments for Environmental and Natural Resource Management*, Resources for the Future, 2003.

[11] Thomas A. Barthold, "Issues in the Design of Environmental Taxes," *Journal of Economic Perspectives*, v. 8, Winter 1994, pp. 133-151.

[12] The excise tax on ozone-depleting chemicals was part of the Revenue Reconciliation Act of 1989. It was enacted primarily to meet the U.S. obligations under the Montreal Protocol of 1987, which required the 162 signatories to reduce production and consumption of substances that deplete the ozone layer. The United States ratified the treaty in 1988, and it went into effect in 1989. In 1996, the Montreal Protocol banned production of CFC's altogether. Since the tax raises revenues, it was also viewed, during the heated 1989 debates over budget reconciliation, as an option for reducing the persistent and large federal budget deficits.

[13] See CRS Report RS21935, *The Black Lung Excise Tax on Coal*, by Salvatore Lazzari.

[14] Renewable resources are generally thought to be less polluting than conventional fossil fuels, but they can also harm the environment and are not pollution free. Hydroelectric power affects wildlife habitats, as do wind farms. The combustion of biomass fuels generates air emissions. The negative externalities engendered by the use of renewables would also have to taxed, in theory.

implemented as an addition to the existing motor fuels excise tax (the taxes on gasoline and diesel fuel). This externality tax would be in addition to the current excise taxes on these fuels that are mainly user charges for the benefits received from federal highway infrastructure.[15]

Clinton's Btu Tax. The Btu (British thermal unit) tax is a broadly-based energy tax based on the heat content or heating potential of a fuel, or energy content in the form of heat. The standard Btu tax — the type considered by the Congress in the 1980s and again in 1990 and the Clinton Administration in 1993 — is a flat or unit excise tax on all forms of energy based on the Btu. For example, one barrel of oil has, on average, about 5.8 million Btu's, meaning that it has 5.8 million units of heat capable of raising one pound of water at maximum density by one degree Fahrenheit. One short ton of coal (2,000 lbs.) contains about 22 million Btu's, about four times the Btu's in one barrel of oil; one thousand cubic feet (mcf) of natural gas contains about 1 million Btu's, about 1/6th that of oil.[16] One gallon of gasoline contains about 125,000 Btu's. Thus, for example, a fixed rate Btu tax of $1.00 per million of Btu's would impose the following taxes: $5.80 per barrel on oil (about 15% of the 2003 oil price), $0.97 per mcf of natural gas (about 20% of natural gas prices paid by pipelines); $20 per ton of coal (about 114% of coal prices), and 12.5¢ per gallon of gasoline (about 11% of recent average gasoline prices).[17]

Oil Import Dependence

On the eve of the 1973 oil embargo, petroleum imports supplied 33.4% of U.S. consumption. Import dependence increased to 44.9% of consumption in 1978, and remained relatively flat through 1992. Since then, however, petroleum imports have increased to over 60% of consumption. For example, during the four week period ending on June 3, 2005, petroleum imports were 60.7% of total supplies.

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[15] The current excise taxes on gasoline, diesel, and most other motor fuels include only the user charge component and the 0.1¢/gallon Leaking Underground Storage Tank (LUST) fund components. For example, the 18.4¢/gallon tax on gasoline consists of the 18.3¢ user charge that goes into the highway trust fund, and the 0.1¢ that goes into the LUST trust fund. Thus, there is no externality component on these fuels to correct for the cost imposed on society from the harm caused by emissions from the combustion of the fuels. There are three exceptions: 4.3¢ of the taxes on diesel used by railroads and by boats on inland waterways, and 6.8¢ of the tax on gasoline used by recreational motorboats, goes into the general fund of the U.S. Treasury, which might be thought of as externality taxes. On the various components of these taxes by fuel type, as well as the total tax rate per gallon by fuel type, see CRS Report RS20281, *Transportation Fuel Taxes and Legislative Issues*, by Bernard A. Gelb.

[16] In the U.S. coal is traded in short tons (2,000 lbs.) and transported in long tons (2,240 lbs.); in Europe coal is traded in metric tons (about 2,204 lbs).

[17] All prices are for the year 2003. 2003 was selected because that is the most recent year for which average annual prices are available for each of the fuels. Prices, which can vary substantially between fuel grades, quality, and heat content are measured at follows: Oil prices are average refiner acquisition costs; natural gas prices are measured at the wellhead; the coal price is the average minemouth price for both underground and surface mines; electricity prices represent the average for all uses; gasoline price is the refiner price excluding taxes; and diesel price is the refiner price, excluding taxes, of No.2 diesel fuel.

Table 2. A $1 Million BTU Tax on Selected Fuels as % of 2003 Fuel Price

Fuel	Heat or Energy Content in Btu's/unit	Average Prices in 2004	$1/million Btu tax Per Unit of Fuel	$1/ million Btu Tax as % of Fuel Price
Crude Oil	5,800,000/barrel	$27.56/barrel	$5.80/barrel	21%
Natural Gas	1,030/mcf	$4.88/mcf	$0.97/mcf	20%
Coal	20,411,000/short ton	$17.85/short ton	$20.41/short ton	114%
Electricity	3,412/kWh	$0.0742/kWh.	$0.003412/kWh	5%
Gasoline (conventional)	125,000/gallon	1.16/gallon	$0.125/gallon	11%
Diesel	139,000/gallon	0.94/gallon	$0.139/gallon	15%

Source: All data from Monthly Energy Review, May 2005. Coal price data are from the Energy Information Administration's website.

