Energy Savings and Job Impacts From the Proposed Energy Tax

Skip Laitner

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Executive Summary

A debate is underway concerning the impact a broad-based energy tax would have on energy use, the economy, and the environment. The Clinton Administration and proponents of the energy tax claim that the tax as proposed will stimulate energy efficiency, encourage use of cleaner energy sources, and help the economy by reducing the Federal deficit. Opponents claim that higher energy prices will harm the economy, reduce U.S. competitiveness, and lead to significant job loss.

Based on a study we recently completed on the Clinton proposal, the energy tax will prompt businesses and consumers to purchase less gasoline, electricity, natural gas, and other fuels. Overall energy consumption is expected to decline by about 1.5 to 2.0 percent over baseline levels. The money saved on reduced energy purchases will, in effect, become a source of new discretionary income. The new income will, in turn, enable businesses to expand their output of goods and services, and provide households the opportunity to purchase more food, clothing, housing, and other consumer goods. Moreover, these new purchases would be made for consumer goods and services that are more labor-intensive compared to conventional energy purchases.

By fully accounting for the energy savings and other relevant economic factors, we find that the energy tax, by itself, will lead to a net increase of about 40,000 jobs nationwide. More importantly, consumers and businesses could realize much greater benefits if energy efficiency efforts are expanded at the same time that the tax is phased in. Under a proposal by ACE^3 the energy programs would include expanded energy retrofits in buildings and manufacturing facilities, technical assistance to homes and businesses, and energy efficiency standards. Indeed, a recycling of the energy tax dollars into such efforts would stimulate a level of energy savings that more than offset the proposed cost of the energy tax. The analysis suggests that such an expansion of energy efficiency programs along with enacting the tax will create a net increase of over 500,000 jobs for the American economy.

The negative impacts claimed by industry analysts are the result of measuring the wrong pattern of expenditures triggered by the proposed energy tax. In short, the industry claims are based on flawed and incomplete assumptions. They ignore, for example, the respending of the energy bill savings made possible by the efficiency improvements that the tax will induce. They also ignore the relative labor intensities of different sectors of the economy. Finally, the industry analysis appears to ignore or minimize the employment benefits of the tax revenue itself.

I. Introduction

The Clinton Administration proposed a modest, broad-based Federal energy tax as part of its deficit reduction strategy. When fully phased in, the proposed tax would increase energy prices about 7.5 cents per gallon of gasoline, 26 cents per thousand cubic feet of natural gas, and 0.3 cents per kilowatt-hour (kWh) of electricity on average. The House of Representatives approved a broad-based energy tax that is similar to the original Administration proposal. The Senate approved a smaller tax of 4.3 cents per gallon on gasoline, diesel fuel, and marine fuel. Budget conferees will attempt to develop some combination or variation of these energy tax options as they hammer out a final deficit reduction package.

The original energy tax proposal would raise on the order of $33 billion per year on a gross basis when it is fully phased in, without accounting for indirect reductions in other tax payments. Based on current energy prices, the tax would increase the average retail energy price by about seven percent. Given that the tax would be phased in three steps between 1994 and 1996, the impact on energy prices at each step would be relatively modest.

A debate is underway concerning the impacts a broad-based energy tax would have on energy use, the economy, and the environment. The Administration and proponents of the energy tax claim that the tax as proposed will stimulate energy conservation, encourage use of cleaner energy sources, and help the economy by reducing the Federal deficit. Opponents claim that higher energy prices will harm the economy, reduce U.S. competitiveness, and lead to significant job loss.

As currently designed, the ability of the energy tax to promote a higher level of energy efficiency rests on two things: (1) the consumer response to modestly higher energy prices; and (2) the change in patterns of spending to more labor-intensive activities. If adoption of the energy tax is accompanied by new or expanded initiatives to increase the nation's overall level of energy efficiency, the positive impacts on jobs and national income could be much greater.

To understand these prospects, this paper first explores the concept of price elasticity and its influence on energy demand. It then estimates the impacts that the Clinton Administration's broad-based energy tax would have on energy demand, employment and income. Building on this analysis, the paper then evaluates how a program to recycle tax revenues into energy efficiency investments can lower overall energy costs and create new employment opportunities.

II. The Concept of Elasticity

Elasticities state a relationship between the amount of a commodity demanded and the variables which shape that demand either in the short-run or the long-run. Generally, the two biggest variables which affect consumption are income and price.[1] In that regard, there are three specific elasticities or relationships which must be considered as part of an overall understanding of energy consumption patterns. They are referred to as price elasticities, cross elasticities, and income elasticities.

