STRUCTURING AN ENERGY TAX SO THAT ENERGY BILLS DO NOT INCREASE

Howard Geller
John DeCicco
Steven Nadel

March 1993

STRUCTURING AN ENERGY TAX SO THAT ENERGY BILLS DO NOT INCREASE

Howard Geller, John DeCicco, and Steven Nadel
American Council for an Energy-Efficient Economy
Washington, DC

March 8, 1993 (Revised)

A. Introduction and Summary

The Clinton Administration has proposed a broad-based Federal energy tax as part of its deficit reduction strategy. A debate is underway concerning the advantages and disadvantages of different tax approaches, including a broad-based Btu tax, a gasoline tax, or a carbon tax. In comparing tax options, policy makers and other parties are considering impact on energy markets, consumers and the environment as well as impact on the deficit and the economy.

This paper shows that no matter which form of energy tax is adopted, **total national energy expenditures during the next decade could actually decline at the same time a new energy tax is implemented if about 15 percent of the tax revenue is recycled into energy efficiency programs.** Using energy more efficiently would also reduce our trade deficit, enhance energy security, and cut carbon dioxide emissions and other pollutants associated with energy use. In addition, certain energy efficiency programs, such as weatherization of low-income and public housing, directly address the regressivity of energy taxes.

We present a specific set of energy efficiency initiatives that are cost effective and provide high leverage in terms of energy, monetary, and pollutant savings. We find that by directing about $4.3 billion of energy tax revenue to energy efficiency programs annually, national energy use would be reduced by about five percent and consumers' energy bills would fall by nearly $33 billion per year by 1998. Within ten years (i.e., by 2003), national energy use would fall by nearly eleven percent and consumers' energy bills would drop by over $83 billion per year. These reductions in energy demand are far greater than the reductions expected as consumers directly respond to the new energy tax. For the nation as a whole, the energy bill savings within five years approximately offset the energy tax as proposed by the Clinton Administration.

Thus, policy makers have the opportunity to combine the bitter pill of energy taxes with the sweet syrup of energy efficiency. Taking advantage of this opportunity would benefit consumers, business, the Federal government, and the environment.

A. Introduction and Summary

The Clinton Administration has proposed a broad-based Federal energy tax as part of its deficit reduction strategy. A debate is underway concerning the advantages and disadvantages of different tax approaches, including a broad-based Btu tax, a gasoline tax, or a carbon tax. In comparing tax options, policy makers and other parties are considering impact on energy markets, consumers and the environment as well as impact on the deficit and the economy.

This paper shows that no matter which form of energy tax is adopted, **total national energy expenditures during the next decade could actually decline at the same time a new energy tax is implemented if about 15 percent of the tax revenue is recycled into energy efficiency programs.** Using energy more efficiently would also reduce our trade deficit, enhance energy security, and cut carbon dioxide emissions and other pollutants associated with energy use. In addition, certain energy efficiency programs, such as weatherization of low-income and public housing, directly address the regressivity of energy taxes.

We present a specific set of energy efficiency initiatives that are cost effective and provide high leverage in terms of energy, monetary, and pollutant savings. We find that by directing about $4.3 billion of energy tax revenue to energy efficiency programs annually, national energy use would be reduced by about five percent and consumers' energy bills would fall by nearly $33 billion per year by 1998. Within ten years (i.e., by 2003), national energy use would fall by nearly eleven percent and consumers' energy bills would drop by over $83 billion per year. These reductions in energy demand are far greater than the reductions expected as consumers directly respond to the new energy tax. For the nation as a whole, the energy bill savings within five years approximately offset the energy tax as proposed by the Clinton Administration.

Thus, policy makers have the opportunity to combine the bitter pill of energy taxes with the sweet syrup of energy efficiency. Taking advantage of this opportunity would benefit consumers, business, the Federal government, and the environment.

B. **Direct Tax Impacts**

An energy tax will have a direct impact on energy demand as some consumers change their behavior in response to higher energy prices. The response obviously depends on the scale of the tax and how it is implemented. For example, phasing the tax in gradually may have less of an impact than adopting it all at once. In fact, behavioral and social research shows that the way in which an energy conservation policy or program is communicated can be just as important if not more important than the size of a financial incentive (Stern and Aronson, 1984). The response to an energy tax is likely to be reduced if the tax is hidden from consumers or if conservation options are not clearly presented and easy to implement.

The broad-based Btu tax proposed by the Clinton Administration is relatively modest. When fully phased in, the tax will increase energy prices by about 7.5 cents for a gallon of gasoline, 26 cents for a thousand cubic feet of natural gas, and 0.20 cents for a kWh of electricity on average. The tax would be phased in in three steps between 1994 and 1996, meaning the impact on energy prices at each step will be barely noticeable to consumers.

The broad-based energy tax would raise on the order of $33 billion of additional tax revenue per year on a gross basis when it is fully phased in, without accounting for indirect reductions in other tax payments and assuming energy consumption rises about one percent per year in the short run. For comparison, the national energy bill including most existing energy taxes was $473 billion in 1990 (EIA 1992a). Energy prices have been relatively stable since then. Thus, a broad-based energy tax generating $33 billion per year would increase the average retail energy price by about seven percent.

In the short run, demand for energy services is relatively inelastic -- that is, a change in price by itself will not significantly affect the consumption of energy. For example, the Department of Energy (DOE) estimates that a five percent increase in gasoline prices would result in only a 0.55 percent decrease in vehicle-miles traveled and a one percent improvement in average new car fuel economy in the short run (EIA 1993b). In effect, consumers have only a limited ability to change their patterns of travel and manufacturers cannot alter their vehicle designs or product offerings in the short run.

Some economists estimate a higher long-run price response. Based on a historical analysis of energy trends, they estimate a a 2.0 to 3.5 percent reduction in consumption for a five percent increase in energy price (Bohi 1981; Gately and Rappaport 1988). However, these studies fail to account for regulatory and other non-price factors that were influencing energy markets at the same time as price variations. Other studies that explicitly examine these multiple factors, such as analysis of the relative importance of changes in gasoline price and the CAFE standards on auto fuel economy, conclude that the CAFE standards were the decisive factor and that prices had only a small impact on auto fuel economy during the 1970s and 80s (Greene 1990).