A variety of external costs may be associated with petroleum importation. These may result when petroleum importers fail to take into account the non-market costs of ("excessive") dependence on imported petroleum from countries that are politically unstable or perhaps unfriendly to the United States. These costs are:

- the weakened defense posture and greater military vulnerability in the event of an embargo or supply disruption;
- the cost of allocating greater resources to national defense in order to maintain the level of national security preferred (compared with the quantity that would be allocated with much lower oil imports); and
- the economic and social costs in terms of unemployment, inflation, and shortages that would result from an effective oil embargo, or oil price spikes.[18]

One economically efficient policy to correct for these distortions would impose a tax (or tariff) on imported petroleum based on the per-barrel estimate of these costs (the so-called oil import "premium"). Such a tax, however, would likely violate trade agreements, and thus policymakers focus on alternative policies such as tax incentives for domestic petroleum production, which also reduce the demand for imported petroleum.

[18] CRS Report 98-1 ENR, *Oil Imports: An Overview and Update of Economic and Security Effects*, by John L. Moore, Carl E. Behrens, and John Blodgett.

The problem of vulnerability to embargoes and price shocks, which relates to dependence on imported oil from the Organization of Petroleum Exporting Countries (OPEC) and other unstable foreign countries, is distinct from the problem of import dependence, and might be better addressed in a policy of stockpiling oil as is being done with the Strategic Petroleum Reserve.

Production/Investment Risk

Some have argued that oil price volatility might be a possible source of market failure because it raises the risks associated with investing in oil and gas and may result in under-investment in domestic oil and gas extraction.

For much of the first part of the 20th Century, crude oil prices declined in real terms and the energy markets were relatively stable. The price of oil varied during this period, but new discoveries kept the trend of prices downward; gasoline, natural gas, and electricity prices were also essentially declining in nominal terms during much of this period.[19] The 1973-74 Arab oil embargo against the United States reduced oil supplies by 10-15% and oil prices more than doubled in just two years. The 1978-79 political turmoil in Iran (and the resulting abdication of the Shah) and the Iranian oil workers strike virtually shut off this source of oil supplies from the world market. Iranian oil output dropped from 6 million bpd to 1.2 million bpd in December 1978, although other OPEC producers made up Iran's shortfalls. This was followed by a war between Iran and Iraq, which also threatened world oil supplies and supplies to the United States.

Although the loss of imports to the United States was not that large (about 500,000 bpd), the threat of another supply disruption, combined with oil price controls, caused panic buying on the part of consumers and strategic behavior on the part of oil producers, which resulted in substantial oil price hikes. Crude oil prices more than doubled during this period from about $10/barrel to over $24/barrel. By 1980, the official OPEC price was $36/barrel, but spot market prices reached nearly $40/barrel. Thus, between 1970 and 1980 crude oil prices had increased from around $1.50/barrel to around $35/barrel, an increase of over 2,200%. In 1985-86 there was a sharp decline in oil prices, which were welcomed by consumers and beneficial to the general economy, but which hurt the domestic oil industry (particularly upstream operations), and oil producing regions of the United States (Texas, Louisiana, Oklahoma, and Alaska)

From 1986-1999 oil prices averaged about $17.00 per barrel, but they fluctuated from between $12 and $20 per barrel. Domestic crude oil prices reached a low of about $8/barrel in December 1998, among the lowest crude oil prices in history after correcting for inflation. By the summer of 1999, crude oil prices had recovered to about $20 per barrel; and by the summer of 2000 prices peaked at well over $30 per barrel, due largely to output reductions by OPEC, but also due to the increased energy

[19] U.S. Congress, *The Energy Factbook*, Committee Print 96-IFC-60, November 1980. Prepared by the Congressional Research Service at the request of the Subcommittee on Energy and Power.

demand accompanying increasing growth in the world (particularly the Asian) economies.

Crude prices were still high by November 2000 ($30.30/barrel), but they fell in December after OPEC, which in 2004 produced 42% of the world's oil, increased production. OPEC's prodigious oil reserves, sizeable production capacity, and cartel -type behavior make it the swing producer, capable of affecting short-run prices in either direction, thus making both world and domestic crude oil prices more volatile than they otherwise would be. During the winter of 2002-2003, there was another crude oil price increase, this time due to the anticipated war with Iraq and political upheaval in Venezuela and Nigeria, which are major oil producers and suppliers to the United States. Most recently, prices have reached $60/barrel and have remained above $50 for several months.