Price elasticity refers to the effect of a commodity's own price on its demand. For that reason, it is sometimes referred to as the *own price elasticity*. This is defined as the percentage change in the use of a given commodity when the price of that same quantity changes by one percent.[2]

Price elasticity usually has a negative value to show that as the price increases, demand decreases; or as the price decreases, the demand increases. If a commodity has an elasticity that is greater (in absolute value) than 1.0 — meaning that if the change in demand is greater than one percent for a one percent change in price — then it is said to have an elastic demand. If it has an elasticity of less than one, it is said to have an inelastic demand. If a one percent change in price induces a one percent change in demand, the demand is said to be unitary elastic. Finally, an elasticity of zero implies a perfectly inelastic demand; that is, a change in price has no impact on consumption.

Cross elasticity measures the effect of the price of one commodity on another commodity's demand. More formally, cross elasticity is defined as the percentage change in the quantity of one commodity such as electricity when the price of a second commodity such as natural gas changes by one percent. In a sense, the existence of a strong negative cross elasticity implies the availability of an alternative or substitutes.[3] A low negative cross elasticity, on the other hand, implies the lack of substitutes and (quite likely) a low price elasticity. Finally, *income elasticity* refers to the impact of income changes upon a specific commodity; or, the percentage change in the quantity demanded when income changes by one percent.

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1. The formal statement of the relationship between quantity and a variable is expressed mathematically as $q=f(v)$, where "q" is the amount of a commodity that will be demanded or consumed for each value of a particular variable. In economics, this is nothing more than the demand law where "q" is said to be a function of "v". The variable may be either the price of a commodity or the income of the consumer who wishes to buy the commodity.

2. If we were to evaluate the own price elasticity of electricity as the commodity in question, the mathematical expression might look like:

$$Ep = [(kWh_2 - kWh_1)/kWh_1]/[(P_2 - P_1)/P_1]$$

or, price elasticity equals the kilowatt-hour (kWh) sales in year two less the kWh sales in year one with the resulting total divided by the year one sales; and with this result, in turn, divided by the year two price less the year one price as this total is finally divided by the year one price.

3. A positive cross elasticity usually implies a complement rather than a substitute. For example, if the price of gasoline goes down, and the demand increases for both gasoline and vacations, the demand for vacations is said to be a complement for gasoline.

To illustrate each of these three elasticities, let us begin by examining price elasticity. Let us suppose that households are now consuming about 10,000 kilowatt-hours (kWh) of electricity per year on average. Let us further suppose they pay an average of 10 cents per kWh, and that the nation has an average income of about $10,000. To determine the price elasticity for electricity, let us next suppose that kWh prices increase to 12 cents per kWh and that consumption falls to 9,000 kWh. The change in price is 20 percent, while consumption falls by 10 percent. Under these circumstances, the price elasticity of electricity would then be -0.10 divided by 0.20, or -0.5. Stated differently, for each percentage change in kWh price, the demand will fall by 0.5 percent.

Cross elasticity provides another perspective on changes in demand. If we noted that a 10 percent rise in natural gas prices led to a decrease in natural gas use but a two percent increase in electricity use, we would then conclude that electricity is a substitute for gas. The cross elasticity of electricity with respect to natural gas prices would be 0.02 divided by 0.10, or 0.20. In this case, a one percent change in natural gas prices would increase the demand for electricity by 0.2 percent.

Finally, as might be expected for income elasticity, a positive change in income would likely produce a positive increase in the consumption of energy. Thus, if household income rose by 10 percent and household electricity usage increased by six percent, we would then say that a one percent change in household income would lead to a 0.6 percent change in the demand for electricity.

A. Partial Elasticities

Perhaps the most important feature of elasticities is that they cannot be measured in isolation. For instance, a change in energy prices is unlikely to happen independently from changes in income (or other factors, for that matter). This means that almost all elasticities are only *partial elasticities*. To provide even a minimal review, therefore, of the impact of price on future energy demand, we should also include the influence of income on that demand. As we shall see later in this paper, income has a much stronger impact on changes in energy consumption than do price changes (given the current mix of energy technologies).

Failure to incorporate the influence of both price and income often leads to an inappropriate estimate of future energy demand. Since almost all of the elasticities cited in the literature are only partial elasticities, it is important to include the influence of future income on baseline energy consumption. Moreover, the analyst needs to be careful to reflect price changes from proposed tax increases as increases <u>above</u> the prices that are otherwise expected to occur.