Our own analysis of historical data on gasoline consumption, energy prices, incomes, population, and other economic variables indicates price responses similar to DOE's estimates. We project that a five percent increase in gasoline price will lower gasoline consumption in the medium term (i.e., within five years) by about one percent (Laitner 1993). Based on data published in the DOE's **Annual Energy Outlook 1993**, slightly greater price elasticities are expected in the residential and commercial sectors. The industrial sector appears to have a slightly lower average price elasticity. Overall, we estimate that a five percent increase in energy prices throughout the economy will result in a 1.2 percent reduction in energy consumption in the medium term (Laitner 1993).

We conclude that an energy tax equivalent to about seven percent of current energy costs will have a small direct impact on energy consumption and corresponding pollutant emissions. Based on price elasticity estimates by DOE as well as our own review of price elasticities, on the order of a 1.7 percent reduction in national energy use might result within a few years of the tax fully taking effect. In order to achieve a larger reduction in energy demand, a portion of the tax revenue will have to be dedicated to energy efficiency programs.

C. Energy Efficiency Initiatives

We suggest devoting about $3.3 billion of federal tax revenue initially, increasing to $4.5 billion by 1997 and thereafter, to the following set of energy efficiency initiatives:

- Low-income weatherization
- Public housing retrofits
- Retrofits of federal buildings
- Support for state building code adoption and implementation
- State-based loan program for home weatherization
- EPA Green programs
- RD&D on improved equipment efficiency
- Industrial energy efficiency initiatives
- Investment Assistance for vehicle manufacturers
- Level tax benefits for commuters

Some of these efforts build on current energy efficiency programs; others are new initiatives. Most of the initiatives are similar to proposals contained in the "Sustainable Energy Blueprint" developed recently by a broad coalition of environmental, energy, and consumer groups (CCMC 1992).

The energy efficiency programs as a whole are designed to: 1) generate a high level of private investment in energy efficiency, 2) accelerate the implementation of cost-effective efficiency measures and reduce energy demand in all sectors of the economy, and 3) specifically target low-income households to help address the regressivity problem presented by energy taxes. The energy efficiency programs would be based primarily at DOE, although a few are based at other agencies such as EPA or HUD. New legislative authority may be needed in order to undertake some of the initiatives. Also, a number of the initiatives would be implemented through the states, where activities such as building codes or weatherization of low-income households are traditionally based.

The rationale for and descriptions of the ten initiatives are provided below, along with key assumptions about the effectiveness of each initiative. Our estimates of overall energy and economic impacts are presented in the next section of the paper.

1. **Low-Income Weatherization**

Low-income families typically spend about 25 percent of their income for energy and consume 20 percent more energy per square foot of living space compared to middle and upper income households (Vine and Reyes 1987). Because of inefficient housing and low family income, some poor families cannot afford to pay their utility bills. This results in energy bill subsidies from the federal government as well as utilities, or service cut-offs.

The Weatherization Assistance Program (WAP) based at DOE funds energy efficiency improvements in households with incomes up to 150 percent of the poverty level. The budget is currently $185 million per year. In addition, states are allowed to shift up to 15 percent of Low-Income Home Energy Assistance Program (LIHEAP) funds into weatherization. They have used about $130 million per year for this purpose in recent years (OTA 1992). Together, the WAP/LIHEAP efforts are serving about 250,000 households annually, with about 3 million low-income units weatherized to date. Considering that there are 15-18 million eligible households that have not yet participated in the weatherization program, reaching them would take another 60-70 years at current rates. There is an urgent need to expand the program.

We propose increasing the WAP program by $500 million per year (with a two-year phase-in) in order to more than double the number of households served each year by federally-funded weatherization efforts. In addition, this level of federal support should attract some private funding through utility DSM programs and other sources. We assume that each federal dollar attracts $0.25 of private funds, meaning a total of $625 million per year of additional investments in low-income weatherization.

Based on improvements in program performance that have occurred in recent years in a number of states, it is reasonable to assume end-use energy savings of 25 million Btu/yr per unit weatherized, at an average cost of around $1,500 per unit (Schlegal et al. 1991). This implies about 25 billion Btu/yr of primary energy savings per million dollars invested. Total energy savings from this initiative would reach 70 trillion Btus/yr after five years and 148 trillion Btus/yr after 10 years.

2. **Public Housing Retrofits**

Each year, HUD spends about $2-3 billion subsidizing the energy bills for the 3.6 million tenants that live in HUD-assisted housing units, i.e., public housing and so-called "Section 8" housing (OTA 1991). Public housing units on average consume significantly more energy than privately owned multifamily housing -- one study indicated 65 percent greater energy use (Greeley et al. 1987). Reducing energy waste in public housing is a smart investment for the federal government since it will recoup this investment through reduced publicly-paid energy bills.

The potential for conserving energy, increasing occupant comfort, and improving the quality of public housing is very large. One comprehensive study estimated over 30 percent savings potential in public housing with an average payback period of 4.5 years (HUD 1988). Evaluations of actual public housing retrofits indicate that savings of around 20 percent are common, although comprehensive rehabilitation and retrofit has resulted in measured savings of 44 percent (Ritschard and MacAllister 1992).

We propose devoting $400 million per year to retrofitting HUD-assisted housing (with a two-year phase-in). Assuming the more thorough rehab-retrofit strategy involving adding insulation, new windows where appropriate, and heating system upgrade or replacement, experience shows a cost of around $1,500 and annual end-use energy savings of 60 MBtu per housing unit (Ritschard and MacAllister 1992). This implies saving 58 billion Btu of primary energy annually per million dollars of expenditure. Also, there should be some leveraging of non-federal funds from utilities and other sources, say at the rate of $0.25 for every federal dollar. Total energy savings from this initiative are estimated to reach 130 trillion Btus/yr after five years and 276 trillion Btus/yr after 10 years.