Wide fluctuations in the market price of oil increase investor risk in the energy industry (particularly for oil and gas investments), but it can also inhibit investments in the development of alternative energy resources, both unconventional and renewable, and in energy efficiency. However, all prices fluctuate in a free market, although some more than others. And such fluctuations or risks are part of being in business — they are not necessarily market failures. Further, if oil and gas prices fluctuate "excessively" so that they generate unusual risks that may affect energy, economic, or national security, the preferred approach from an economist's point of view would be to attempt to stabilize the price of oil — this might be done by a variable oil import tax — rather than to provide tax subsidies.[20]

Energy User Charges

Sometimes energy taxes may act as a quasi user fee, a charge for the benefits received by taxpayers from the provision of a public good or quasi-public good financed from the user fee revenues. This is the economic rationale for the gasoline tax, which charges motorists generally in proportion to their use of the interstate highways and highway infrastructure and uses the revenues to build and maintain that infrastructure. To the extent that charges approximate individual benefits received, the tax would be efficient and equitable.[21] Such taxes, however, are less precise instruments than tolls and other benefit charges because 1) they do not actually charge users for the marginal cost of using the infrastructure (including pavement costs, congestion costs, and environmental costs), and 2) some of the highway trust fund revenues — currently the revenues from 2.86¢ of the tax — are allocated for mass transit, which means that motorists are paying to subsidize users of mass transit. It is true that all motorists benefit from reduced congestion, but the most efficient way of addressing this problem is to price the use of the roads to account specifically for the congestion externality.

[20] A variable oil import fee was proposed in the 103rd Congress as title I of H.R. 1024.

[21] If G is the gasoline tax rate, and MPG is automobile fuel efficiency in miles per gallon, then the COST/MILE = G/MPG. So that if G = 18.4¢/gal. and MPG = 30, then the tax cost per mile is 18.4/30 = 0.613¢/mile. If the value of the marginal benefits also equal 0.613¢/mile, then the gasoline tax rate could be construed as economically efficient.

Taxes vs. Tax Subsidies (Incentives)

When the externalities or spillover effects are positive, i.e., when a market transaction or activity confers unpriced benefits on third parties, the market system would Under supply the commodity or activity. The classic case of positive externalities is research and development (R&D) that leads to technological innovations. An individual firm that undertakes R&D activities obviously incurs the cost of these efforts and activities, but it typically does not obtain the entire return, some of which accrues to other firms (free riders) that do not undertake these expenditures. Energy R&D engenders similar spillover effects, whether it is from research in clean-coal technologies, photovoltaic solar systems, electric cars, fuel cells, or energy efficiency technologies. The manufacturer of building equipment and energy-using technologies may not have adequate incentives to support sufficient levels of research to improve building or equipment efficiency because some of the gains may accrue to firms not undertaking the expenditures.

In cases of positive externalities, the social return exceeds the purely private returns to individual companies, and from an economic perspective a subsidy is warranted to bring the marginal costs of production in balance with the marginal social benefit (private benefits + external benefits, at the margin). Such support has produced major innovations in the energy efficiency of various energy using-equipment such as heat pumps and resulted in significant reductions in the price of generating alternative energy such as photovoltaic solar energy. Such is the rationale for the present tax subsidies for such technologies (the tax credit, and expensing treatment of R&D expenditures) as well as government expenditures for energy R&D.

The amount of the subsidy on the product or activity would be the value of the benefits per unit of the commodity traded — proportional to the spillover — conferred on the source of the external benefits. Energy R&D is unlikely, however, to require a differential subsidy — above and beyond that provided for non-energy R&D — since there is no a priori reason to believe that the external benefits from energy R&D are higher or lower than for non-energy R&D.

Energy Tax Subsidies as an Industrial Policy

Many of the incentives or subsidies that are proposed for oil and gas as well as for alternative fuels appear to be based on the supposition that government ought to support business, particularly when times are bad. Such, for example, was the rationale for numerous proposals to help the domestic oil industry, particularly small producers, that were harmed by the downward trend in crude oil prices since the mid-1980s, and the sharp drop in those prices during 1998-99.

The low prices of 1998-99 fostered proposals for economic relief through the tax code for the particularly small independent drillers and producers, which were the harbingers of current comprehensive energy bills. The 1998-99 proposals mainly focused on production tax credits for marginal or stripper oil, which were later included in the American Jobs Creation Act of 2004, P.L. 108-357, enacted on October 22, 2004 (also referred to as the “jobs bill”). A $500 million package of loan guarantees for small independent oil and gas producers, which became law (P.L. 106-51) in August 1999, was enacted in lieu of the tax incentives.

The Economic Justification for Tax Subsidies as an Industrial Policy. There is no purely economic justification, either on efficiency or stabilization grounds, for using tax subsidies as an industrial or employment policy to help a distressed industry — including the conventional fossil fuels industry and the alternative fuels industry. An industrial policy is usually the context for government subsidies to businesses whenever those businesses experience sustained or sharp economic hardships, due generally to any cause but targeted toward industries experiencing declining prices, suffering cost/price squeezes, or competition from foreign firms.

Economic theory does recognize that market failures such as barriers to entry into markets, and other failures that inhibit market competition, may be used to justify government intervention. Intervention may also be justified by "externalities" or spillovers, previously discussed. The U.S. and world crude oil markets are certainly not perfectly competitive, as there are elements of market power particularly in the world oil market, which is significantly affected by the OPEC. But these markets are certainly more competitive today then they have ever been. It does not appear that the imperfections may be exhibited by either the U.S. or world crude oil markets, that they would justify tax subsidies to oil and gas producers on grounds of economic efficiency. Depressed or volatile oil prices (or any other price) are not market failures. An industrial policy is an inefficient way to stimulate aggregate employment.