B. Short-Run Versus Long-Run Elasticities

Up to this point the discussion has been limited to largely short-run elasticities. These reflect demand responses over a short period of time, usually over a year or less. As might be expected, short-run elasticities tend to have a smaller absolute value compared to a longer period of time. While short-run estimates of price elasticities range from a low of -0.03 to as much as -0.5, long-run estimates can exceed -1.0. Bohi, for example, concluded that while short-run energy price elasticities generally hovered around -0.20, the long-run values fell between -0.50 and -0.70. He further concluded that estimates for elasticities greater than -1.0 were highly uncertain.[4]

The reason for the difference in short-run and long-run elasticities is that consumers and businesses have more of an opportunity to change energy use patterns over the long-term. Even with a significant price hike in gasoline prices, for example, it is difficult for commuters to change either their driving patterns or to improve the fuel economy of their existing automobiles within a period of a year. Over a much longer period, however, they not only can buy a more fuel-efficient car, but manufacturers might begin to add fuel economy measures to all cars in their fleets. In addition, it may take consumers a number of years to adopt alternatives to driving — whether mass transit, telecommuting or car pooling. All of these conditions tend to increase the consumer response to higher prices over the long term.[5]

Even with the distinction between short-run and long-run elasticities, the overall elasticity concept is a highly simplified model of the world. While energy price and income are certainly major determinants of energy demand, others determinants include population, living standards, the technological opportunities and costs for increasing energy efficiency, the existing efficiency standards and other policies adopted to influence energy demand, and the behavioral and institutional barriers that discourage efficiency improvements. In certain cases, these other factors can play a larger role in shaping energy demand that either price or income. Perhaps the most notable example is the role of fuel economy standards in reducing overall petroleum demand. One researcher concluded that fuel efficiency standards were roughly twice as important of an influence as gasoline prices during 1978-89.[6]

C. Insights From Past Studies

Over the years there has been substantial interest in the notion of elasticities for energy-related commodities. A 1956 study for the state of Washington, for example, suggested that "an increased or decreased consumption of gasoline has coincided with an increase or decrease in incomes in the state, but that the change in gasoline consumption has not

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4. Douglas R. Bohi, *Analyzing Demand Behavior: A Study of Energy Elasticities* (Baltimore, MD: The Johns Hopkins University Press, 1980), Table 7-1, page 159.

5. This assumes, of course, that the price effect is not offset by higher income levels or other determinants of demand.

6. David L. Greene, "CAFE OR PRICE?: An Analysis of the Effects of Federal Fuel Economy Regulations and Gasoline Prices on New Car MPG, 1978-1989," *The Energy Journal*, Volume 11, Number 3, 1990, pages 37-57.

been proportionately as great. It also appears that there has been relatively little response in consumption to a change in the price of gasoline (either by the seller or by the legislator in changing the tax)."[7] More than 40 years later, the 1993 *Annual Energy Outlook* continues to report a similar response to changes in both price and income.[8]

Because there are so many determinants of demand, even the most sophisticated analytical tools produce, at best, a very uncertain estimate of price and income elasticities. Moreover, the estimation techniques are varied and generally produce results that are relevant only for the series of data which produced the results in the first place. As might be expected, therefore, price and income elasticities are specific to a particular demand function and at a given point in time. Nonetheless, the overall relationship between energy demand and price and income elasticities has remained reasonably stable since the estimates were first produced.

The 1956 Washington State study indicated that in the period from 1946 to 1955, the price elasticity for gasoline was -0.08; that is, a one percent change in price would likely produce "an opposite 0.08 percent change in consumption." Based on the same times series data, "an income change of 1 percent would have been associated with a 0.91 percent change in consumption in the same direction."[9] From this we note that the absolute value for income elasticity, 0.91, is much larger than the absolute value for the price elasticity. This implies that changes in income will have a much larger impact on gasoline demand than changes in income. In other words, the demand for gasoline is relatively inelastic with respect to price compared to changes in income.

As an example the stability of price elasticities over time and between nations, a 1983 working paper reviewing own-price elasticities for various OECD countries, including the United States, showed that final (undifferentiated) energy demand ranged from -0.02 to -0.18.[10] A 1979 study published by the Institute for Energy Analysis indicated a modest range of long-run elasticities from -0.23 for coal to -0.50 for electricity. The long-run elasticity for petroleum fuels was estimated as -0.35.[11]

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7. See, Harry E. McAllister, *The Elasticity of Demand for Gasoline in the State of Washington*, Economic and Business Studies Bulletin No. 29 (Pullman, WA: Bureau of Economic and Business Research, State College of Washington, February 1956), page xiii.