3. Retrofits of Federal Buildings

Federal buildings consume 1 percent of national energy use at a cost of about $3.5 billion per year. Studies indicate that at least 25 percent energy savings are technically and economically feasible in federally owned or leased buildings (OTA 1991). Despite an Executive Order that set a goal of a 20 percent reduction in average energy use per square foot of floor area in federal buildings by 2000, very little is being done to improve energy efficiency in federal buildings. In fact, total federal spending on energy efficiency improvements declined from about $300 million in 1981 to just $50 million in 1990 (OTA 1991).

The Energy Policy Act of 1992 contains a wide range of provisions intended to increase the implementation of cost-effective efficiency measures. However, the Act does not provide an essential ingredient for making energy efficiency happen -- namely adequate funding. We propose investing $300 million per year of Federal energy tax revenue in retrofitting and evaluating the energy performance of Federal buildings over a ten-year period. With some use of utility rebates and energy service company financing, the total energy efficiency investment over a ten-year period could reach $4.2 billion, the level estimated to be necessary to achieve a 25 percent reduction in Federal energy use by the tenth year (Hopkins 1991).

Funding for Federal energy management should also be used for bulk purchases of energy-efficient products, particularly for new products where initial costs are still relatively high. This will help to establish markets for and reduce the cost of new energy efficiency measures. Savings from this type of action are not included in our analysis.

Based on the assumptions explained above, the level of energy savings would reach 105 trillion Btus/yr by 1998 and 210 trillion Btus/yr by 2003. The reduction in the Federal energy bill is estimated to be $280 million by 1995, $700 million by 1998 and $1.4 billion by 2003. Thus, the Federal government would save more than it invests beginning in the third year of the program.

4. State-Based Loan Program for Home Weatherization

While many electric utilities offer demand-side management programs, few gas utilities offer such programs, and for homes using oil, propane and other fuels, such programs are non-existent. In many states, even electric demand-side management programs are limited. Other residential energy conservation programs developed during the 1970s have since been abandoned (e.g., the Federal Solar Energy and Energy Conservation Bank, which was administered by HUD and implemented by states). As a result, most middle-income homeowners have nowhere to turn if they need assistance financing energy efficiency measures. In order to help fill this gap, and assist homeowners to finance energy-saving improvements, several states have used oil overcharge funds to provide low-cost loans to homeowners wanting to implement energy efficiency measures. However, as these funds run out, most of these programs are ending. A federal program which provides grants to states to operate energy efficiency loan programs would allow these programs to continue, and would allow additional states to offer such programs.

We propose allocating $400 million per year to this effort (with a two year phase-in). Assuming that utilities add $1 for every $2 of Federal money, financing would be available for approximately 600,000 home retrofits annually. This level of activity and financing is consistent with the experience of a model loan program run for four years in Massachusetts (DOER 1993). Under the proposed program, homeowners would receive zero interest loans from local banks and utilities. State energy offices would contract with the banks and utilities to pay interest costs. Based on the Massachusetts experience, a typical loan for heating system improvements, insulation, and other weatherization improvements will average approximately $4000. Loan subsidies and administrative costs average about $1000 per loan, and thus total investment levels will be about four times the cost to the government (DOER 1993).

Based on the experience of the Solar Energy and Energy Conservation Bank and other retrofit programs, we assume that these home retrofits have an average simple payback of four years (OTA 1992). Total energy savings from this initiative reach 312 trillion Btus/year after five years and 684 trillion Btus/year after ten years.

5. **Support for State Building Code Adoption and Implementation**

All states have some form of energy efficiency requirements for new buildings, typically in state building codes. Approximately 30 states have mandatory statewide requirements while the other 20 leave the decision on code adoption to local jurisdictions (NCSBCS 1991). While some state energy codes are based on recent standards developed by the Council of American Building Officials (CABO), the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) and other organizations, the majority of state codes have not been updated since the 1970s or early 1980s (ASE 1991).

Substantial energy can be saved if states adopt up-to-date codes. For example, use of the most recent major upgrade to the residential sections of the CABO Model Energy Code (CABO 1989) will result in energy savings of 15-20 percent (depending on climate) relative to earlier versions (ASE 1991). Similarly, use of the most recent ASHRAE standard for commercial buildings (ASHRAE 1989) will result in energy savings of approximately 15 percent relative to earlier versions (PNL 1987). New standards now under development will result in additional savings of approximately 20 percent for residential buildings (PNL 1992) and 30 percent or more for commercial buildings (ASHRAE 1992).

Furthermore, code adoption is only half the equation. If codes are not enforced, energy savings can be reduced dramatically. Analysis of code compliance in California estimated that immediately following adoption of a new code in 1988, only 50 percent of the energy savings embodied in the code were being captured. After extensive training and enforcement were undertaken, an estimated 75 percent of the available energy savings were being captured (Johnson 1992).

We propose that $25 million per year be provided to states to fund state-level code adoption, training, and enforcement efforts. This level of funding is proportionally scaled to California's current level of energy code expenditures ($3.2 million). When this initiative is fully implemented, we assume it reduces energy use in new buildings by 15 percent on average. This assumption is derived from a combination of improved codes in some states and better code implementation in most states. Due to the time needed to ramp-up this program, we assume these level of savings are achieved in the fifth year of the program. Savings estimates are based on construction and energy use intensity estimates derived from recent DOE reports (EIA 1993b). The total energy savings from this initiative reach 189 trillion Btus/yr after five years and 504 trillion Btus/yr after ten years.

6. EPA Green Programs

The Global Change Division of the U.S. EPA is sponsoring a set of "Green Programs" devoted to saving energy and thereby preventing pollution. These are voluntary programs such as Green Lights, Energy Star Computers, and the Golden Carrot Super-Efficient Refrigerator Program. The initial results for these programs are very encouraging. For example, over 700 organizations joined the Green Lights program by the end of 1992; Intel has agreed to incorporate energy-savings features into its microprocessors in response to the Energy Star Computer program; and 25 utilities have pooled $30 million in incentives to accelerate the commercialization of super-efficient, non-CFC refrigerators (EPA 1992).