The Social Rate of Discount and Market Failures

Some have argued that the competitive free-market system may establish interest rates (or private discount rates) that are too high, which may lead producers to discount the future excessively and therefore deplete energy and other minerals too rapidly. Rapid depletion increases environmental damages for the current generation and reduces economic living standards (real income) for future generations who would have a lower capital stock.

In general, economic theory and empirical evidence refute the proposition that competitive markets lead to excessive exploitation of mineral resources. Capital markets are also believed to function fairly close to competition, and there is no market failure that results in interest rates higher than the competitive rates. Even if the argument were true, however, it would at the very least suggest policies to lower interest rates, elimination of all federal tax subsidies for nonrenewable resources, and the imposition of a federal severance tax to reduce production of these resources.

Energy Conservation and Energy Efficiency

Energy taxes on producers and consumers that factor in the external costs of energy use, such as air pollution, would contribute significantly to energy conservation by raising energy prices and reducing the demand for energy. The demand for energy would decline both through a direct demand response, i.e., curbing energy use through reductions in output, service, or utility levels (e.g., by reducing the number of miles driven, indoor temperatures during winter by turning down the thermostat, etc.) and through substitution of more energy-efficient for less energy-efficient technologies. This would be true for all energy that generates external costs, but is particularly true for fossil fuels, whose external costs are generally greater than for other energy types.

However, energy taxes to encourage conservation should be unnecessary on economic grounds because over the longer term, as depletion gradually diminishes the stock of exhaustible energy resources (such as petroleum), conventional energy prices would be expected to increase in real terms, all else (such as technological advancements and innovations, and the degree of recycling) remaining the same.[22] As a result, more of the energy efficient technologies would become profitable and investment in energy-efficient technologies would increase (for example, more energy efficient housing, automobiles with higher miles per gallon, and more energy efficient industrial equipment such as boilers).[23]

Thus, aside from energy taxes or subsidies to correct for energy production and consumption externalities, and aside from possible user charges, economists generally argue there is no economic justification for additional taxes or tax subsidies to encourage greater energy conservation, or energy efficiency. This is because there is generally no market failure in energy use (notwithstanding the environmental externalities discussed above, or the exceptions discussed below) or in investment in energy-using technologies — at either the household or business level — that requires such tax subsidies. Just as the competitive market system, corrected for externalities, automatically and efficiently leads to the optimal production and use of energy resources, it also leads to the optimal amount of investment in energy efficiency technologies. All this is done without the effect of subsidies, in terms of revenue losses and allocational distortions, which reduce aggregate output and the general welfare.

There are four market failures in energy use, however, that may be an economic justification for government intervention, but only one is a rationale for certain types of conservation tax subsidies. In rental housing, the tenant and the landlord lack strong financial incentives to invest in energy conservation equipment and materials, even when the benefits clearly outweigh the costs, because the benefits from such conservation may not entirely accrue to the party undertaking the energy-saving expenditure and effort. Builders and buyers may also lack sufficient information, a problem which is also discussed below.

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[22] Technical change and recycling can offset the depletion effect of resource exhaustion.

[23] Energy efficiency, an engineering concept or measure that has little in common with economic efficiency, basically measures the energy/output ratio — the amount of energy input required to generate one unit of output. For example, the average thermal efficiency of coal-fired steam generators is about 34%, which means that it takes an average of 100 Btu's of fuel to generate an average of 34 Btu's of electricity (64% of the energy from the fuel is lost or "wasted").

As a general rule, tenants are not going to improve the energy efficiency of a residence that does not belong to them, even if the unit is metered. They might if the rate of return (or payback) is sufficiently large, but most tenants do not occupy rental housing long enough to reap the full benefits of the energy conservation investments. Part of the problem is also that it is not always easy to calculate the energy savings potential (hence, rates of return) from various retrofitting investments. Landlords may not be able to control the energy consumption habits of renters to sufficiently recover the full cost of the energy conservation expenditures, regardless of whether the units are individually metered or not. If the units are individually metered, then the landlord would not undertake such investments since all the benefits therefrom would accrue to the renters, unless a landlord could charge higher rents on apartments with lower utility costs. If the units are not individually metered, but under centralized control, the benefits of conservation measures may accrue largely to the landlord, but even here the tenants may have sufficient control over energy use to subvert the accrual of any gains to the landlord. In such cases, from the landlord's perspective, it may be easier and cheaper to forego the conservation investments and simply pass on energy costs as part of the rents. Individual metering can be quite costly and while it may reduce some of the distortions, it is not likely to completely eliminate these, because even if the landlord can charge higher rents, he may not be able to recover the costs of energy conservation efforts or investments.

