OIL SLICKERS:
HOW PETROLEUM BENEFITS AT THE TAXPAYER'S EXPENSE

Jenny B. Wahl, Ph.D.

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The Institute for Local Self-Reliance (ILSR) is a non-profit research and educational organization that provides technical assistance and information on environmentally sound economic development strategies. Since 1974, ILSR has worked with citizen groups, government and private businesses to develop policies that extract the maximum value from local resources.

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A Word from ILSR

Market economies work best when they rely on accurate prices. Yet many of the prices we pay do not reflect the full costs of producing, using and disposing the goods we consume. The most important example of this mismatch may occur in the transportation sector.

For 22 years ILSR has worked to build strong and environmentally sound economies. One practical tool for moving us in this direction is to get the prices right. It is in that spirit that we offer this study.

The United States has by far the lowest gasoline prices among industrialized countries, and the few brave politicians who have tried to raise gas taxes quickly felt the anger of their constituents. Yet the price we pay at the pump for gasoline and diesel bears little relationship to the real cost of driving.

This is true even in the narrowest sense. Many of us believe our transportation system is a pay-as-you go proposition, that motor vehicle fees and gas taxes fully cover the cost of the roads upon which we drive. But as John Bailey points out in his well-documented ILSR report, *Making the Car Pay Its Way*, the costs of maintaining local roads in Minneapolis largely comes not from transportation taxes but from property taxes. If we were to shift this burden onto drivers and off of property owners, motorists would have to pay 18 cents more a gallon.

Many other quantifiable costs are unaccounted for in the price we pay at the pump. To determine these costs, the Institute for Local Self-Reliance asked Dr. Jenny Wahl to review the existing literature on the subject. Dr. Wahl is a most fitting person to undertake this task. She is one of the nation's eminent tax analysts and economists. An Associate Professor of Economics at Saint Olaf College in Northfield, Minnesota, Dr. Wahl has worked in the U.S. Treasury Department's Office of Tax Analysis and is a member of the Star Tribune's Board of Economists.

Dr. Wahl's conclusion—that if we eliminated the tax, environmental and military subsidies for gasoline, the price at the pump could rise by 32 cents a gallon—we think is not only defensible but very conservative. For example, this report gives very little weight to the potential costs of global warming.

Based on this study, Minnesotans subsidize the oil industry by over $700 million a year. These subsidies have the perverse effect of artificially lowering the price of gasoline. This encourages driving and increases pollution while slowing the development of alternatives such as more efficient vehicles or non-petroleum fuels.

Dr. David Morris
Vice President

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EXECUTIVE SUMMARY

How much does gasoline cost? A lot more than what you pay at the pump. If you include the tax subsidies, the costs to taxpayers of protecting oil supplies, and the costs of environmental and health hazards, a gallon of gas costs about 32 cents more than its pump price.

The national costs of petroleum unaccounted for in its retail price — its external costs — range from $42 billion to nearly $350 billion per year. The costs to Minnesotans range from $469 million to $2.95 billion per year. Transalted into cents per gallon, gasoline receives subsidies that range from 21 cents to $1.34 per gallon. Tax subsidies received by the petroleum industry are the easiest to measure and account for $3.3 billion to $10.9 billion of this total. The largest single cost element encompasses the military costs of protecting our oil supplies, which range from $26.6 billion to $70.7 billion. The hardest cost element to quantify, but also potentially the most important, is the environmental and health costs associated with pollution and global warming. Estimates of these costs range from $25.5 billion to $267 billion per year.

This report concludes that a reasonable and still conservative estimate of the external costs of gasoline is 32 cents per gallon or $84 billion per year. This estimate assumes a very low external environmental and health cost.

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We are not going to solve our transportation-related security, climate, pollution, and congestion problems without a serious effort to internal ize the costs now generated by motor vehicle drivers.

—James MacKenzie, World Resources Institute[1]

Suppose you ran a business. You'd pay to protect your property – salaries for security guards, the cost of fences, insurance premiums, and the like. You would also expect to pay — either through a private contract or in court —for damages you might inflict on others. If, say, the fumes from your auto-repair shop blew into the restaurant next door, you'd likely pay your neighbor something for their losses.[2] And you wouldn't expect to receive tax breaks any greater than the other businesses in the neighborhood.

None of this is true for the petroleum industry. It can count on the U.S. military to defend its interests abroad, and it depends on taxpayers to finance strategic petroleum reserves at home should overseas supplies be disrupted. Despite what oil and gas does to our health and environment, the petroleum industry bears few costs associated with these ills, either. What is more, the U.S. tax system gives out among its most handsome subsidies to oil and gas interests.[3] As a result, the prices of oil products are artificially lower than they otherwise would be.

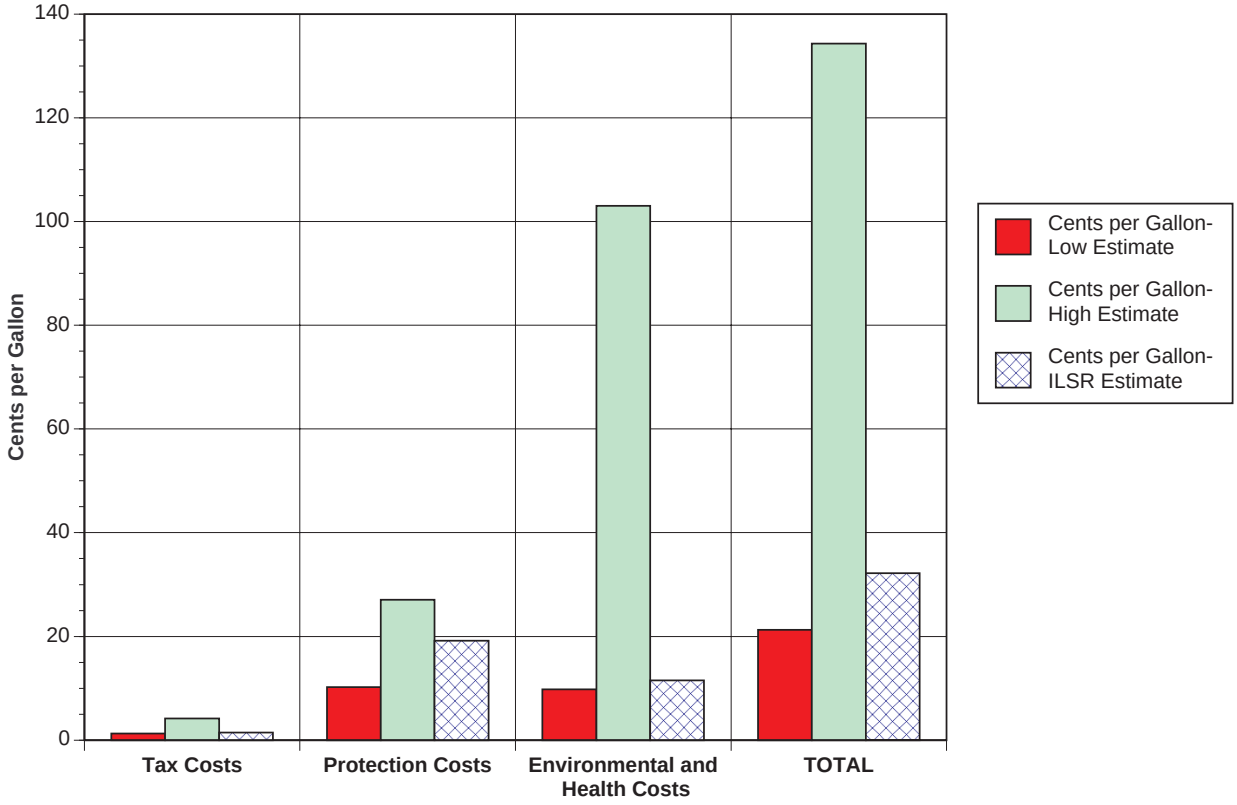
What is the true cost of gasoline? Much more than what you pay at the pump. A gallon of regular unleaded costs about $1.30, but about 37 cents of that is state and federal taxes primarily used to pay for transportation-related expenses like road construction and maintenance.[4] If motorists had to pay the true cost of gasoline, the pump price would be much higher.