8. See especially, Energy Information Administration, *Assumptions for the Annual Energy Outlook 1993* (Washington, DC: U.S. Department of Energy, DOE/EIA-0527(93), January 1993), page 26.

9. Harry E. McAllister, op. cit., page xiii.

10. Axel Mittlestädt, "Use of Demand Elastics in Estimating Energy Demand," working paper No. 1 for the OECD Economics and Statistics Department (Paris, France: Organization of Economic Co-operation and Development, March 1983), Table 2.

11. Edward L. Allen, *Energy and Economic Growth in the United States* (Cambridge, MA: The MIT Press, 1979), page 161. The values cited here are for the 101-quad rather than the 126-quad scenario for the year 2000 since they lower numbers are more reflective of actual projections published by the U.S. Department of Energy.

Finally, the *Annual Energy Outlook 1993* recently updated its own estimates of both price and income elasticities for vehicle miles travelled (VMT) as this factor affects the overall demand for transportation fuels. This re-estimation resulted in a price response of -0.11, while the income response showed a value of 0.82. Again, an important insight from these results is that the impact of changes in income will significantly outweigh similar changes in energy prices.

III. Our Own Price Impact Analysis

To better understand how the proposed energy tax might affect energy use, we performed an analysis of how price changes and income levels might interact to shape future energy demand. The analysis is based on the set of projections from the *Annual Energy Outlook 1993* (AEO) prepared by the U.S. Department of Energy.[12]

The AEO projections are based upon a complete set of economic and demographic relationships. They also incorporate the already anticipated changes in the nation's technology base. The data reflects, for instance, the changes which are likely to occur from the enactment of the Energy Policy Act of 1992. In effect, the AEO reasonably captures the influence of other determinants on total energy demand. This allows us to focus more completely on the impact of proposed energy tax as it affects future prices. The data are also formatted in a way that makes it relatively easy to verify likely responses to changes in overall energy prices.

The year 2010 was selected as the basis of comparison to capture all long-run impacts in the analysis. Based upon the data in the Reference scenario, the Department of Energy (DOE) presently forecasts an increase in energy consumption from 84.6 quadrillion Btus (Quads) of primary energy in 1990 to 106.7 Quads in 2010. This suggests an annual growth rate of 1.2 percent. At the same time, the average price of energy at the end-use is projected to increase one percent annually, from $8.68 per million Btu (MBtu) in 1990 to $10.36 per MBtu in 2010 (all measured in 1991 dollars). Real Gross Domestic Product (GDP) is projected to grow from $4,885 billion in 1990 to $7,287 billion in 2010 (measured in 1987 dollars).[13]

Adapting the AEO reference case data (and built-in assumptions about the nation's present and anticipated future technology mix) provides the following demand function in a logarithm format:[14]

12. *Annual Energy Outlook 1993*, op. cit.

13. See, Tables A2, A3, and A7, *Annual Energy Outlook*, op. cit.

14. The logarithm format is useful since the parameters that are generated, in this case β_1 and β_2, are elasticities for price and income, respectively.

$$\text{Ln(Quads)} = \alpha + \beta_1 * \text{Ln}(\text{PRICE}_t) + \beta_2 * \text{Ln}(\text{GDP}_t)$$

where:

Quads	=	U.S. Energy Consumption in Quadrillion Btus
α	=	Constant Term
β_1	=	Price Elasticity of Demand for Primary Energy
β_2	=	Income Elasticity of Demand for Primary Energy
PRICE	=	Real Price of Primary Energy in 1991 $
GDP	=	Real Gross Domestic Product in 1987 $

Data Period: 1990 to 2010

The model expressed in equation four generated a constant term of -1.06, a long-run price elasticity of -0.33, and a long-run income elasticity of 0.73. The implication of this result is that a 10 percent increase in the weighted price of energy will produce a 3.3 percent decrease in primary energy consumption. Similarly, a 10 percent increase in GDP will result in a 7.3 percent increase in energy demand.[15]

For all of the variables and parameters used to estimate the 1990-2010 energy consumption patterns, it is interesting to note that the complexity and technology assumptions of the AEO model can be distilled to the above equation and results. In other words, equation one suggests that price and income explain more than 99 percent of total energy demand. One caution is appropriate, however. While the results are significant in their current form and with the existing data, the elasticities derived here may not be applicable to other times series data or models that use them.