These market failures may lead to Under investment in conservation measures in rental housing and provide the economic rationale for Internal Revenue Code (IRC) §136, which allows the value of any energy conservation subsidy provided by electric utilities to households to be excluded from gross income. Without such explicit exclusion, such subsidies would be treated as gross income and subject to tax. This exclusion, however, applies to both owner-occupied and rental housing, and to a limited extent to business conservation subsidies.

There are other types of market failures in energy use that may suggest either minimum efficiency standards or government-provided information such as energy efficiency labels. As suggested above, many homeowners may not know the precise payback or rate of return of a particular energy-efficiency enhancing investment, or may not know how to calculate it. This may be a particularly serious problem for older homes, which are less energy efficient then newer models — those built since the energy crisis of the 1970s. This market failure problem suggests government-provided information as a solution, however, rather than tax subsidies.

A third energy market failure arises out of asymmetric information between energy consumers and manufacturers of energy efficient equipment. The energy consumer may have little incentive to become fully informed about the energy efficiency of a particular energy-using or -saving item, while the producer, who has complete and accurate information, doesn't have the incentive to produce a higher priced and more energy efficient product, since it is might be more difficult to market and sell such a product. Thus, while a particular energy-saving device may have a high rate of return, the market may not provide it. This problem suggests either government mandated efficiency standards or labeling as is currently being done with appliance energy labels and fuel economy labels.

Finally, although capital markets are generally competitive and efficient, low-income consumers may have difficulty acquiring loans for conservation investments, even when such investments are profitable (the present value of the energy expenditure savings is greater than the capital costs). This suggests that low or zero interest rate loans for low income consumers or even weatherization grants could address the problem.

Renewable vs. Conventional Fuels

The higher energy prices that would result from taxes imposed on conventional energy to address external costs would also lead to more investment to increase the supply of alternative fuels, which would, in time, lead to even more conservation of (reduced demand for) conventional fuels. Over the longer term, the supply of these alternatives would tend to increase as depletion of conventional energy raises its real price. Even without increases in conventional fuel prices, alternative energy could gain a price advantage through future technological advances.

As in the case of energy conservation, there are no externalities or market failures that cause under-investment in alternative energy technologies and under-supply of alternative fuels. The private market system works effectively and efficiently in developing any form of energy and its technologies if there are sufficient profit incentives, i.e., if the rate of return on such investments is above the opportunity cost of capital. Moreover, the market ensures that the least-cost, most efficient alternatives become commercialized first, and the market adjusts quickly and efficiently to the changing dynamics of the marketplace.

In general, in cases where alternative fuels have difficulty penetrating the market, it is because they cannot be competitively priced, relative to conventional fuels, generally because either oil prices are too low, capital costs of alternative fuels technologies are too high, or both. To illustrate, compare the estimated 30-year levelized costs, per unit of electrical output, and the capital costs of various technologies for producing electricity using conventional fuels (primarily coal, but also natural gas) and alternative fuels such as biomass and wind energy systems.[24] Electric utilities can upgrade existing coal-fired units at a cost of 2.0¢/kWh, or they can invest in the latest efficient and cleaner technology (the advanced combined-cycle natural gas unit) at a cost of about 3.5¢/KWh. These are substantially lower than some estimates of the cost/KWh of the following energy alternatives: 15.0¢ for photovoltaics; 5-10¢ for small hydroelectric; 6-8¢ for solar thermal power; 4-7¢ for wind power; and 4-6¢ for biomass. Much of these cost differences are due to the significantly higher capital costs of generating electricity with alternative energy resources ($7,000/KW for photovoltaics, $1,500/KW for biomass, $1,000/KW for wind) as compared with conventional fuels ($400/KW for the combined cycle natural gas and $200/KW for retrofitting existing coal-fired units).[25]

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[24] Levelized costs converts a series of nonuniform costs over time into an average annual cost over that time period.

[25] For the cost of the advanced combined-cycle (and other coal technology options) options see CRS Report 98-615 ENR, *Electricity Restructuring: Implications for Air Quality*, by (continued...)

Volatile oil prices can increase investor risk and inhibit the development of alternative, renewable (solar, wind, etc.), and unconventional resources. This is because oil is the benchmark energy resource that sets the long-term price (and therefore influences the profitability) of all other fuels. Hypothetically, if alternative fuels would be profitable at oil prices of $40 per barrel, but prices fluctuate between $20 per barrel and $60 per barrel, there will generally be less investment in renewable and unconventional resources than if the price were stable at $40 every year. However, as discussed before, tax subsidies for alternative fuels are a costly and inefficient policy to correct for such risks.

Does Oil and Gas Have a Competitive Advantage?

It is sometimes argued that alternative fuels such as solar and wind energy and other 'renewables' are at a competitive disadvantage, vis-a-vis fossil fuels, because of the production tax subsidies — expensing, percentage depletion, and others — bestowed on the oil and gas industry over decades, and that this justifies countervailing subsidies to alternative fuels to "level the playing field." Historically the large tax subsidies for oil and gas — which totaled tens of billions of dollars to date — helped keep domestic and world oil prices low, encouraged consumption, and discouraged the development of alternatives fuels. Past subsidies, however, do not determine the economic viability of alternative fuels at the present time — past subsidies do not significantly affect the current competitive structure of the energy market.