This initiative involves expanding the EPA Green Programs and greatly increasing their overall funding. Total federal funding for the programs would be increased to $150 million per year, over ten times their budget in recent years. New funding would be used to increase promotion within current programs, extend the Green Lights concept to other major energy end uses in buildings, extend the Energy Star concept to other types of equipment such as printers, air conditioners, or cooking equipment, and extend the Golden Carrot concept to other products such as heat pumps, clothes washers, or clothes dryers.

Based on information provided by EPA, we estimate that every dollar of Federal expenditure on Green Programs will lead to about $34 of total investment in energy efficiency measures during the next ten years. We further estimate primary energy savings of 57 billion Btus/yr on average per million dollars invested. By rapidly scaling up the Green Programs and extending them to a wide range of end uses and technologies in the residential, commercial, and industrial sectors, primary energy savings could reach 1,930 trillion Btus/yr by 1998 and 3,590 trillion Btus/yr by 2003.

7. RD&D on Improved Equipment Efficiency

The U.S. Department of Energy presently spends about $40 million annual on research, development, and demonstrations (RD&D) of new energy saving technologies for buildings. This research is primarily carried out by national laboratories and tends to be long-term in nature. Over the past 15 years this program has accelerated the commercialization of many products including electronic ballasts, low-emissivity window coatings, improved compressors for refrigeration equipment, and heat pump water heaters (Geller et al. 1987).

However, in addition to the long-term work presently supported by DOE, there is a need to conduct shorter-term RD&D work in conjunction with manufacturers (ACEEE/ASE 1992). Many energy-saving technologies have been partially developed by manufacturers, but work to complete their development is proceeding slowly due to cutbacks in private sector R&D budgets and/or manufacturer concerns that consumers will not be interested in energy-efficient equipment. Among the promising products whose commercialization could be accelerated by DOE co-funding are incandescent lamps that are 25-50% more efficient than today's products, microwave and heat pump clothes dryers, new "electronic" motors that operate at high efficiency even under part-load conditions, and high efficiency commercial air conditioning equipment (Nadel et al. 1993).

We propose that $50 million in Federal funds be added to building energy efficiency RD&D programs each year, with the private sector required to match these funds dollar for dollar. Based on the results of three of DOE's most successful R&D efforts in the 1975-1985 period, we estimate that benefits in the tenth year of this initiative will be five times greater than the cumulative RD&D expenditures through that year (Brown, Berry and

Goel 1989). Savings are assumed to begin in the fourth year of the initiative, with linear increases thereafter. Total investments by consumers in energy-efficient equipment are estimated assuming a three year simple payback. Under these assumptions, savings reach nearly 200 trillion Btus/yr after five years and about 650 trillion Btus/yr after ten years.

8. **Industrial Energy Efficiency Initiatives**

There are many opportunities for energy efficiency improvements in the industrial sector. One study sponsored by DOE shows that industrial energy intensity could be reduced by 24% through investments in cost-effective efficiency measures (Carlsmith et al. 1990). A variety of obstacles hamper industrial energy efficiency efforts, however. Outside of a few industries, energy is a small cost of production and plant managers are more concerned about capacity, output, and product quality. In many industries, energy conservation projects must offer a payback of two years or less in order to be implemented (Geller et al. 1991). And some industries lack capital or technical know-how.

In order to accelerate industrial energy efficiency improvements and enhance the competitiveness of American industry, we are proposing a combination of technical assistance efforts, loan guarantees and interest rate buydowns, and grants for demonstration of innovative industrial process improvements or equipment. The total Federal cost for these activities is estimated to be $500 million per year when the programs are fully phased-in four years. Two activities build on successful but small-scale projects already occurring at DOE, the Energy Analysis and Diagnostic Centers (EADC) program and the National Industrial Competitiveness through Efficiency: Energy, Environment, Economics (NICE3) program. These programs would be greatly expanded and a new energy productivity fund would be established. The fund would be used to reduce the effective interest rate on private capital borrowed by industries for projects that reduce energy intensity, prevent pollution, and enhance competitiveness. Industries could also use the fund for collateral to secure private loans where necessary.

Considering the experience with the EADC program as well as the fact that the fund can leverage substantial private capital if it is carefully designed, we assume that each federal dollar in this area will leverage six dollars of total investment. Also, based on broad experience with industrial energy efficiency improvements, we assume a 2.5 year payback on average (Alliance to Save Energy 1983; Ross 1987). This implies 100 billion Btus of primary energy savings per million dollars of investment. The overall energy savings from this initiative reach 840 trillion Btus/yr by 1998 and 2,340 trillion Btus/yr by 2003.

9. Investment Assistance for Vehicle Manufacturers

The fuel economy of new cars and light trucks (known as light vehicles) peaked at 25.9 miles per gallon (mpg) in 1988 and has recently hovered around 25.0 mpg. The large increases in fuel economy that occurred through 1988 were due mainly to the original CAFE standards, along with the oil price shocks, shortages, and expectations of much higher prices (Greene 1990). Short of another oil crisis, significant increases in fuel economy will only occur if there are new federal policies specifically directed at new vehicle efficiency improvement, such as stronger CAFE standards plus a program of fees and rebates or an expanded gas guzzler tax.

Increased fuel economy can offset the consumer impacts of a higher fuel tax. However, substantial investments are needed to develop new vehicles and retool for production. Although automakers continually upgrade their products in order to remain competitive, there is nevertheless a rationale for earmarking a portion of the new tax revenues for automotive industry investment assistance tied to mandated fuel economy improvements. Assisting with capital investments for production of more efficient vehicles in the United States also would enhance the competitiveness of our auto industry.

We propose a $2 billion annual investment assistance program during a ten year period, in conjunction with steady increases in automobile and light truck fuel economy such that a 40 percent overall improvement is achieved within ten years. The investment assistance program would allocate grants to automakers for capital expenditures associated with new or retooled facilities needed to build efficient vehicles in the United States. To qualify for a grant, automakers would make proposals showing product plans for vehicles that will exceed the CAFE standards in their model year of release. If automakers do not comply with strengthened CAFE standards, we suggest that they be required to repay their grants to the Federal government (i.e., the grants could be converted to loans). Other details of such a program, including where it is administered, terms of grant applications, restrictions, and other issues, will have to be worked out.