With the long-run parameters of the price and income which the AEO model established, we can now forecast the year 2010 energy consumption. Recalling that the 2010 price is estimated at $10.36 (1991 dollars per MBtu) and that GDP is projected to be $7,287 (billions of 1987 dollars), the equation above indicates a energy consumption of 107.0 Quads. The question now becomes how the energy tax proposal will affect this result. In effect, we must translate the proposed tax into a year 2010 price hike.

Based upon the energy tax proposal as of April 1993, gasoline will be taxed at the rate of 7.5 cents per gallon, natural gas at 26 cents per 1,000 cubic feet, coal at $5.57 per ton, and hydro and nuclear energy at about $2.66 per 1,000 kWh when the energy tax is fully implemented.[16] It appears that the energy tax will lead to about a seven percent increase in the average cost of energy at least initially. In addition, the proposed energy tax would be indexed to inflation.

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15. All independent variables in the equation are statistically significant in terms of their T-statistic where $\alpha = 2.17$, PRICE = -4.64 and GDP = 20.10. Moreover, total adjusted R-squared is 99.98 percent and the F-Statistic is 1,187.

16. "Administration Alters Proposal for Energy Tax," *The Wall Street Journal*, April 2, 1993, page A2.

We assume the energy tax will raise the average retail energy price in 2010 from $10.36 per MBtu as forecast in the AEO to $11.09 per MBtu. If overall GDP remains unchanged as a result of the modestly higher energy prices,[17] we now have the required two economic drivers to plug into the demand function found in equation one. First we have a positive change in energy prices from $10.36 to $11.09 per MBtu, and second, we have the estimated growth in GDP. Using both variables in the model indicates that the year 2010 consumption will decline from 107.3 to 104.7 Quads. This is a 2.2 percent decline in energy demand as a result of the proposed energy tax. Due to the increase in GDP, the forecasted energy consumption of 104.7 Quads is still 24 percent greater than energy consumption as of 1990.

IV. Economic and Job Impact Analysis

A. Our Own Job Impact Analysis

Cost-effective investments in energy efficiency technologies will improve overall economic efficiency. This, in turn, creates jobs. To test this notion, we established a simplified model to evaluate two different energy tax scenarios: (1) a revenue-raising, energy tax-only scenario that generates new receipts for the federal government; and (2) an energy tax and tax-recycling scenario in which part of the increased revenues are invested in ten energy major efficiency programs. This tax-recycling scenario is more fully described in a paper previously released by the American Council for an Energy-Efficient Economy.[18]

In brief, the ACE^3 tax-recycling proposal offers a specific set of energy efficiency initiatives that are funded using about 12 percent of the proposed energy tax revenues.[19] Table 1 summarizes the ten energy efficiency initiatives, which address energy use and efficiency opportunities in all sectors of the economy. Through the 1994-2003 period, the ACE^3 proposal calls for $43 billion in federal expenditures which would, in turn, leverage another $160 billion in private investments. Cumulative energy and energy bill savings, in that same period, would be 55 quads and $394 billion, respectively. The net savings to consumers and businesses over this 10-year period would be $191 billion. Clearly, the tax-recycling scenario offers a cost-effective investment for the American economy.

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17. See the discussion on how the energy tax is likely to affect future changes in GDP in the section that follows. For a further review on this point, see also, William U. Chandler and Andrew K. Nicholls, "Assessing Carbon Emissions Control Strategies: A Carbon Tax or a Gasoline Tax," a policy paper prepared for the American Council for an Energy Efficient Economy, February 1990, pages 16-21.

18. See Howard Geller, John DeCicco, and Steven Nadel, "Structuring an Energy Tax So That Energy Bills Do Not Increase," (Washington, DC: American Council for an Energy-Efficient Economy, March 1993).

19. Of course, the energy efficiency initiatives could be funded out of the general Treasury using funds shifted from other energy and/or non-programs.

The tax-only and the tax-recycling scenarios were evaluated using an input-output model. This approach utilizes job and income multipliers to estimate total economic impacts that result from spending changes within each sector of the economy. In this case, the task is to account for all changes in consumer, business and government spending that might be brought about as a result of the proposed Btu tax and the energy efficiency programs.