As to the current oil and gas tax subsidies, there are two reasons that these subsidies are unlikely to reduce the competitiveness of alternative fuels. First, current oil and gas tax subsidies are smaller than they have been historically. Indeed, some evidence suggests that current oil and gas tax subsidies are smaller, in relationship to industry size, than the tax subsidies for alternative fuels.[26] Second, and more importantly, the structure of the world crude oil market since the 1970s has changed in a fundamental but critical way: Crude oil prices have since the 1970s been determined in a world oil market, a market which has become more competitive and in which U.S. domestic producers are price takers. In such a market, the subsidies for oil and gas have little if any effect on the market price of crude oil, hence little, if any, effect on the competitiveness of alternative fuels.

Energy Taxes to Increase Revenues and Reduce Deficits

Energy taxes have also been proposed for primarily fiscal reasons — to generate revenues for deficit reduction. The first federal gasoline tax was enacted in 1932 (at 1¢/gal. for gasoline and 2¢ for diesel fuel) as a way of cushioning federal deficits,

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[25] (...continued)
Larry Parker. The estimates for renewables are from Ulf Hansen, "Technological Options for Power Generation," *The Energy Journal*, v.19, 1998, table 3.

[26] See Table 1 in CRS Issue Brief IB10054, *Energy Tax Policy*, by Salvatore Lazzari.

which were mounting with the Great Depression. Energy tax proposals for deficit reduction were commonplace during the 1982-1993 period as budget deficits mounted due to huge tax cuts under the Economic Recovery Tax Act of 1981 (P.L. 97-34) and the nation experienced reduced inflation, economic recession, defense buildups, and the federal inability to control spending. Several energy taxes were proposed at that time:

- an increase in the excise taxes on gasoline, diesel, and other motor fuels;
- a sizeable tax on imported oil (in addition to the customs duties that are already imposed on imported petroleum);
- a tax on both imported and domestically produced crude oil; and
- a broadly-based or general energy tax on all or most types of energy consumption, either based on the heat content of the fuel (Btu tax), the carbon content of the fuel (the carbon tax), or on the sales price (the ad valorem energy tax).

Eventually, only the tax on gasoline and other motor fuels was increased (by 5¢ in 1982, 5¢ in 1990, and by 4.3¢ in 1993).

As a general economic principle there is no distinct fiscal rationale for a federal energy tax as a source of general fund financing of federal activities or for deficit reduction. Economic principles suggest federal programs ought to be financed by general income or general consumption taxes. Such taxes, however, while less distortive and more equitable than energy taxes and other selective excise taxes (or differential commodity taxes) are also distortional. Income taxes, for instance, distort the choice between work and leisure by raising the price of work relative to the price of leisure, which tends to increase leisure and reduce work. Income taxes also distort the choice between consuming and saving for the future by raising the price of consuming in the future (i.e., saving).

If an efficiency enhancing tax, such as an externality correcting energy tax, could be substituted for a distortional tax in a revenue neutral way, not only would there be no budgetary effect, but there would be a gain in efficiency (e.g., a reduction in pollution to the environment).[27] In some cases, the revenue gain — hence the possible efficiency gain — could be substantial. For example, a $30/ton tax on carbon emissions, which would roughly stabilize carbon emissions at their 2000 levels, would generate about $40 billion annually; a $100 per ton tax could generate as much as $100 billion annually.[28]

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[27] Some label the environmental gains and the efficiency gains from green taxes as the "double dividend," but it is really the same effect.

[28] Revenue estimates run at about $1/ ton of CO2, at least for relatively small taxes per ton. See U.S. Congressional Budget Office, *Reducing the Deficit: Spending and Revenue Options*, March 1997, p. 392; and U.S. Congressional Budget Office, *Carbon Charges As*

(continued...)

Another example is the gasoline tax. Currently, the burden of the gasoline tax is largely offset or counterbalanced by the benefits received from highways and infrastructure financed from the tax. This means that under current law, and indeed since the inception of the gasoline tax, there has never been a tax on gasoline that accounts for the external costs of driving: the environmental costs of oil production and refining, the environmental costs from tailpipe emissions, the costs of oil import dependence, and the road congestion. A policy to impose a tax on gasoline as a substitute for a distorting income tax would not only make drivers pay for the external costs of driving, it would reduce income tax distortions, and enhance economic efficiency. Moreover, higher gasoline prices would promote petroleum conservation, reduce air pollution, and carbon emissions substantially, and would promote the development of alternative fuels without a large cost, in terms of reduced revenues from subsidization, to the federal budgetary. However, gasoline taxes of this magnitude could be, unless phased-in gradually, a significant shock to the economy.

Energy Taxes vs. Regulation to Achieve Environmental Policy Goals

Energy taxes and subsidies, when used to correct for externalities and other market failures, offer an efficient alternative or supplement to regulations as an instrument of environmental policy. Regulations prescribe the type of technology or equipment for environmental protection, the maximum permitted rate of emission for a particular pollutant, or a minimum energy-efficiency standard, and are part of the "command-and-control" approach to environmental protection. Regulations, such as standards, give policymakers more assurance that environmental policy goals will be achieved regardless of cost, but are often more costly and less economically efficient than taxes or tradeable emissions permits.