Many experts have tried to quantify the external costs of oil. In this report, ILSR reviews dozens of existing studies and develops a range of estimates and a single best guess-number. The three key types of external costs are preferential tax treatment; the cost of protecting oil supplies; and the environmental and health costs associated with burning oil.[5] The methodology used in this report is to identify key studies, to extract from them a range of estimates of the external cost of petroleum and to translate that number into cents per gallon of gasoline. Tables 3, 4, and 5 break down the costs by category and element. Tables 1 and 2 summarize the results of these tables. Based on the studies reviewed, our best-guess estimate of the subsidies received by petroleum each year is $84 billion. This figure of 32 cents per gallon, we believe is very conservative. Figure 1 presents the low and high external cost estimates and the ILSR estimate. With regard to the tax costs, the ILSR estimate is very close to the lowest bound of the range. This is also true of the ILSR estimate of environmental and health costs, where the ILSR estimate is less than 20 percent above the low cost estimate. The ILSR estimate for military subsidies to oil is in the higher range because most of the studies of these costs clustered at this level. This translates into about 32 cents per gallon of gasoline.[6] For Minnesota, which uses about 2.2 billion gallons of gasoline per year, this external cost represents about $704 million.

TABLE 1
The Range of External Costs of Petroleum

	U.S. Total Cost (cents per gallon)	ILSR Estimate (cents per gallon)
Tax Costs	1.3 - 4.2	1.5
Protection Costs	10.2 - 27.1	19.2
Environmental and Health Costs	9.8 - 103.0	11.5
TOTAL	**21.3 - 134.3**	**32.2**

Figure 1: The External Cost of Gasoline (cents per gallon)



Note: These numbers allocate the external costs of the 261 billion gallons of petroleum annually consumed in the U.S. across all uses.

One comment about the applicability of these estimates to Minnesota: the figures presented in this report are national averages. Despite what Garrison Keillor says, Minnesotans in fact are average in many respects – adult population, income, federal income tax payments, number of vehicles, and gas taxes. The state boasts 1.74 percent of the population aged 18 and older, it reports 1.85 percent of income earned by individuals, it pays 1.8 percent of federal taxes.[7] Its citizens own 1.97 percent of passenger cars (about 3 million) and 1.69 percent of buses and trucks (nearly a million).[8] Minnesotans pay median federal and excise tax rates on gasoline.[9] In one key respect, however, we differ from some states – we import virtually all of our petroleum.

TABLE 2
The Range of External Costs of Petroleum

	U.S. Total Cost (billion $)	U.S. Cost ILSR Estimate (billion $)	Minnesota Cost (million $)	Minnesota Cost ILSR Estimate (million $)
Tax Costs	3.3 - 10.9	3.7	28.6 - 92.4	32
Protection Costs	26.6 - 70.7	50	224.4 - 596.2	419
Environmental and Health Costs	25.5 - 267	30	215.6 - 2,266	253
TOTAL	**55.4 - 348.6**	**83.7**	**468.6 - 2,954**	**704**

TAX PREFERENCES

One way that Americans subsidize the petroleum industry is through the tax code. The Treasury Department and the Joint Committee on Taxation track these sorts of subsidies but, naturally, view them in terms of losses to government coffers. Yet the two concepts are simply reverse sides of the same coin — a lower tax due to preferential treatment is the equivalent of a subsidy.[10] Moreover, lower taxes for one set of taxpayers mean higher taxes for the rest of us.[11] One means of expressing the degree of tax preference enjoyed by an industry is to calculate its effective tax rate.

Jane Gravelle of the Congressional Research Service found an effective tax rate on oil and gas extraction income of 11 percent, as compared to the statutory rate of 35 percent. Other industries have effective tax rates much closer to the statutory rate.[12]

The official term used to describe a taxpayer subsidy is a "tax expenditure." As the Joint Committee on Taxation puts it, tax expenditures are "decreases in . . . tax liabilities that result from provisions in income tax laws and regulations that have been enacted to provide economic incentives . . . or tax relief . . ."[13] The petroleum industry enjoys a variety of these provisions, despite recommendations (official and otherwise) to end them.[14] Petroleum producers are currently requesting even greater tax relief, including tax credits for oil produced from existing stripper wells and from deep water.[15]

All told, Americans will give up $3.3 billion to $10.9 billion in tax revenues in 1996 because of tax preferences enjoyed by the petroleum industry.[16] Table 3 summarizes the various annual tax subsidies that petroleum receives.

TABLE 3
Annual Tax Subsidies to Petroleum

Federal Tax Categories	Amount (million $)
Percentage depletion	985.0
Alternative fuel production	756.0
Expensing of exploration and development	140-275
Enhanced recovery	97.0
Deferral of income from controlled foreign	180-286
Foreign tax credit (in contrast to deduction)	777-3,380
Accelerated depreciation	113-4,438
Research and experimentation	114.0
Working capital exception to passive loss limitation	60.0
Alaska native corporations	0-15
Exclusion of interest on municipal bonds	0-180
TOTAL	**3,222-10,586**
TOTAL adjusted for state taxes	**3,319-10,904**

Percentage depletion method One of the largest tax subsidies enjoyed by petroleum producers is a provision that allows them to deduct a percentage of gross income to account for depletion of oil reserves.[17] Most taxpayers are entitled to deductions that correspond to the costs of doing business, but the percentage depletion deduction bears no resemblance to the costs actually incurred by oil and gas producers. In fact, producers can continue to claim percentage depletion long after all expenses incurred to acquire or develop a property have been recovered. The size of this subsidy is $985 million for 1996.

The percentage depletion method has been with us since nearly the beginning of the income tax. The allowable rate was set at 27.5 percent in 1926, finally reduced to 22 percent in 1969. The Tax Reduction Act of 1975 repealed the deduction for major oil companies, and later acts reduced the rate to 15 percent and restricted the use of the deduction. Yet recent tax law has gone the other way. Because of national security concerns, in 1989 the cap on the allowable deductible amount increased from 50 percent to 100 percent of net income. The 1990 Act expanded the use of percentage depletion to transferred property. And the Energy Policy Act of 1992 provided that excess percentage depletion deductions related to oil and gas production are not items of tax preference for purposes of the alternative minimum tax for taxable years beginning after 1992.

Alternative (nonconventional) fuel production credit A second large subsidy given to petroleum producers is a tax credit of $3 per barrel-of-oil-equivalent for fuels produced by non-conventional means.[18] This credit applies, for example, to oil produced from shale and tar sands and gas produced from geopressured brine, Devonian shale, coal seams, or biomass. The petroleum industry is not the only one to benefit from this credit, but it captured 72 percent of the total in 1991 and 76 percent in 1992.[19] Texaco took enough alternative fuel production credits to reduce its tax bill by $29.3 million in 1994.[20] The overall tax subsidy to petroleum interests attributable to this preference item will be about $756 million in 1996. According to one Treasury official, this subsidy is fast becoming more important as producers look for deposits of oil in hard-to-reach places.