Each spending change — whether a reduction in energy bills or a loss of disposable income as a result of higher taxes — is matched with its appropriate multiplier. The spending change times the multiplier yields a total impact on the economy for that individual expenditure. The sum of all positive and negative impacts then provides a net job and economic impact which might be expected from a given policy initiative. In other words, to evaluate the effects of the proposed energy tax, all benefits and all costs must be added up to determine the net impact on the economy.[20]

For this analysis, we assume that the energy tax receipts will be used to reduce the Federal deficit.[21] A number of major spending changes are implicit within this policy. First, consumers and businesses will have less discretionary income, thereby reducing consumer spending. The lower deficit will also result in fewer interest payments since borrowing will be reduced. As consumers respond to the increase in energy prices, they will tend to use less energy. The reduction in energy use will mean less revenue for the nation's energy suppliers. Finally, by purchasing less energy, consumers and businesses will have slightly more money to invest and spend on other goods and services.

The spending changes in both the tax-only and the tax-recycling scenarios were evaluated for their job and income impacts using the Regional Input-Output Modeling System (RIMS) data for the U.S.[22] The key multiplier ratios are summarized in Table 2. It is important to note in Table 2 that the energy sectors tend to have the smallest job and income multipliers — that is, expenditures for energy will support fewer jobs and less income in the U.S. economy than expenditures on other types of goods and services. Thus, diverting revenues away from energy purchases, due either to higher energy prices or targeted energy efficiency programs, and towards other purchases will lead to a net increase in jobs and income.

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20. For a similar treatment of how economic impacts of an energy efficiency scenario might be evaluated, see, Howard Geller, John DeCicco and Skip Laitner, "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, October, 1992.

21. If the point of our analysis were to evaluate the impact of the Administration's entire budget and tax package, we would then determine whether the full budget offers a net reduction in the federal deficit, or whether total spending will increase beyond the level of the proposed energy tax. However, since we are only trying to understand the impact of the energy tax, it is reasonable to assume that all energy tax revenues will be used to reduce the deficit.

22. Bureau of Economic Analysis, *Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II)*, U.S. Department of Commerce, Washington, DC, 1992. It should be noted that while the job multipliers refer to actual changes in employment, the income multipliers refer only to changes in earnings, often referred to as wage and salary compensation.

We assume that consumers and businesses will invest in energy efficiency measures, when they respond to higher energy prices (as indicated by the estimated energy price elasticities). Furthermore, we assume that there is a cost for these energy efficiency measures. In reality, the actual changes in the nation's energy use will result from investments in energy efficiency measures and changes in consumer behavior. The latter, actions such changing thermostat settings or driving patterns, generally do not involve an economic cost. Therefore, the analysis presented here is conservative in that it probably overstates the cost of saving energy in response to the energy tax and consequently understates the overall economic benefits.

In this analysis, we provide the economic impacts for the year 2003 which coincides with the last year of the ACE^3 tax recycling proposal. The baseline (pre-tax) scenario was drawn from the 1993 Annual Energy Outlook.[23] It was then modified to incorporate changes in energy prices and the anticipated consumer response to those price changes as measured by price elasticities. The analysis that follows assumes an average price elasticity of -0.33 as it was generated from the AEO data and described in the previous section.

Table 3 provides the primary energy consumption (in trillion Btus) by end-use sector in each of the scenarios evaluated. Based upon an average price elasticity of -0.33 and the resulting energy price increase from the Btu tax, the tax-only scenario shows a 1.9 percent drop in national energy consumption compared to the baseline scenario. On the other hand, the tax-recycling scenario shows a 12.6 percent drop in consumption. This is the result of investments in cost-effective energy efficient technologies accelerated through targeted energy efficiency programs.

Table 4 shows the results of the economic impact analysis. For both scenarios the fuel-weighted price increase in the year 2003 is $0.396 per million Btus (in 1991 dollars). Under the tax-only scenario, the energy tax generates about $35.7 billion of gross tax revenues for the federal government in 2003. The price increase induces a consumer energy bill savings of about $11.9 billion, leading to a net loss for consumers of about $23.8 billion in that year.

Even with this initial loss of discretionary income, the energy tax produces a modest but positive economic impact for the economy as a whole, as indicated in the last two rows of Table 4. When all costs and benefits are added up, together with their appropriate multiplier effects, the tax-only scenario yields a net gain of 39,000 jobs and $2.3 billion per year of additional income by 2003.