To illustrate the fundamental reason why a standard would be economically less efficient than the tax, consider a regulation that prescribes that electric utility generators must be at least 45% energy-efficient as a way of conserving energy and reducing power plant emissions. That is, every fossil-fuel-fired generator in use would have to have an efficiency rate of 45%. In response to the standard, and given current economics of alternative generation strategies, most utilities would invest in the advanced combined-cycle natural gas system (ACCNG), which is the cheapest and most energy efficient technology, with an efficiency rate close to 50%. Subjecting all firms to the same regulatory standard essentially ensures the same behavioral response regardless of differences in the marginal costs of reducing air emissions. But, while the ACCNG system is the least-costly technology among those feasible technologies that meet the 45% energy efficiency standard, it may not be the least-cost energy conservation or air pollution control strategy for every single utility, in every single plant, every single generating unit, and for each of the various types of emissions.

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[28] (...continued)
A Response to Global Warming: the Effects of Taxing Fossil Fuels, August 1990, p. 21.

Intuition suggests, and many studies have confirmed, that the marginal costs of pollution control (marginal abatement costs) vary for each type of pollutant and with the type of technology that utilities use. With the regulation as described, no account would be taken of the differences among utilities, plants, and generating units in their capacity to reduce emissions. Yet, because of differences in site characteristics, design, and utilization rate, current generating units differ significantly with respect to the difficulty (or ease) and the cost of reducing emissions. As a result, those firms with the greater pollution abatement costs would have to undertake the same level of abatement as those with lower marginal abatement costs.

Because of these cost differences, there are many different strategies and options that utilities might use to reduce exhaust emissions from power plants. For example, some utilities might just reduce output, others might invest in pollution control equipment, and still others might replace their coal-fired units with advanced technologies. If there are enough differences among utilities and their marginal abatement costs, then the total costs of reducing emissions with the regulatory standard would be greater (less efficient) than any of the market-based approaches.

In contrast, a tax would provide the incentive for each polluter to reduce pollution in the least costly way — up to the point at which the tax just equals the marginal abatement costs. In the above illustration, the utility with the lower marginal abatement costs of reducing pollution would undertake more pollution abatement than the utility with higher marginal abatement costs. In that way the total cost of abatement would be minimized. Tax revenues could be used to compensate the parties that are harmed by the emissions. The total costs of emissions control from utilities would be much lower if utilities were permitted to use various technologies and control options that are the least cost for that particular utility, that particular plant, and that particular generating unit, to address different emissions, which is how a tax would work. By using a tax instead of a standard, all those anti-pollution activities that cost less than the tax will, in theory, be undertaken.

Taxes or Tradeable Emissions Permits

An alternative market-based approach for environmental protection — an efficient alternative to emissions taxes or their practical equivalent, energy taxes — is the tradeable emission permit or allowance, also known as "pollution rights," "cap-and-trade," or marketable pollution permits. Under this approach, the government (the Congress and the environmental authorities) requires each emitter of a particular pollutant to have a legal permit to emit a fixed amount of that pollutant. The authorities establish a target level for aggregate emissions of a particular pollutant (say so many hundreds of thousand of tons per year), and the pollution equivalence of the tradeable permits (one permit equals one ton of X pollutant). It also allows these permits to be traded in the marketplace among source emitters (or among anyone), who can either buy and use them (if the costs of a permit are less than the marginal abatement costs), save them for future use (if they expect marginal abatement costs to rise above the cost of each permit) or sell them (if their marginal abatement costs per ton are less than the price of a permit). The idea underlying this approach is that it achieves any given level of pollution at lower costs, and is thus economically efficient. Those firms with relatively low marginal abatement costs will choose abatement over permits; those with relatively high abatement costs will choose to purchase permits rather than control pollution. The aggregate level of pollution is fixed, however.

While in theory allowances are equivalent to an emissions tax — and thus also more efficient than standards — in practice there are differences that may make tradeable permits generally more appealing to the policymaker in certain situations while the emissions tax approach is more appealing in others.[29] First, tradeable permits fix the level of aggregate pollution and let the price adjust, whereas the tax fixes the price (the statutory tax rate per unit) and lets the quantity of pollutant (or its equivalent amount of energy) adjust. Thus, tradeable permits appear to give the authorities greater certainty of control over the level of pollution, and therefore control over air and water quality. Tradable permits are considered by many a superior instrument when pollution is reaching some critical level and the government needs to control the quantity of the emissions. Another advantage of tradeable permits is that they avoid the information problem associated with emissions taxes, which would require authorities to know both the marginal external costs (the monetary value of the damages) and the marginal abatement costs per unit of pollution. This information, none of which is required with tradeable permits, is difficult and costly to estimate and in some cases not available at all. None of this is required with tradeable permits. Finally, taxes may be eroded by inflation and affected by the entry and exit of firms. This is not a problem for tradeable permits.

Under a tradeable permit system the authorities must establish a system for monitoring the emissions of the polluter. This is relatively simple when the number of polluters is relatively small in relationship to the magnitude of the emissions, which is the case with SO_2 emitted by electric utilities. As the number of polluters increases, the complexity of emissions monitoring and program administration increases exponentially, which raises the transactions costs of the permit system to such levels that it would no longer make tradeable permits efficient. Such is the case with CO_2 emissions which have millions of sources. In such a case an emissions tax is more appealing.