Expensing of exploration and development costs A tenet of good tax policy is to match costs and benefits appropriately. In general, costs that yield future benefits must be capitalized and recovered over that future period for tax purposes. But oil and gas producers can instead expense certain exploration and development expenditures – that is, take an immediate tax deduction – regardless of how long these investments might be expected to generate future income.[21] In 1996, this subsidy cost us $140 million; in recent years, the subsidy has run as high as $275 million.[22] Recent Tax Court decisions have tended to favor the taxpayer – permitting larger deductions and thus greater subsidies to the petroleum industry.[23]

Enhanced oil recovery credit Yet another tax benefit enjoyed by the petroleum industry is the ability to take a tax credit for the costs of certain methods designed to enhance the process of recovering oil.[24] Such methods include injecting chemicals into wells. The Treasury Department estimates this subsidy at $100 million for 1997; this amount translates to about $97 million in 1996 dollars.

Foreign tax provisions U.S. companies are taxed on their worldwide income but entitled to a credit for taxes paid to other governments, with some restrictions.[25] This "foreign tax credit" is intended to prevent double taxation and to harmonize domestic tax policy with the realities of multinational business operations. For the most part, the credit works reasonably well to ensure that U.S. companies pay the same (or greater) tax on income earned abroad as on income earned at home. In two major areas, however, the tax code can be manipulated: when U.S. companies establish subsidiaries overseas and can time the repatriation of dividends, and when foreign governments and U.S. multinationals conspire to call something a tax when it is not. All sorts of industries may benefit from the former; the petroleum industry may particularly gain from the latter practice.

Income earned through controlled foreign corporations is not taxed in the U.S. until it returns home as dividends.[26] Tax subsidies arising from income deferral will total $1.8 billion in 1996 for all industries. Of the largest 7,500 such corporations, between 10 and 15.9 percent were associated with oil and gas interests in 1992.[27] Estimated subsidies arising from deferral of income therefore range from $180 million to $286 million for the petroleum industry in 1996.

Tax subsidies for petroleum associated with the foreign tax credit are even larger. In 1992, petroleum companies took about $5.2 billion in foreign tax credits.[28] Because many oil-producing countries have no business tax (particularly in the Persian Gulf), some of the amounts claimed as foreign taxes were actually royalty payments in disguise, akin to the royalties and severance taxes that oil and gas companies pay to states like Alaska and Texas. As a result, a recent Senate bill proposed disallowing foreign tax credits for any oil and gas extraction income from anywhere for multinational corporations. The Administration proposed a milder version suggesting that credits be denied for income received in countries that have no effective corporate tax. Both proposals have

quietly disappeared.[29] If the petroleum industry could only deduct foreign taxes instead of taking a credit for them, we could raise an additional $3.38 billion in revenue in 1996. If such a provision applied only to income from countries with no income tax, we could raise about $777 million. But the failure of the Senate and Administration proposals, coupled with major defeats for the Internal Revenue Service in the Tax Court, indicate that these subsidies are firmly entrenched.[30]

Accelerated depreciation allowances Most U.S. taxpayers know that they can take depreciation deductions on business assets – deductions based on asset cost that correspond to the reduction in value of the asset due to wear and tear or obsolescence. Most of us also know that we can take bigger deductions in the first years after we buy a business asset. That is, we can accelerate depreciation for tax purposes and therefore enjoy lower tax bills earlier on. By comparison with straight-line depreciation (which would entitle us to equal tax deductions each year over the life of the asset), we can keep our money longer and thus gain a tax benefit.

For all industries, the estimated tax expenditure associated with accelerated depreciation totals nearly $24 billion for 1996 and over $35 billion for 1997.[31] Yet these large numbers overestimate the true amount of tax subsidies enjoyed by asset holders. Accelerated depreciation is designed in part to counteract the effects of inflation. For good accounting reasons, people must base depreciation deductions on the purchase price of an asset. In times of inflation, however, the prices of most assets (and therefore their replacement costs) increase over time. Straight-line depreciation thus underestimates the annualized cost associated with a depreciable asset when inflation is present. But we have had relatively lower inflation in the past few years than during the period in which the tax authorities crafted the accelerated depreciation rules. Some portion of the tax expenditure currently attributable to accelerated depreciation should therefore be considered a taxpayer subsidy.

How much of the estimated tax expenditure on accelerated depreciation represents a taxpayer subsidy for petroleum? Corporate tax return data indicate that the petroleum industry accounts for about 4.7 to 4.8 percent of depreciation deductions and about 12.6 percent of depreciable assets.[32] An upper bound on the subsidy to petroleum from this tax provision could look to the 1997 tax expenditure data and include the entire (pro-rated) amount – nearly $4.5 billion. If, say, only 10 percent of the 1996 tax expenditure amount were counted, a lower bound for the figure would be about $113 million.

Expiring provisions: research and experimentation, exception from passive loss limitation for working capital Two features of the tax code that pertain to taxpayer subsidies to petroleum have expired, but the presence of transition rules means that subsidies in these two areas still exist for the next several years. The first feature is favorable tax treatment for research and experimentation costs, which expired in July 1995. Certain incentives will be phased out over a period of years, creating an estimated $2.4 billion in tax expenditures for 1996 and $10.9 billion for 1996-2000 across all industries. The portion attributable to the petroleum industry is approximately $114 million for 1996. A second expired provision that pertains solely to the oil and gas industry is an exception to the passive loss limitation for working capital – resulting from a complicated interaction of tax regulations. This exception was repealed in 1993 but will still cost $60 million in 1996 and $320 million over the period 1996 to 2000.

Other relevant federal subsidies Two additional tax expenditure items may generate subsidies to the petroleum industry: the treatment of Alaska native corporations and the exclusion of interest on industrial development bonds. Businesses run by Alaskan natives receive favorable tax treatment to the tune of about $15 million annually. Although these companies have not necessarily been associated with petroleum, natives have recently agitated for a share of Alaska royalty oil to set up some petroleum interests. The exclusion of interest on state and local industrial development bonds for energy facilities will create a tax expenditure of about $180 million in 1996. Not all of this amount can be attributed to petroleum, but some fraction can.

To calculate subsidies to the petroleum industry generated by special tax or financial treatment, two other items deserve mention. The United States has existing or proposed tax treaties with a number of oil-producing countries, including Egypt, Indonesia, Mexico, Russia, and Kazakhstan. To the extent that treaties might reduce statutory tax rates or grant favorable treatment for certain types of income, petroleum interests may benefit beyond the confines of the existing tax code and regulations.

Besides the possibility of benefiting from tax incentives and tax treaties, oil companies are lining up with multibillion dollar projects at the doors of the Overseas Private Investment Corporation (OPIC). Essentially, those companies with OPIC status are insured with taxpayer dollars against adverse changes in the host country's political conditions. Recently, OPIC administrators approved loan guarantees and insurance worth $28 million to Texaco to establish a Russian facility. Conoco implemented a similar project at about the same time.[33] OPIC companies have been set up to foster economic development in certain regions, particularly the Soviet Union – a laudable goal, perhaps. But OPIC companies also mean that, if a company loses all or part of its investment due to unrest abroad, U.S. taxpayers will foot the bill.

Interaction of state and federal tax calculations Because most states piggyback off federal tax returns to calculate state taxable income, industries that benefit from favorable federal tax deductions also benefit at the state level. (Federal tax credits do not generate similar piggyback effects.) State corporate tax rates vary widely but average about 5 percent. A conservative accounting for the interaction of state and federal taxes would augment total federal subsidies by about 3 percent.[34]

Conclusion The total tax subsidies related to petroleum are $3.3 billion to $10.9 billion. Per gallon of gasoline, this comes to 1.3 cents to 4.2 cents per gallon. We believe that 1.45 cents per gallon is a conservative and reasonable estimate.