We project that the Federal grants would leverage substantial private investments in energy efficiency measures in order for vehicle producers to improve average fuel economy by 40 percent within ten years. According to our estimates, total investments in energy efficiency measures would reach $5.6 billion by 1998 and $11 billion by 2003.

Increasing the average fuel economy of new light vehicles approximately four percent per year over 10 years will yield primary energy savings of 0.8 Quads by 1998 and 2.6 Quads by 2003. Because it takes several years for more efficient vehicles to penetrate the on-road vehicle stock, the savings are small at first, but grow rapidly by the end of the decade and beyond.

10. Level Tax Benefits for Commuters

Currently, the Federal government encourages driving alone by allowing employers to provide their workers with free parking as a non-taxable benefit. The parking benefit is tax-exempt up to $155 per month, while employer reimbursement for mass transit use is only tax-exempt up to $60 per month. No tax-exempt benefit is available to cover other commuting costs incurred by workers who walk, bike, or rideshare (such as shared vehicle costs, other than workplace parking, in a carpool). The parking subsidy is most probably regressive and unfair to people who live in cities or small towns but do not drive to work.

We propose leveling the playing field between automobiles and other commuting modes by raising the tax-free benefit limit for mass transit use to $155 per month and by requiring that employers who offer a parking subsidy also offer a similar benefit to their employees who do not drive to work. This would establish a broad, tax-exempt commuter allowance, based on the local market value of workplace parking, up to the current parking benefit limit.

Currently, 91.2% of commuters go to work by private motor vehicle (Hu and Young 1992). About 90% of these receive free parking at a national average cost of $30 per month, amounting to an aggregate subsidy of $30 billion per year (Shoup 1992). Assuming that 33% of the remaining 8.8% of workers are given a comparable general commuting subsidy implies an annual cost of $1 billion. A 20% business tax credit would provide an inducement for employers who might prefer to increase their employee commuting benefits (instead of reducing parking benefits so as to hold their expenses constant). This would cost the U.S. Treasury about $200 million per year. We assume that the Federal cost begins at this level and increases slightly over time due to population growth (Spencer 1989).

Energy savings would come from employees now driving who switch modes or rideshare in order to "cash-out" the commuter benefit. We estimate energy savings of 0.14 Quads/yr and fuel cost savings of $1.5 billion/yr by 1998, with slightly greater savings thereafter. In making these estimates, we assume that the tax modification stimulates five percent of commuters to stop driving alone to work by 1998.

D. Overall Energy and Economic Savings

In performing our savings analysis, we considered: 1) the stream of federal investments in the ten programs during 1994-2003, 2) the stream of total investment in energy efficiency measures during this period resulting from the federal initiatives, 3) the expected primary energy savings during 1994-2003 resulting from the ten initiatives, and 4) the overall energy bill savings during 1994-2003 as a consequence of the energy efficiency actions. We have not estimated energy and economic savings beyond the ten-year period even though large savings will continue to occur beyond 2003. Thus, our projections of benefits are conservative. Also, we have attempted not to "double count" energy savings that result from other energy efficiency efforts (e.g., appliance standards or utility DSM programs).

To estimate total investments in energy efficiency and primary energy savings, each program was evaluated separately. For converting energy savings into energy bill reductions, we used the most recent price projections from the U.S. Department of Energy (EIA 1993a), along with the energy tax proposed by the Clinton Administration. Our energy price assumptions are shown in Table 1. For most of the programs, average sectoral energy prices (constant 1990 dollars per million Btus of primary energy) were used to estimate energy bill savings. For the two transportation-related programs, gasoline prices were used since the initiatives pertain to light vehicles.

As mentioned previously, proposed Federal expenditures for the ten programs total $3.3 billion in 1995, rising to $4.5 billion by 1997 and thereafter (Table 2). Assuming a new energy tax produces about $33 billion per year of gross revenue when fully phased in, our proposed set of initiatives absorbs about 13 percent of the revenue. The grants for vehicle manufacturers represent about half the proposed funding package.

We estimate that the initiatives would result in about $8 billion/yr of total investment in energy efficiency measures in 1994, rising to around $22 billion/yr of investment by 1996 and thereafter (Table 3). The cumulative investment from 1994 through 2003 would be over $200 billion. The EPA Green programs and the investment assistance for vehicle manufacturers proposals each provide about one-third of the total energy efficiency investment, while the home weatherization loan program and industrial energy efficiency proposals each provide about 11 percent of the total.

For the set of initiatives as a whole, we estimate about $4.60 of total investment in energy efficiency for each Federal dollar. The programs that result in the greatest leveraging of private funds are the EPA Green programs, support for state building code activities, and RD&D on improved equipment efficiency.

We project that these initiatives would save about 2.0 Quads of primary energy by 1996, 4.8 Quads by 1998, and 11.2 Quads by

2003 (Table 4). Achieving savings of this magnitude would reduce national energy consumption by five percent in 1998 and by eleven percent in 2003, relative to current DOE projections (EIA 1993a). The EPA Green Programs, investment assistance for vehicle manufacturers, and industrial energy efficiency initiatives provide the most energy savings.

The projected energy savings from the energy efficiency initiatives far exceeds the energy savings that would result from consumers directly responding to a modest energy tax. For example, assuming a 1.2 percent reduction in energy consumption for each five percent increase in average energy as discussed above, the direct energy savings in 2003 would be about 1.7 Quads -- less than one-sixth the projected savings from the ten efficiency initiatives.

The projected energy bill savings build up over time, reaching about $14 billion in 1996, $33 billion in 1998, and $83 billion in 2003 (Table 5). The EPA Green programs and investment assistance for vehicle manufacturers provide about two-thirds of the total projected bill savings. All of the programs except low-income weatherization provide energy bill savings that are greater than the sum of Federal expenditures over the ten-year period. Low-income weatherization, because of its relatively long average payback period, requires additional years of energy savings before the benefits exceed Federal costs.