The reason for the net increase in jobs and income is that the energy bill savings are respent in sectors which have larger jobs and income multipliers than the energy sectors (see Table 2). Also, government sector multipliers are somewhat larger than the household (or residential) multipliers. Since households are the major source of tax

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23. See Appendix A of the *Annual Energy Outlook 1993*, op. cit.

revenues, any funds moved from households to the government sector activities will likely create a small net gain as well.[24]

By comparison, the tax-recycling scenario generates a substantial increase in economic benefits compared to the tax-only scenario. Our analysis indicates that by adopting the energy tax along with targeted energy efficiency programs, consumer savings will increase to $29.9 billion by 2003. This savings will lead to a net increase of about 563,000 jobs and provide additional wage and salary income of $13.9 billion annually by 2003.

Because the price response is such a significant driver of energy bill savings, particularly in the tax-only scenarios, we also tested how changes in the assumed price elasticities might affect the outcome of the analysis. Table 5 provides the results of this sensitivity analysis.

Drawing from the literature, notably the review provided by Bohi,[25] and a report by Mittlestädt,[26] it appears that a reasonable lower boundary for the average energy price elasticity is -0.20, while a value of -0.50 establishes a reasonable upper boundary. Using these upper and lower limits, Table 5 shows the reduction in energy consumption that is attributable only to the price effect, ranging from 1.2 to 2.9 percent (with the middle value of nearly two percent). Similarly, the employment impact ranges from a net gain of 3,000 jobs to as many as 90,000 jobs in the tax-only scenario. As in the main analysis (see Table 4), the tax-recycling scenario provides much greater economic stimulus for the nation, with as many as 615,000 additional jobs in 2003 assuming high consumer response (i.e., the upper limit of potential energy price elasticity).

There is one further item that should be noted in this analysis. Although there will be more total employment in the tax-recycling scenario, the average wage rate is expected to fall — about $40 per job compared to the baseline scenario. For the most part, the reason is that jobs within the energy industry tend to be better paying relative to other jobs in the economy. On the other hand, the estimated cost of living is expected to drop by about $200 per job as a result of reduced energy consumption. Since the reduction in average energy bill more than offsets the reduction in average annual wage rate, consumers still come out ahead.

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24. This will be true up to the point where other constraints such as higher interest rates may begin to offset any initial advantage of government spending compared to household purchases. But this is not likely to occur under this scenario since: a) the deficit is brought down which provides a downward pressure on interest rates; and b) energy efficiency improvements tend to be less costly than new energy supply which tends to free up even more sources of capital.

25. *Analyzing Demand Behavior*, op. cit.

26. "Use of Demand Elastics in Estimating Energy Demand," op. cit.

B. A Critique of NAM and API Studies

Since the introduction of the energy tax there have been a number of studies which indicate that such a policy would negatively impact the American economy. Two of the recent macroeconomic studies have been published by the National Association of Manufacturers (NAM) and the American Petroleum Institute (API). NAM, for example, suggests a loss of Gross Domestic Product (GDP) of $38 billion by 1998 if the energy tax is enacted.[27] In a separate analysis, the API projected losses to GDP on the order of $34 billion by 1998.[28] A subsequent study released by API reduced the economic loss to only $27 billion in 1998.[29] As a result of these alleged economic constraints, both NAM and API estimated losses of about 400,000 jobs in 1998.

Curiously, the API analysis refers to the employment impacts as a reduction in job growth. But a closer look at the modeling reveals a useful insight. About one-half of the loss in job growth (or 200,000 jobs) is the result of a voluntary reduction in the labor supply. Presumably this implies that people choose to leave the work force because they want to return to school for more education, accept an early retirement, or opt for more leisure time over additional consumption. In other words, actual "job losses" may be less than one-half of the numbers presented in the media. By the time other adjustments are made to the NAM and API analysis, it becomes apparent that the energy tax can actually lead to more rather than fewer employment opportunities.

The NAM and API analyses rely on short-run aggregate demand macroeconomic models developed by other consultants. API, for example, utilized the consulting services of DRI/McGraw-Hill in deriving its estimates of economic impacts. The NAM analysis relied on the Washington University model. Neither organization has made clear the full set of assumptions, models and algorithms which underlie their results. Although this makes it difficult to assess the analysis, we can generate some insight into why their evaluations have produced very negative results by examining the published information, and by reviewing the conceptual framework that underpins macroeconomic models of this type.

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27. See especially, Table I of the Appendix to the "Testimony of Paul Huard," op. cit.

28. "U.S. Energy Policy in the Clinton Administration", remarks by Charles J. Dibona to the National Economists Club, Washington, DC, on behalf of the American Petroleum Institute, April 12, 1993.