EXPENDITURES DESIGNED TO PROTECT OIL SUPPLIES

Currently, the United States imports 1.4 million barrels of oil a day from Persian Gulf countries; one-quarter of the world's oil supply comes from the region.[35] Even more telling, two-thirds of the known oil reserves lie in the Gulf – the largest supplies in Saudi Arabia, the next-largest in Iraq.[36] Much of the rest of the world's petroleum supply comes from other potentially politically unstable countries.

Given our dependence on the continuing supply of foreign oil, we have undertaken a number of measures designed to insulate ourselves against disruption.[37] Most notably, the U.S. maintains a military presence – which it is willing to use in combat — in oil-sensitive areas. We also maintain a large reserve of crude oil in tanks around the country. In addition, we devote Department of Energy funds to petroleum research.

All of these programs come at taxpayer expense at a cost of $26.6 billion to $70.7 billion per year, with a greater probability attached to the high end of the range.[38] Table 4 details the various costs associated with protecting petroleum.

TABLE 4
Annual Costs of Protecting Petroleum Resources

	Amount (million $)
Routine Maintenance of Troops and Equipment	25,200-63,000
Annualized Cost of Combat	300-6,300
Petroleum Reserve-Routine Maintenance	201
Petroleum Reserve-Annualized Cost of Moving	5-10
Foregone Use of Funds	724-1,035
R & D Costs	180
TOTAL	**26,610-70,726**

Routine maintenance of military forces In 1996, the total requested funding for military operations by the Defense Department is $252 billion.[39] How much is devoted to protecting petroleum? Hard to say. Even without the presence of oil, some troops might be stationed in oil-rich areas for other reasons. What is more, troops can be mobilized worldwide if necessary. Knowing the number of soldiers present in a given region does not necessarily tell us what we would like to know: the incremental cost of maintaining and equipping military personnel solely because we want to protect oil supplies. Direct calculation of such a cost is virtually impossible.

Indirect calculation is, however, possible. According to a former Assistant Secretary of Defense for Economic Security, we currently have about 17,000 troops in the Persian Gulf.[40] This represents just over 1 percent of military personnel; the same percentage in budgetary terms is about $2.8 billion annually. By comparison, 42 percent (about 660,000 troops) served in the Gulf during the Desert Storm Operation.[41] In February 1991, the Congressional Budget Office estimated the annual (post-war) cost of stationing on-shore active forces in the Persian Gulf at $3.89 billion.[42] Of course, we maintain off-shore forces, troops in other oil-sensitive areas, and administrative personnel as well. Plausible estimates of the annual expense devoted to routine protection of oil resources might therefore range from 10 to 25 percent of the annual military budget — $25.2 to $63 billion.

Most researchers have estimated annual expenses toward the high end of this range. In a comprehensive survey of the literature on the subject, the Congressional Research Service found that analysts' estimates ranged from about $56 billion to $73 billion (in current dollars) annually devoted to defense of the Middle East/Persian Gulf.[43] Many experts have estimated the security costs of protecting petroleum at $50 billion or more per year.[44]

The cost of combat In addition to routine maintenance of troops near oil-rich areas, we have fought bloody battles – Desert Storm and Desert Shield are only the most recent. Estimates of the incremental cost of those conflicts vary, ranging from $57 billion to over $100 billion.[45] Our allies paid some of the cost – commitments are about $54 billion, but actual collections are more like $37 billion. The total costs of this war to U.S. taxpayers were therefore $3 billion to $63 billion. Naturally, none of these figures count the costs of pain and suffering to U.S. soldiers, nor costs to our adversaries.

We don't fight such wars every year. One Defense Department official speculated that the Gulf War might keep things quiet for up to 10 years.[46] At that rate, the annualized cost to U.S. taxpayers of combat to protect petroleum ranges from $300 million to $6.3 billion

Petroleum reserves The bulk of U.S. oil reserves – about 575 million barrels as of August 1, 1996 — resides in the Strategic Petroleum Reserve. The cost of maintaining the reserve is about 35 cents per barrel per year – over $200 million annually.[47]

Not only do taxpayers pay to maintain the reserve, they currently face a $100 million tab for decommissioning and moving part of it because of water intrusion and contamination. In all likelihood, other such moves will be necessary later on. Assuming that similar moves might take place every 10 to 20 years, the annualized cost would fall between $5 million and $10 million.

Yet a third – and much larger – cost to taxpayers is the foregone interest on the value of the reserves. Because we have billions of dollars tied up in barrels of oil rather than ready for use, we are giving up between $724 million and $1,035 million per year. Some of this loss could be offset if oil increased in value; over the life of the reserve, the value of petroleum has actually fallen.[48]

In addition to the Strategic Petroleum Reserve, we have Naval Petroleum Reserves. These Reserves were instituted to help the Navy convert from coal to oil. The budget request for 1996 to maintain the reserve is $208 million. Because public law has already authorized the sale of these reserves, (and because the oil produced there has been sold competitively on the open market), it is not included as a cost to taxpayers.

Research and development expenses The Department of Energy receives funding for research in fossil energy. In 1996, $180 million will be devoted solely to petroleum R & D.[49]

Conclusion The total costs for protecting our access to oil is $26.6 billion to $70.7 billion. Given the number of respected analysts who have concluded that the figure is around $50 billion, we have used that as our best-guess estimate. This translates into 19.2 cents per gallon.

ENVIRONMENTAL AND HEALTH COSTS

Petroleum products cause a variety of environmental and health damages, most of which go unreimbursed. These external costs are among the most difficult to quantity and estimates of the size of damages vary considerably. Calculations of environmental costs are also complicated by the varying methodologies used by analysts. For example, some calculate the damages caused by using oil; others calculate the costs of reducing or avoiding pollution. As Table 5 shows, estimates for the total external environmental and health costs associated with petroleum range from $25.5 billion to $267 billion in current dollars.

TABLE 5
Annual External Environmental and Health Costs of Petroleum

	Amount (million $)
Groundwater, Soil, and Air Pollution	24,867-240,333
Costs Associated With Global Warming	633-26,667
TOTAL	**25,550-267,000**

Environmental effects from within-border spills and leaky tanks Accidental (and sometimes deliberate) oil and gas spills pollute our surroundings. As one home-grown illustration, Lake Superior suffered an estimated 36 spills in 1994, consisting of a total of more than 11,000 gallons of fuel oil.[50]

Perhaps more ominous than spills are the 2.5 million underground and 250,000 above-ground storage tanks scattered around the country, filled mostly with petroleum products.[51] Thousands of these tanks have sprung leaks; the Environmental Protection Agency has estimated that more than 25 percent may be leaking or will leak within the next 3 to 5 years.[52] Cleanup is costly: the state of Texas has estimated its cost of cleaning up leaky underground storage tanks (cleverly termed LUSTs) at $2.5 billion, for instance. California has at least 30,000 known USTs; environmental lawyers working in the private sector estimate that half of their practice deals with oil and gas UST issues.[53] In one horrific 1988 incident, over 700 thousand gallons of diesel fuel spewed into Pennsylvania's Monongahela River from a collapsed storage tank.