Assuming the new energy tax increases energy costs by $33 billion per year when fully phased in, the energy bill savings from our proposed energy efficiency programs would offset the tax by the fifth year (1998). Over the ten-year period, the estimated energy bill savings of $394 billion exceed the total tax increase. Thus, the combination of the energy tax and energy efficiency programs results in **lower** consumer energy costs, compared to the scenario where neither action is taken.

Additional economic benefits will result when consumers reinvest their energy bill savings in sectors of the economy that are more labor-intensive than the energy industries. In other words, investing in energy efficiency can be considered a stimulus for long-term economic growth and employment as well as an improvement of economic efficiency (Geller, DeCicco, and Laitner 1992). Our preliminary analysis of these issues indicates that our proposed recycling package could lead to a net increase in employment of around 500,000 jobs by 2003. We intend to examine employment effects in detail in a follow-up analysis.

The energy savings will, of course, also reduce the tax revenues collected. Cutting energy use in 2003 by eleven percent cuts energy tax revenues an equivalent amount. The net effect on the federal budget will be much different, however, because federal agencies realize some of the energy savings. For example, all of the $1.4 billion savings in 2003 in federal buildings, plus a portion of the $2.3 billion savings in public housing, will represent cuts in federal spending. Also, the economic growth and increases in net business income will enhance general tax revenues. Although we have not attempted to model these second-order effects, it is clear that the net benefits of energy efficiency investments will be strongly positive for the country as a whole.

E. Conclusion

The goals of deficit reduction, consumer protection, economic stimulus, and environmental improvement are not mutually exclusive. By recycling about 15 percent of new energy tax revenues into energy efficiency programs, total national energy expenditures during the next decade could actually decline at the same time that the Federal budget deficit is reduced. Using energy more efficiently also would reduce our trade deficit, enhance energy security, and cut emissions of carbon dioxide and other pollutants associated with energy use. In addition, certain energy efficiency programs, such as weatherization of low-income and public housing, directly address the regressivity of energy taxes.

The modest, broad-based energy tax proposed by the Clinton Administration might reduce energy use by about 1.7 percent as a result of consumers changing their behavior in response to the tax. A much greater reduction in energy use and consequently pollutant emissions will occur if a portion of the tax is dedicated to a broad and comprehensive set of energy efficiency programs.

We recommend using tax revenue to expand or initiate ten different energy efficiency initiatives, including home weatherization, support for state building code adoption and implementation, EPA Green programs, investment assistance for auto manufacturers, and technical and financial assistance to increase energy efficiency and improve competitiveness throughout U.S. industries. Wide-ranging and well-funded initiatives are needed in order to realize the savings described above.

In summary, the Clinton Administration and the Congress have the opportunity to combine the bitter pill of energy taxes with the sweet syrup of energy efficiency. Taking advantage of this opportunity would benefit consumers, businesses, the Federal government, and the environment.

References

ACEEE/ASE 1992, **Achieving Greater Energy Efficiency in Buildings: The Role of DOE's Office of Building Technologies**, American Council for an Energy-Efficient Economy and the Alliance To Save Energy, Washington, DC.

ASE 1983, **Industrial Investment in Energy Efficiency: Opportunities, Management Practices, and Tax Incentives**, Alliance To Save Energy, Washington, DC.

ASE 1991, **Better Building Codes for Energy Efficiency**, Alliance to Save Energy, Washington, DC.

ASHRAE 1989, "ASHRAE Standard 90.1 National Energy Model," American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., Atlanta, GA.

ASHRAE 1992, memo to criteria development panel re: ASHRAE Standard 90.1 National Energy Model - Version 2.0, November 12, 1992, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA.

Bohi, D.R. 1981, **Analyzing Demand Behavior: A Study of Energy Elasticities**, Resources for the Future, Johns Hopkins University Press.

Brown, M.A., L.G. Berry and R.K. Goel 1989, "Commercializing Government-Sponsored Innovations: Twelve Successful Buildings Case Studies," Oak Ridge National Laboratory, Oak Ridge, TN.

CABO 1989, **Model Energy Code**, Council of American Building Officials, Falls Church, VA.

Carlsmith, R.S., W.U. Chandler, J.E. McMahon, and D.J. Santini 1990, "Energy Efficiency: How Far Can We Go," ORNL/TM-11411, Oak Ridge National Laboratory, Oak Ridge, TN.

CCMC 1992, "A Sustainable Energy Blueprint," Communications Consortium Media Center, Washington, DC.

DOER 1993, personal communication from John Manning regarding HEAT Information, February 4, 1993, Department of Energy Resources, Cambridge, MA.

EIA 1992a, **State Energy Price and Expenditure Report, 1990**, DOE/EIA-0376(90), U.S. Department of Energy, Energy Information Administration, Washington, DC.

EIA 1992b, **State Energy Data Report, 1960-1990**, DOE/EIA-0214(90), U.S. Department of Energy, Energy Information Administration, Washington, DC.

EIA 1993a, **Annual Energy Outlook 1993**, DOE/EIA-0383(93), Energy Information Administration, U.S. Department of Energy, Washington, DC.

EIA 1993b, **Assumptions for the Annual Energy Outlook 1993**, DOE/EIA-0527(93), Energy Information Administration, U.S. Department of Energy, Washington, DC.

EPA 1992, "Office of Atmospheric Programs -- 1992 Accomplishments and Prospects for 1993," Vol. 1: Global Change Division, EPA 430-K-92-031, U.S. Environmental Protection Agency, Washington, DC.

Gately, D. and P. Rappaport 1988, "The Adjustment of U.S. Oil Demand to the Price Increases of the 1970s," **The Energy Journal 9**(2).

Geller, H. et al. 1987, "The Role of Federal Research and Development in Advancing Energy Efficiency: A $50 Billion Contribution to the U.S. Economy," **Annual Review of Energy 1987**, Annual Reviews, Inc., Palo Alto, CA.