The economic efficiency advantages of market-based approaches to environmental protection are suggested by the documented evidence on the success of the tradeable permit system — mandated by title IV of the Clean Air Act — in controlling emissions of sulfur dioxide (SO_2) by electric utilities while lowering compliance costs as compared to initial or regulatory costs.[30] According to the Environmental Protection Agency: "Both the Acid Rain Program's rate-based

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[29] See David W. Pearce and R. Kerry Turner, *Economics of Natural Resources and the Environment* (The Johns Hopkins University Press, Baltimore, 1990), p. 92.

[30] Paul L. Joskow, Richard Schmalensee, and Elizabeth M. Bailey, "The Market for Sulfur Dioxide Emissions," *American Economic Review*, September 1998, pp. 669-685. See also Richard Schmalensee, Paul L. Joskow, A Denny Ellerman, Juan Pablo Montero, and Elizabeth M. Bailey, "An Interim Evaluation of Sulfur Dioxide Emissions Trading," *Journal of Economic Perspectives*, v. 12, summer 1998, pp. 53-68; and Carl E. Zipper and Leonard Gilroy, "Sulfur Dioxide Emissions and Market Effects Under the Clean Air Act Acid Rain Program," *Journal of Air & Waste Management Association*, vol. 48, September 1998, pp. 829-837.

approach to NO_x reduction and cap-and-trade approach to SO_2 reduction have been very successful."[31] Tradable permits are also being discussed as an instrument of controlling greenhouse gases worldwide, part of an international framework to control emissions of CO_2 and other greenhouse gases.

The Economic Effects of Energy Taxes

The level of, and changes to, energy taxes and subsidies can affect energy prices and output, economic growth rates, income distribution, and international trade. Thus, they can be a very powerful energy and economic policy instrument.

Efficiency Effects

As was discussed above, energy taxes and subsidies can be a useful instrument to correct for pre-existing distortions in the allocation of resources and simultaneously generate tax revenues, if they are imposed on activities or commodities such as energy resources whose production and use generate external costs, or if they are imposed as user fees for the services of a public good. Otherwise, selective energy excise taxes for either greater production, improved technical energy efficiency, or increased supply of alternative fuels reduce the efficiency of the economy. Reduced efficiency implies reduced output and lower standards of living.

Distributional Effects

With respect to energy taxes on supply, there is generally no separate equity case that can be made for taxing energy at a higher rate than other commodities. Due to nonrenewable resources' finite stock, economic rents (also called scarcity rents) are created when these resources are produced. Under competitive conditions such rents would be expected to rise at the rate of interest so as to achieve asset or capital market equilibrium. Such rents are not excessive under competitive supply and need not be taxed away on equity grounds.[32] Energy taxes on consumers (e.g., gasoline taxes, oil taxes, or general energy taxes) also frequently have negative distributional consequences because the incidence of such taxes often falls disproportionately on lower incomes. Finally, energy tax subsidies frequently also have adverse distributional effects. One example — there are others — is the income tax credit

[31] U.S. Environmental Protection Agency, *1997 Compliance Report: Acid Rain Program*, EPA-430-R-98-012, August 1998, p. 22.

[32] The existence of a successful cartel or some other force or factor that inhibits competition might generate substantial economic rents, particularly for low-cost producers. For example, clearly Saudi Arabia and other Persian Gulf producers earn substantial economic rents from their oil production as it costs only a few dollars per barrel (average production costs of Saudi oil have been estimated at about $1.50/barrel) to produce oil. However, U.S. oil producers are basically the high cost or marginal producers from the perspective of the world crude oil market and do not generally earn such high rents. In any event, as noted before, the world crude oil market is much more competitive today than at any time during the last 30 years; it is thought that even OPEC cannot establish, for sustained periods of time, crude oil prices above competitive equilibrium levels.

(the §29 tax credit) for non-conventional energy resources, which in addition to distorting resource allocation, losing tax revenues, and not reducing oil import dependence (since it has basically increased the supply of methane gas rather than alternatives to petroleum) is also questionable on tax equity grounds. Supporters of the credit contend that it encourages domestic energy production, however, and could become more important in the future. They also note that domestic methane resulting from the credits helps offset the growing U.S. need for natural gas imports.

Macroeconomic Effects

Increases in energy taxes are basically a contractionary fiscal policy that would tend to reduce aggregate output and employment, and produce a temporary increase in the rate of inflation above the baseline. Increases in taxes on final energy demand, such as a hike in the gasoline tax, tend to be (dollar for dollar) less contractionary than energy taxes on industry (such as an oil tax) although these, too, reduce household income, consumer spending, and to some extent business costs and profits. Sizeable taxes on oil increase the price of all energy and can trigger relatively large cutbacks in industrial energy use and energy used as inputs into production. Such taxes, including an oil import tax, can produce macroeconomic effects akin to an oil price shock, resulting in a temporary but sharp slowdown in the economy's growth.