Minnesota has its share of problems, with over 70 tank farms and some large refineries located within the state. In March 1994, for example, a leaky tank at Ashland Petroleum's St. Paul Park facility released upwards of 130,000 gallons of gasoline into the groundwater. In May of the same year, 1,500 gallons of oil leaked into the Mississippi River. As much as 2 million gallons of petroleum products are estimated to have accumulated on the water table over the last 50 years at the St. Paul Park site.[54]

How do we pay for this mess? In part, with a battery of fees and fines. In the past, we have designed some liability-based excise taxes in attempts to include these social costs in the final prices of petroleum and other potentially hazardous products. At the federal level, these have included Superfund, LUST, and oil spill taxes. These taxes are no longer being collected, although balances exist in each fund.[55] Moreover, a good part of the funds goes toward assessment studies, research, and lawyer fees rather than restoration.[56] And the funds devoted to contaminated sites pay only for costs of cleanup, not damages manifested by lower crop yields, medical bills, and the like. Superfund does not even apply to petroleum products – benzene, a known carcinogen, will not qualify contaminated gasoline stations as Superfund sites.[57]

Minnesota has certain fees and taxes in place devoted to dealing with petroleum contamination. The state charges an inspection fee of 85 cents per thousand gallons of petroleum products. We also have a LUST charge of 2 cents per gallon of petroleum products received in the state, subject to a cap on total collections; this tax is on a 4-month cycle and is not currently being collected. We impose fines on violators as well – Ashland faced $330,000 in penalties for the March 1994 LUST spill, although the company could reduce the fine if it complies with safety upgrades ahead of schedule.

Some fees, such as federal and state pipeline safety user fees, go toward regulation and inspection. Unlike liability-based excise taxes, such measures arguably help prevent problems rather than pay for pollution that has already occurred. Although user fees and fines on violators help fund the operation of oversight, taxpayers certainly bear some of the costs. Minnesota has over 50 thousand miles of pipelines.[58]

Fees typically do not come close to paying for petroleum-related damages. Legal remedies are a potential alternative to fees: private citizens have some recourse to the courts if they suffer injuries due to petroleum contamination. Yet causation is hard to establish.[59] And people often have no one to sue. Those injured by a LUST, for example, may find that the tank belonged to an independent dealer who bought from several distributors, then went bankrupt. Those who do win lawsuits often gain only injunctive relief – stopping further damages – rather than gaining compensation for damages that have already occurred.

Explicit fees and civil remedies place some responsibility for environment on the producers and consumers of oil. Despite these measures, the bulk of environmental damages from within-border spills and LUSTs probably rests implicitly on ordinary citizens.

One estimate of the costs associated with petroleum leaks and spills alone is 237 million barrel-equivalents of oil annually, or about $4.3 billion worth.[60] The Environmental Protection Agency estimates the cost just of cleaning up petroleum-contaminated groundwater at $790 million per year.[61] Delucchi estimates the health and environmental effects of leaking motor vehicle storage tanks at $120 million to $1.8 billion a year in current dollars.[62]

Oil spills in the ocean Oil is spilled into the ocean fairly often, but the amount spilled per incident tends to be relatively small – except in some widely known instances. (Because many tankers as yet have only a single hull, the probability of an oil spill in an accident is relatively high.[63]) One of the first large ocean oil spills was by the Amoco *Cadiz* in 1978, near the French coast. At the time, the losses were estimated at $190 to $290 million (in 1978 dollars).[64] More recently, 9,276 tanker accidents occurred worldwide in 1989, with 518 resulting in oil spills. One year later, one of the largest-ever spills took place – the Exxon *Valdez* dumped over 11 million gallons of oil off the shoreline of Alaska. The company paid a settlement of over $1 billion (and deducted most of it from taxable income). In 1991, only 3 known major oil spills occurred, putting about 55,000 gallons of oil in the ocean.

How much are U.S. residents affected by ocean oil spills? The *Valdez* incident may just be the tip of the iceberg — more than one-third of all petroleum products transported by oceangoing tankers pass through U.S. waters. [65] And the *Valdez* was exceptional: many spills probably go unreported and unattributed. As a result, most of the cost of ocean oil spills is likely borne by every-one but the responsible parties. Delucchi estimates the cost of oil spills as $2.4 to $6.0 billion a year in current dollars[66]

Mortality, morbidity, and reduced crop yields associated with petroleum pollution Whole hosts of medical ailments are related to exposure to petroleum products. Respiratory problems and cancer rank among the biggest offenders, although eye irritation, cardiovascular problems, and injuries caused by fires, explosions, and gasoline ingestion also occur.[67] Benzene, a major component of gasoline, is a proven human carcinogen. Other components of gasoline and oil likely cause cancer as well.[68] Reduced crop yields and acid rain are yet other side-effects of petroleum contamination.

Air pollution caused by fossil-fuel combustion and volatility is a major contributor to these ills – even with the standards set by the Clean Air Act (as amended) and the 1990 Pollution Prevention Act. Fuel combustion is responsible for almost half of the human-generated emissions of nitrous oxides, major ingredients of ozone and, in turn, smog.[69] It generates more than half of all carbon monoxide emissions and more than a third of all volatile organic-compound emissions.[70] It is a significant factor in a variety of air-quality and health-related problems, from ground-level smog and carbon monoxide to atmospheric acid rain. Even with new-car fuel-efficiency standards and pollution-emission requirements, motor vehicles generate an immense amount of pollution because we continue to drive more cars for longer distances each year.[71]

You might think that, compared to other states, Minnesota's air pollution problems are not so bad. You would be right, in a sense – state air generally falls within the National Ambient Air Quality Standards (NAAQS). Yet, because of petroleum products, the Twin Cities and Duluth frequently violate NAAQS. Among the largest single air polluters in Minnesota are Ashland and Koch. Ashland was penalized nearly $60,000 in April 1995 for violating air quality standards.[72] What is more, both the Environmental Protection Agency and Congress acknowledge that scientists often find that pollution concentrations they formerly thought were safe are in fact harmful.[73] Furthermore, the NAAQS do not reflect the latest scientific knowledge because the Environmental Protection Agency does not have the resource to keep the NAAQS up to date.[74] So Minnesota's air probably causes more harm than the statistics reveal.

Isolating the health and agricultural effects of exposure to petroleum products is a difficult task. Nevertheless, some studies have attempted it. The Office of Mobile Sources of the Environmental Protection Agency recently estimated that the U.S. cancer incidence associated with gasoline ranges from 400 to 754 cases per year; the incidence associated with diesel exhaust is 178 to 860 cases per year.[75] Private researchers have estimated even higher figures.[76] One study estimated that ozone air pollution is associated with 10 to 20 percent – and nearly 50 percent on bad days — of all respiratory hospital visits and admission. Another found that a 1 percent increase in the concentration of ozone was associated with a .015 percent increase in total mortality.[77]

Some researchers have couched their results in monetary rather than morbidity terms. Air pollutants such as ozone and nitrous oxide, substantially generated by motor vehicles, cause an estimated $2 billion to $4 billion loss in U.S. crop yields annually, for instance.[78] One study estimated that the costs of ozone alone generated by motor vehicles — in terms of health effects, lost labor hours, and reduced agricultural yields — came 8.3 cents per gallon of gasoline (in current dollars). That translates into more than $9 billion a year.[79] Others have calculated the cost of illness, premature death, reduced visibility, lower agricultural production, and damage to materials at $25 billion to $240 billion (current dollars) per year.[80]

Global warming Petroleum products cause health and other problems at current levels of consumption. Yet they also create significant problems for the future because they contribute to global warming. Experts estimate that up to one-half of greenhouse gas emissions (particularly carbon dioxide) are from fossil fuel combustion, with transportation activities being the largest single source.[81]

Why should we care? Because global warming could cost us considerably. Estimates of the current cost of US fuel-cycle emissions of greenhouse gas emissions range from $3 billion to $27 billion.[82] One scholar predicts that we may experience a 2.5 degree Centigrade warming by the year 2025 at current emission levels and trends. In the U.S. alone, that will translate into overall damages of $60 billion annually from agricultural losses, a rise in sea level, increased mortality, losses to the ski industry, increased electrical use from air conditioners, and lost water supply.[83]

Various researchers have estimated the benefits of curbing emissions so as to keep them at a certain level or to stabilize the atmospheric concentration of carbon dioxide.[84] The Office of Technology Assessment rated the economic health benefits of holding emissions constant at $633 million to $5 billion a year in current dollars.[85] These estimates focus on constant levels of emissions, however. If we want to halt global warming, we would actually need to cut emissions considerably. This would call for a substantial tax.[86] Experts have suggested that we need taxes ranging from 20 to75 cents per gallon of oil to accomplish this.