Geller, H.S., E. Hirst, E. Mills, A.H. Rosenfeld, and M. Ross, 1991, "Getting America Back on the Energy-Efficiency Track: No-Regrets Policies for Slowing Climate Change," American Council for an Energy-Efficient Economy, Washington, DC.

Geller, H., J. DeCicco and S. Laitner 1992, "Energy Efficiency and Job Creation: The Employment and Income Benefits from Investing in Energy Conserving Technologies," American Council for an Energy-Efficient Economy, Washington, DC.

Greely, K., E. Mills, C. Goldman, R. Ritschard, and M. Jackson 1987, "Baseline Analysis of Measured Energy Consumption in Public Housing," LBL-22854, Lawrence Berkeley Laboratory, Berkeley, CA.

Greene, D.L. 1990, "CAFE or Price? An analysis of the effects of federal fuel economy regulations and gasoline price on new car MPG, 1978-1989," **The Energy Journal 11**(3).

Hopkins, M. 1991, "Energy Use in Federal Facilities: Squandering Taxpayer Dollars and Needlessly Polluting the Environment," Alliance to Save Energy, Washington, DC.

Hu, P.S., and J. Young 1992, "1990 National Personal Transportation Survey (NPTS), Summary of Travel Trends," Report FHWA-PL-92-027, Federal Highway Administration, Washington, DC.

HUD 1988, "Study of the Modernization Needs of the Public and Indian Housing Stock," HUD-1130-PDR, U.S. Department of Housing and Urban Development, Washington, DC.

Johnson, Jeffrey A. 1992, "Changing the Efficiency in New Buildings: California's Perspective," **Proceedings ACEEE 1992 Summer Study on Energy Efficiency in Buildings**, Vol. 6, American Council for an Energy-Efficient Economy, Washington, DC.

Laitner, S. 1993, Personal communication concerning unpublished analysis conducted for ACEEE, March 8, 1993, Economic Research Associates, Eugene, OR.

Nadel, S. D. Bourne, M. Shepard, L. Rainer, and L. Smith 1993, "Emerging Technologies to Improve Energy Efficiency in the Residential and Commercial Sectors," American Council for an Energy-Efficient Economy, Washington, DC.

NCSBCS 1991, **Energy Directory: 1991 Edition**, National Conference of States on Building Codes & Standards, Herndon, VA.

OTA 1991, **Energy Efficiency in the Federal Government: Government by Good Example?**, OTA-E-492, Office of Technology Assessment, U.S. Congress, Washington, DC.

OTA 1992, **Building Energy Efficiency**, OTA-E-518, Office of Technology Assessment, U.S. Congress, Washington, DC.

PNL 1987, tables & graphs on ASHRAE Standard 90.1 savings, Pacific Northwest Laboratory, Richland, WA.

PNL 1992, "Proposed Revision of the Model Energy Code Thermal Envelope Requirements - Review Draft," Pacific Northwest Laboratory, Richland, WA.

Ritschard, R. and A. MacAllister 1992, "Persistence of Savings in Multifamily Public Housing," **Proceedings of the ACEEE 1992 Summer Study on Energy Efficiency in Buildings**, Vol.4, American Council for an Energy-Efficient Economy, Washington, DC.

Ross, M. 1987, "Industrial Energy Conservation and the Steel Industry in the United States," **Energy 12** (10/11), pp. 1135-1152.

Schlegel, J., J. McBride, S. Thomas, and P. Berkowitz 1991, "Low-Income Weatherization: Past, Present, and Future," in E. Vine and D. Crawley, eds., **State of the Art of Energy Efficiency: Future Directions**, American Council for an Energy-Efficient Economy, Washington, DC.

Shoup, D.C. 1992, "Cashing Out Employer-Paid Parking," Office of Technical Assistance and Safety, Federal Transit Administration, U.S. Department of Transportation, Washington, DC.

Spencer, G. 1989, "Projections of the population of the United States, by age, sex, and race: 1988 to 2080," Current Population Reports, Series P-25, No. 1018, Bureau of Census, Washington, DC.

Stern, P.C. and E. Aronson 1984, **Energy Use: The Human Dimension**, W.H. Freeman, New York, NY.

Vine, E. and I. Reyes 1987, "Residential Energy Consumption and Expenditure Patterns of Low-Income Households in the United States," Lawrence Berkeley Laboratory, Berkeley, CA.

TABLE 1

Energy Price Assumptions

Sector	Average energy price, constant 1990$ per Million Btu										Average Rate of Escalation
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	%/yr
Residential	7.20	7.34	7.48	7.60	7.67	7.74	7.82	7.90	7.97	8.05	1.0
Commercial	6.26	6.36	6.47	6.54	6.58	6.62	6.65	6.69	6.73	6.77	0.6
Industrial	3.61	3.75	3.89	3.99	4.05	4.10	4.15	4.21	4.26	4.32	1.4
Transportation (gasoline only)	9.59	9.89	10.18	10.38	10.48	10.57	10.67	10.77	10.88	10.98	1.0
	Energy tax levels (1990$ per MBtu)										
Residential	0.04	0.11	0.18	0.22	0.22	0.22	0.22	0.22	0.22	0.22	
Commercial	0.04	0.11	0.18	0.21	0.21	0.21	0.21	0.21	0.21	0.21	
Industrial	0.05	0.14	0.23	0.28	0.28	0.28	0.28	0.28	0.28	0.28	
Transportation (gasoline only)	0.10	0.30	0.50	0.60	0.60	0.60	0.60	0.60	0.60	0.60	

Note: Average energy prices include existing state and federal taxes plus the energy taxes levels shown above.