The current U.S. administration speaks of its commitment to addressing the problem of global warming. In his speech at the Rio de Janeiro conference held on Earth Day 1992, President Clinton expressed his desire to return U.S. emissions of greenhouse gases to 1990 levels by the year 2000.[87] Indeed, since 1990 the Environmental Protection Agency has issued or proposed numerous regulations and guidance designed to reduce air pollution and greenhouse gas emissions. But the agency does not have the resources to enforce its own standards and, in fact, has fallen far behind in implementing many of the provisions of the Clean Air Act.[88]

Conclusion From the various studies reviewed, we extracted a range of estimates for environmental and health costs of $25.5 billion to $267 billion. Our best-guess estimate is $30 billion, which translates to 11.5 cents per gallon. This figure gives little weight to the costs of global warming.

ENDNOTES

1 *The Environmental Costs of Transportation*, 1992, p. 44.

2 Just such a controversy arose not long ago between the Acropol Inn on Grand Avenue in St. Paul and its neighbor, Auto Clinic Inc., resulting in a lawsuit filed in Ramsey District Court.

3 Another such industry is pharmaceuticals, which reaps substantial benefits from the possessions tax credit.

4 Gas taxes and vehicle fees pay only a portion of the costs or road construction and maintenance. An in-depth study of local road financing in Minneapolis found that a significant portion of the costs of local roads comes from non-transportation taxes such as property taxes. The subsidy to motorists from the general taxpayer in Minneapolis is 18 cents per gallon. *Making the Car Pay Its Way: The Case of Minneapolis Roads*, John Bailey, Institute for Local Self-Reliance, 1992.

5 This analysis does not include the subsidies to energy consumption generated through low-income home energy assistance programs. For estimates of these, see Energy Information Administration, U.S. Department of Energy, *Federal Energy Subsidies: Direct and Indirect Interventions in Energy Markets*, November 1992.

6 We buy just over 17 million barrels of oil a day, 9 million of them imported. This translates into about 261 billion gallons of oil consumed each year. We consume about 116 billion gallons of gasoline each year. Energy Information Administration, U.S. Department of Energy, *Monthly Energy Review*, April 1996. The share of oil devoted to gasoline use is actually rising: just over the past decade, it has gone from under 40 to over 45 percent of total petroleum used. Energy Information Administration, U.S. Department of Energy, *Monthly Energy Review*, various issues.

7 U.S. Bureau of the Census, *Current Population Reports*, series P25-1111, Series A State Population Projections; Statistics of Income Division, Internal Revenue Service, *SOI Bulletin*, Spring 1996.

8 American Automobile Manufacturers Association, *Motor Vehicle Facts & Figures*, 1994, p. 33. Adapted from data provided by the U.S. Department of Transportation, Federal Highway Administration. These figures do not include military vehicles.

9 Federal excise taxes are currently 18.3 cents per gallon of gasoline, of which 4.3 cents go into the general fund and the remainder into the highway trust fund. Minnesota excise taxes that are transferred to the state's Department of Transportation for the state highway trust fund equal 20 cents per gallon. In terms of total state and local taxes on gasoline (including excise and sales tax), Minnesota ranks just about in the middle of all states. See D.C. Department of Finance and Revenue, *Tax Rates and Tax Burdens in the District of Columbia: A Nationwide Comparison*, June 1995, and *Survey of State and Local Gasoline Taxes*, Minnesota House Research Information Brief, February 1994.

[10] Of course, most of us enjoy some tax preferences – the mortgage interest deduction, for example. Yet the benefits of these sorts of tax preferences are spread much more widely across people than the preferences concentrated in a given industry.

[11] Alternatively, less taxes for some might mean a greater budget deficit (and therefore higher taxes later) or fewer services provided.

[12] Jane Gravelle, *Economic Effects of Taxing Capital Income*, MIT Press, 1994, p. 54ff.

[13] Joint Committee on Taxation, *Estimates of Federal Tax Expenditures for Fiscal Years 1988-1992*, February 1987. For three reasons, one must take care in interpreting tax expenditure estimates. Certain provisions overlap, so double-counting is a possibility. This is probably not a major issue for tax expenditures related to petroleum. Not only might tax expenditures overlap, they do not include behavioral effects. That is, the data do not account for shifts in output generated by alterations in the tax code. Again, this is likely a minor matter here because the elasticity of demand for petroleum is inelastic (quantity demanded is relatively unresponsive to price), at least in the short-run. Finally, tax expenditures are calculated on the basis of current cash flows, rather than in present-value terms. In most instances, the differences in calculation are minimal. For tax preferences that generate benefits for a number of periods, however, one must use a present-value calculation to determine an accurate revenue-loss figure attributable to a given fiscal year. For the most part, I can rely on cash-flow numbers; for certain provisions, however, I report present-value figures.

[14] The Treasury Department's noted 1984 blueprint for tax reform is just one of many documents that have called for repealing the tax incentives enjoyed by the petroleum industry. Office of the Secretary, U.S. Department of the Treasury, *Tax Reform for Fairness, Simplicity, and Economic Growth*, November 1984.

[15] *U.S. Dependence on Foreign Oil*, Senate Hearings 104-21, *Domestic Oil and Gas Tax Proposals to Increase Production*, Senate Hearings 103-971.

[16] Tax expenditure data come primarily from Office of Management and Budget, *Budget of the United States Government, Fiscal Year 1997, Analytical Perspectives*, pp. 61-87. Naturally, certain people benefit from the subsidies: some benefits may flow to stockholders and executives; arguably, some may go to employees and creditors as well. Yet the salient point about subsidies is that they encourage more investment and activity in a particular enterprise than is economically warranted: on net, they cost society. The data reported here represent the net cost to taxpayers.

[17] Internal Revenue Code sections 611 to 613A.

[18] Internal Revenue Code section 29. The provision applies only to domestic production from facilities or wells in place before 1993.

[19] Statistics of Income, Internal Revenue Service, *SOI Corporate Tax Return Source Books*, 1991 and 1992 returns.

[20] *New York Times*, May 14, 1995, p. 1.

[21] Internal Revenue Code section 263.

[22] These numbers pertain to the present value of the tax expenditure.

[23] See particularly *Louisiana Land and Expl. Co.*, 102 T.C. 21 (1994). Reported in *Tax Notes*, September 25, 1995, p. 1560.

[24] Internal Revenue Code section 43. Also see Code sections 193 and 263.

[25] Internal Revenue Code sections 901 and following.

[26] Not only can companies manipulate timing, they can take advantage of swings in exchange rates to minimize tax burdens. See Jenny Wahl, "Taxation of Foreign Exchange Gains and Losses and the Tax Reform Act of 1986," *National Tax Journal*, March 1989.

[27] Statistics of Income, Internal Revenue Service, *SOI Bulletin*, Winter 1995-1996, from pp. 99-104. These numbers are based on proportions of assets and of receipts.

[28] *SOI Bulletin*, Winter 1995-1996, from pp. 115-129. Foreign taxes paid, accrued, or deemed paid amounted to about $6.17 billion.

[29] See the protest from Texaco on p. 1327 of *Tax Notes*, Mar. 4, 1996. Treasury Department officials relayed much of the background information to me.

[30] In one recent suit, the IRS determined that Amoco had a $466.2 million deficiency for 1980-82. Amoco had claimed a foreign tax credit for taxes paid to Egypt; the IRS argued that the money had been funneled back through an Egyptian subsidiary as a government subsidy. The IRS lost. Reported in *Tax Notes*, April 10, 1995, pp. 452-54. In a suit from December 22, 1993, the Tax Court rejected the IRS's reallocation of income for Exxon. See *Tax Notes*, January 9, 1995.

[31] These numbers correspond to present value calculations.

[32] Statistics of Income, Internal Revenue Service, *Corporate Tax Return Source Books*, 1991 and 1992 returns.

[33] See testimony by Friends of the Earth, *Domestic Oil and Gas Proposals to Increase Production*, Senate Hearing 103-971, p. 171.

[34] Some have suggested that states also subsidize petroleum by imposing sales taxes on gasoline that are relatively lower than sales taxes on other items. Union of Concerned Scientists, *Money Down the Pipeline: Uncovering the Hidden Subsidies to the Oil Industry*, September 12, 1995. I could not find sufficient evidence to adopt this reasoning. See for example D.C. Department of Finance and Revenue, *Tax Rates and Tax Burdens*, and *Survey of State and Local Gasoline Taxes*, Minnesota House Research Information Brief.

[35] *Monthly Energy Review*, April 1996. Also see Congressional Office of Technology Assessment, *U.S. Oil Import Vulnerability*, 1991.

[36] Statement by Susan Tierney, Assistant Secretary for Policy, U.S. Department of Energy, *U.S. Dependence on Foreign Oil*, Senate Hearing 104-21; Energy Information Administration, Department of Energy, *Monthly Energy Review*, June 1996.

[37] States as well as the federal government attempt to protect valuable petroleum resources. States like Alaska and Texas require oil companies to pay royalties (in cash or in kind) and severance taxes, in part to slow down depletion. Yet calculating the value of extracted oil, particularly in Alaska where no on-site market exists, is often a matter of controversy. As a result, the amount of royalties and taxes paid may not fully compensate states for the loss of their resources.

[38] These figures estimate the cost to taxpayers of protecting petroleum. If oil companies instead shelled out protection money, they would probably be allowed to deduct at least part of their expenses from taxable income, just as any business might deduct insurance premiums or guards' salaries. If all such expenses were deductible and losses fully carried over, taxpayers would effectively bear 35 percent of these costs. (If expenses were high enough, companies would have to carry over losses to other years. Because carryover periods are limited, some losses might never be deducted. Taxpayers would then bear less than 35 percent of costs.) Existing costs of protecting petroleum reserves, relative to this "deductability baseline," therefore come to $17.3 billion to $46 billion per year. How plausible is this scenario? Oil companies would not be likely to hire guards to protect supplies, at least not to the extent that U.S. military forces currently do. Companies might, however, insure against some losses, either through third parties or on their own.

[39] Office of Management and Budget, *Budget*. The total Defense Department budget comes to over $263 billion in 1996. This figure does not account for emergency energy preparedness (about $150 million annually) nor international security assistance.

[40] Testimony by Joshua Gotbaum, Department of Defense, *U.S. Dependence on Foreign Oil*, Senate Hearing 104-21, p. 27. His Office has been abolished.

[41] See *Persian Gulf War Veterans and Related Issues*, hearing before subcommittee on oversight and investigations, Committee on Veterans Affairs, House of Representatives, June 9, 1993.

[42] This breaks down into $260 million for equipment and the remainder for active shore forces. *Cost of War in the Gulf*, hearing before the Committee on the Budget, House of Representatives, February 27, 1991.

[43] Congressional Research Service, *The External Costs of Oil Used in Transportation*, June 17, 1992.

[44] Earl Ravenal, *Designing Defense for A New World Order*, Cato Institute, 1992, p. 46, calculated the cost of maintaining a military presence in the Middle East at $50 billion. James MacKenzie, a researcher at World Resources Institute and frequent commentator on the social cost of petroleum, testified to the same number. *The Environmental Costs of Transportation Energy Use*, hearing before the subcommittee on the environment of the Committee of Science, Space, and Technology, House of Representatives, September 17, 1992. Edwin Rothschild, *Oil Imports, Taxpayer Subsidies, and the Petroleum Industry*, Citizen Action, May 1995, put the national security cost of oil at $57 billion annually. Also see General Accounting Office, *Southwest Asia: Cost of Protecting U.S. Interests*, August 1991. For a comprehensive analysis, see the 1994 report for the National Renewable Energy Laboratory, *Fuel Ethanol "Special Studies"* by Energetics, Inc. located at Website http://rredc.nrel.gov/biomass/doe/rbep/ethanol

[45] Joshua Gotbaum, Assistant Secretary for Economic Security, Department of Defense, estimated the incremental costs of the war at $57 billion. *U.S. Dependence on Foreign Oil*, Senate Hearing 104-21, p. 27. The Office of Management and Budget puts the cost closer to $100 billion or more. *Update on Costs of Desert Shield/Desert Storm*, hearing before the Committee on the Budget, House of Representatives, May 15, 1991.

[46] Testimony by Joshua Gotbaum, *U.S. Dependence on Foreign Oil*, Senate Hearing 104-21.

[47] Conversation with officials at the Strategic Petroleum Reserve Office, U.S. Department of Energy. Budget requests for maintenance for 1996 were $264 million. Office of Management and Budget, *Budget*. The original goal for the Reserve was 1 billion barrels, but we are currently depleting the Reserve rather than adding to it.

[48] The oil in the Reserve cost somewhere between $19 and $21 billion to purchase; its current market value (at just over $18 per barrel) is much less – about $10.5 billion. If the Reserve were sold and the proceeds invested at 7 percent, taxpayers would enjoy annual returns of about $724 million. At 10 percent, the amount would be $1,035 million annually.

[49] Office of Management and Budget, *Budget*.

[50] Reported in the *Minneapolis Star-Tribune*, May 14, 1995.

[51] Estimated by the Office of Underground Storage Tanks, Environmental Protection Agency. Also see *Underground Storage Tanks*, hearing before the subcommittee on energy and agriculture, Committee on Small Business, House of Representatives, November 18, 1987.

[52] The *Washington Post* of May 10, 1992, had a story about thousands of leaky gas and oil tanks in the D.C. area, for example.

[53] Conversation with environmental lawyers in San Francisco.

[54] Reported in the *Minneapolis Star-Tribune*, August 31, 1995, and May 24, 1995.

[55] Only Superfund retains some interest – Senate bill S. 2027 proposed a 5-year extension of Superfund; it has been referred to the Senate Finance Committee. One source at the Environmental Protection Agency estimated that the funds will pay for no more than 18-months'-worth of cleanup. They may not last that long: some Congressmen have suggested tapping the trust funds to pay for the general costs of government operations.

[56] Siamack Shojal, ed., *The New Global Oil Market: Understanding Energy Issues in the World Economy*, Praeger, 1995, p. 177

[57] The petroleum industry also enjoys exclusions or other special provisions in the Clean Water Act, the Clean Air Act, the Safe Drinking Water Act, the Hazardous Liquid Pipeline Safety Act, the Oil Pollution Act, and the Emergency Planning and Community Right-To-Know Act. Testimony by Friends of the Earth, *Domestic Oil and Gas Proposals to Increase Production*.