TABLE 2

Proposed Federal Expenditures for Energy Efficiency Programs

	Annual Expenditures, Million 1990$										Cumulative	
Program	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	5 yrs	10 yrs
1 Low-income weatherization	250	500	500	500	500	500	500	500	500	500	2,250	4,750
2 Public housing retrofits	200	400	400	400	400	400	400	400	400	400	1,800	3,800
3 Retrofits of Federal buildings	300	300	300	300	300	300	300	300	300	300	1,500	3,000
4 EPA Green Programs	150	150	150	150	150	150	150	150	150	150	750	1,500
5 State building code adoption & implementation	25	25	25	25	25	25	25	25	25	25	125	250
6 RD&D on improved equipment efficiency	50	50	50	50	50	50	50	50	50	50	250	500
7 State loan programs for home weatherization	133	267	400	400	400	400	400	400	400	400	1,600	3,600
8 Industrial sector efficiency	50	100	250	500	500	500	500	500	500	500	1,400	3,900
9 Stronger CAFE with manufacturer grants	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	10,000	20,000
10 Level playing field for commuter subsidies	200	202	204	206	208	210	212	214	216	218	1,019	2,087
TOTAL	3,358	3,994	4,279	4,531	4,533	4,535	4,537	4,539	4,541	4,543	20,694	43,387

TABLE 3

Projected Total Expenditures for Energy Efficiency Programs

Program	Total Annual Expenditures (Public and Private), Million 1990$										Cumulative	
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	5 yrs	10 yrs
1 Low-income weatherization	312	625	625	625	625	625	625	625	625	625	2,812	5,937
2 Public housing retrofits	250	500	500	500	500	500	500	500	500	500	2,250	4,750
3 Retrofits of Federal buildings	420	420	420	420	420	420	420	420	420	420	2,100	4,200
4 EPA Green Programs	2,370	6,270	9,830	10,890	7,890	6,420	5,440	4,930	4,390	3,830	37,250	62,260
5 State building code adoption & implementation	250	250	250	250	250	250	250	250	250	250	1,250	2,500
6 RD&D on improved equipment efficiency	0	0	0	238	476	714	952	1,190	1,429	1,667	714	6,667
7 State loan programs for home weatherization	800	1,600	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	9,600	21,600
8 Industrial sector efficiency	300	600	1,500	3,000	3,000	3,000	3,000	3,000	3,000	3,000	8,400	23,400
9 Stronger CAFE with manufacturer grants	2,900	3,800	4,700	5,600	6,500	7,400	8,300	9,200	10,100	11,000	23,500	69,500
10 Level playing field for commuter subsidies	200	202	204	206	208	210	212	214	216	218	1,019	2,087
TOTAL	7,802	14,267	20,429	24,129	22,269	21,939	22,099	22,729	23,329	23,909	88,896	202,901

TABLE 4

Projected Primary Energy Savings from Energy Efficiency Programs

Program	Annual Energy Savings, Quads (10^{15} Btu/year) 1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Cumulative 5 yrs	10 yrs
1 Low-income weatherization	0.008	0.023	0.039	0.055	0.070	0.086	0.102	0.117	0.133	0.148	0.195	0.781
2 Public housing retrofits	0.014	0.044	0.072	0.102	0.130	0.160	0.188	0.218	0.246	0.276	0.362	1.450
3 Retrofits of Federal buildings	0.021	0.042	0.063	0.084	0.105	0.126	0.147	0.168	0.189	0.210	0.315	1.155
4 EPA Green Programs	0.170	0.480	0.960	1.500	1.930	2.300	2.650	3.010	3.320	3.590	5.040	19.910
5 State building code adoption & implementation	0.013	0.038	0.076	0.126	0.189	0.252	0.315	0.378	0.441	0.504	0.442	2.332
6 RD&D on improved equipment efficiency	0.000	0.000	0.000	0.100	0.199	0.296	0.392	0.486	0.578	0.669	0.299	2.720
7 State loan programs for home weatherization	0.028	0.082	0.162	0.241	0.320	0.397	0.474	0.550	0.625	0.700	0.834	3.579
8 Industrial sector efficiency	0.030	0.090	0.240	0.540	0.840	1.140	1.440	1.740	2.040	2.340	1.740	10.440
9 Stronger CAFE with manufacturer grants	0.060	0.180	0.340	0.560	0.840	1.140	1.480	1.860	2.240	2.640	1.980	11.340
10 Level playing field for commuter subsidies	0.028	0.056	0.084	0.112	0.140	0.141	0.143	0.144	0.145	0.147	0.420	1.140
TOTAL	0.372	1.035	2.036	3.421	4.763	6.039	7.330	8.670	9.958	11.223	11.627	54.847

TABLE 5

Projected Energy Bill Reductions from Energy Efficiency Programs

Program	Nationwide Savings in Annual Energy Bills, Million 1990$										Cumulative	
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	5 yrs	10 yrs
1 Low-income weatherization	58	169	292	418	537	666	798	924	1,060	1,191	1,473	6,112
2 Public housing retrofits	101	323	539	775	997	1,239	1,470	1,721	1,961	2,222	2,735	11,348
3 Retrofits of Federal buildings	131	267	408	549	691	834	978	1,124	1,272	1,422	2,046	7,677
4 EPA Green Programs	994	2,867	5,854	9,277	12,034	14,458	16,795	19,232	21,387	23,316	31,026	126,214
5 State building code adoption & implementation	88	262	534	897	1,357	1,824	2,298	2,780	3,270	3,767	3,138	17,077
6 RD&D on improved equipment efficiency	0	0	0	714	1,429	2,143	2,857	3,571	4,286	5,000	2,143	20,000
7 State loan programs for home weatherization	200	604	1,216	1,834	2,452	3,076	3,706	4,342	4,984	5,632	6,306	28,045
8 Industrial sector efficiency	108	338	934	2,157	3,399	4,673	5,980	7,320	8,694	10,103	6,937	43,707
9 Stronger CAFE with manufacturer grants	575	1,779	3,462	5,812	8,800	12,055	15,798	20,041	24,364	28,986	20,427	121,671
10 Level playing field for commuter subsidies	269	554	855	1,162	1,467	1,494	1,523	1,551	1,581	1,611	4,306	12,066
TOTAL	2,525	7,163	14,093	23,596	33,161	42,461	52,201	62,607	72,858	83,250	80,538	393,916