[58] Because of certain provisions our state probably is more successful at maintaining safety than others are. Minnesota's Office of Pipeline Safety is located in the Office of Public Safety and can quickly call upon other agencies in emergencies; in contrast, most such offices are located in Offices of Public Utilities. Also, Minnesota's Office is responsible for both instate and interstate pipelines; most states regulate only instate pipelines and must rely on federal officials to inspect interstate lines. About one-third of the state Office's budget is covered by a federal grant. Conversations with officials in Minnesota's Office of Pipeline Safety.

[59] For one account of the difficulties of establishing causation, see Jonathan Harr, *A Civil Action*, Random House, 1995.

[60] Testimony by Friends of the Earth, *Domestic Oil and Gas Proposals to Increase Production*, Senate Hearing 103-971.

[61] ABB Environmental Services, *The OPA Liner Study*, January 24, 1993, p. 57.

[62] Mark DeLucchi, *Summary of Non-monetary Externalities of Motor Vehicle Use*, Draft prepared for the Union of Concerned Scientists, October 1995.

[63] Legislation passed after the Exxon *Valdez* spill requires double hulls for new oceangoing tankers unless the Coast Guard finds a good alternative. Single hulls will be phased out in U.S. waters by 2015. Ships flying foreign flags are more prone to spill off our coasts. Eric Anderson and Wayne Tilley, "Oil Spills," *Land Economics*, May 1995,

[64] See National Oceanic and Atmospheric Administration, U.S. Department of Commerce, *Assessing the Social Costs of Oil Spills: The Amoco Cadiz Case Study*, 1983.

[65] Anderson and Tilley, "Oil Spills," p. 216.

[66] DeLucchi, *Summary*

[67] Between 1983 and 1992, fires and explosions in U.S. oil refineries and petrochemical plants killed more than 80 workers, injured 900 workers, and caused the evacuation of thousands. Testimony by Friends of the Earth, *Domestic Oil and Gas Proposals to Increase Production*. Approximately 30,000 cases of accidental ingestion of gasoline occurred in 1987, according to the American Association of Poison Control Centers, with almost 30 percent being children aged 2 years or younger.

[68] A variety of cancer studies exist. See for example Myron Mehlman and Arthur Upton, eds, *The Identification and Control of Environmental and Occupational Diseases: Hazards and Risks of Chemicals in the Oil Refining Industry*, Princeton Scientific Publishing Co., Inc., 1994; Office of Health and Environmental Assessment, Environmental Protection Agency, *Evaluation of the Carcinogenicity of Unleaded Gasoline*, April 1987; Office of Research and Development, Environmental Protection Agency, *Air Quality Criteria for Ozone and Related Photochemical Oxidants*. Also see Environmental Criteria and Assessment Office, Environmental Protection Agency, *Health Assessment Document for Diesel Emissions*, 1990;.

[69] Office of Research and Development, Environmental Protection Agency, *Air Quality Criteria for Ozone and Related Photochemical Oxidants*, vol. 1, p. 3-63; Mackenzie et al., *The Going Rate*; David Greene and Danilo J. Santini, *Transportation and Global Climate Change*, 1993; Office of Research and Development, Environmental Protection Agency, *Air Quality Criteria for Carbon Monoxide*, December 1991, p. 6-9; and Office of Research and Development, Environmental Protection Agency, *Air Quality Criteria for Ozone*

and Related Photochemical Oxidants, vol. 1, p. 3-63. See as well the testimony of Victor Rezendes, Director, Energy and Science Issues, Government Accounting Office, *The Environmental Costs of Transportation*, 1992, and testimony of Robert Sussman, Environmental Protection Agency, *Global Climate Change and Air Pollutants*, hearings before the subcommittee on health and environment, Committee on Energy and Commerce, House of Representatives, August 4 and October 26, 1993.

70 Mackenzie et al., *The Going Rate*.

71 See MacKenzie et al., *The Going Rate*, and testimony of James MacKenzie, *The Environmental Costs of Transportation Energy Use*, 1992.

72 Reported in the *Minneapolis Star-Tribune*, August 31, 1995, February 4, 1995..

73 See the legislative history to the Clean Air Act Amendments of 1977, and *Lead Industries Ass'n v. Environmental Protection Agency*, 647 F.2d 1130 (CD Cir. 1980), *cert. den.*, 449 U.S. 1042 (Dec. 8, 1980)

74 See *In the Matter of the Quantification of Environmental Costs Pursuant to Law of Minnesota 1993, Chapter 356, Section 3*, State of Minnesota Office of Administrative Hearings, Findings of Fact, Conclusions, Recommendation, and Memorandum, 6-2500-8632-2, E-999/CI-93-583, p. 24.

75 Adapted from J.M. Adler and P.M. Carey, "Air Toxics Emissions and Health Risks from Mobile Sources," presented at the annual meeting of the Air and Waste Management Association, 1989.

76 Myron Mehlman, "Carcinogenicity of Motor Fuels: Gasoline," in Mehlman and Upton, eds., *The Identification and Control of Environmental and Occupational Diseases.*

77 P.L. Kinney and H. Ozkaynak, "Associations of Daily Mortality and Air Pollution in Los Angeles County," *Environmental Resources* 54, 1991, 99-120.

78 Office of Research and Development, Environmental Protection Agency. For estimates of certain effects on agriculture, see the summary in Office of Research and Development, Environmental Protection Agency, *Air Quality Criteria for Ozone and Related Photochemical Oxidants*, July 1996, vol. II, table 5-38.

79 Mark French, *Efficiency and Equity of a Gasoline Tax Increase*, Paper #33, Finance and Economics Discussion Series, Federal Reserve Board of Governors, July 1988.

80 UC-Davis researchers, reported in MacKenzie et al., *The Going Rate*. Mark Delucchi, as reported by the Union of Concerned Scientists, *Money Down the Pipeline*, estimated damages of gasoline to human health alone to be $42.1 to $181.7 billion a year in 1990 dollars.

81 Mackenzie et al., *The Going Rate*, estimated that driving leads to 25 percent of carbon dioxide emissions. Others have estimated even higher figures. See for example the testimony of Howard Geller and John DeCicco, *The Environmental Costs of Transportation Energy Use*, 1992, and the testimony of Robert Sussman, *Global Climate Change and Air Pollutants*, 1993. These experts estimate that transportation accounts for one-third of greenhouse gases.

82 Union of Concerned Scientists, *Money Down the Pipeline*, Table 7 (converted to 1996 dollars).

83 William Cline, *Economics of Global Warming*, Institute for International Economics, 1992. Also see Organization for Economic Cooperation and Development, *Transport Policy and Global* Warming, 1993, Global *Warming*, 1992, and *Climate Change: Evaluating the Socio-Economic Impacts*, 1991.

84 The Intergovernmental Panel on Climate Change, *Climate Change, the IPCC Scientific Assessment*, Cambridge, 1990, recommended that global carbon dioxide emissions should be reduced by 60 to 80 percent in order to stabilize concentrations.

85 Congressional Office of Technology Assessment, *Catching Our Breath: Next Steps for Reducing Urban Ozone*, July 1989.

86 Congressional Budget Office, *Energy Use and Emissions of Carbon Dioxide: Federal Spending and Credit Programs and Tax Policies*, December 1990; Cline, *Economics of Global Warming*; Dale Jorgenson and Peter Wilcoxen, *Reducing U.S. Carbon Dioxide Emissions: The Cost of Different Goals*, CSIA Discussion Paper 91-9, Kennedy School, Harvard University (cited in MacKenzie et al., *The Going Rate*).

87 Representative Henry Waxman has noted that the plans proposed to do this are largely a collection of voluntary measures without any real enforcement mechanisms. *Global Climate Change and Air Pollutants*, 1992, p. 97. Waxman was the chair of the subcommittee.

88 *Global Climate Change*, 1993, p. 42.