29. "Comparison of the Economic Impact of the Clinton Administration's Proposed Btu Tax and Alternatives," DRI/McGraw-Hill, Washington, DC, May 1993.

Broadly speaking there are two main issues to be reviewed in assessing the API and NAM reports. First, there are conceptual limitations in how economic theory is adapted for use to the evaluation of the energy tax.[30] Second, there are significant areas where the studies fail to capture appropriate feedbacks that offset initial constraints to the nation's economic activity. These are discussed in turn.

1. Conceptual Limitations

To better understand how the API and NAM studies arrived at their estimates of job losses, we can replicate their analytical framework by assuming that the energy tax depresses output, and hence employment. For example, if we use the API estimate that energy tax revenues are increased by $22 billion in 1998, and that GDP rises to $8,100 billion in 1998 (in current dollars), then the tax rate is about 0.3 percent of GDP. Further API data suggests that under its baseline scenario economic growth will rise to about 122 million jobs by 1998. If one adopts the view that the energy tax is nothing more than a brake on the economy, the impact of a 0.3 percent reduction in output implies a loss of about 330,000 jobs. Such a result is very close to the API and NAM projections and suggests conceptually just how the negative impact was determined.

API and NAM suggest that energy taxes have adverse short-run impacts because they simultaneously raise inflation and reduce after-tax income. In this manner, economic output is weakened compared to the baseline scenario. But the effects described by the API/NAM studies would likely occur only if the economy were already at full employment. Most observers agree, however, that substantial unemployment will remain in the short- and medium-term.

Today the unemployment rate is still hovering around seven percent. Even if one accepts a *natural unemployment rate* as six percent, the one percent differential implies a GDP that is still about three percent below optimal levels.[31] Macroeconomic theory suggests that when the economy is operating below its full capacity, the inflationary impact of changes in tax policy will be minimized compared to a full-employment economy.

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30. For a particularly thoughtful and independent critique of such models, see a pair of memos written to the Senate Budget Committee by Jane Gravelle, a senior specialist in economic policy with the Congressional Research Service, June 8 and 9, 1993. In addition to the API/NAM projections, the CRS memos also reviewed the employment projections from two general equilibrium models. One was used by the American Electric Power Company and the other was published by the National Bureau of Economic Research and the MIT Press.

31. This is based on comparison of the level of employment if the nation's productive resources were "fully employed." When the unemployment rate exceeds the natural rate, the economy is said to suffer from an output gap. As a rule of thumb, macroeconomist Arthur Okun suggested that for each one percent difference between the natural unemployment rate and the actual rate, the GDP differential is a minus three percent. In other words, the 1992 GDP of $5,951 billion might have been nearly $180 billion higher had the employment rate been six percent rather than seven percent. With this size of an output gap, it makes it more difficult of prices to rise significantly. Of course, this also assumes that six percent is the natural rate of unemployment. Some economists believe it lies closer to five percent or even less. If so, there may exist an even greater level of an output gap.

Disregarding the full employment issue for a moment, it is not clear that inflationary pressures will actually move in a lock-step relationship with higher energy prices. To the contrary, as the energy tax begins to reduce discretionary income, the demand for consumer goods will also be reduced. This means that lower consumer and business demand should offset to some degree the inflationary effect of higher energy prices.

Moreover, as Milton Friedman and others suggested following the period of stagflation in the 1970s, the gap in output is related not so much to the level of inflation, but to the change in the rate of inflation. First, by phasing in the energy tax over a period of three years, and second, by maintaining a modest increment in the overall price changes, the consumer response that might otherwise weaken economic activity will be negligible. With the API analysis suggesting, for example, that inflation under the energy tax scenario might be as little as 0.1 percent above baseline, the change may so minimal as leave consumption wholly unaffected.

Finally, the worst case scenarios presented by both API and NAM assume a monetary policy that is neutral with respect to the energy tax. Their more detailed analysis, however, show scenarios which explicitly incorporate accommodation of the Clinton deficit reduction plan noting that "the bond market has already responded favorably to the program, and Federal Reserve Chairman Alan Greenspan has given his preliminary, conditional blessing."[32] A February 1993 analysis conducted by NAM found that with a monetary offset the Clinton Administration's proposals may decrease GDP and employment by only 0.05 percent.[33] In that case, if the error term is as little as ± 1.5 percent (at the 95 percent confidence interval), a negative 0.05 percent employment impact could actually mean a net gain of nearly 1.5 percent!

2. Underestimated Feedback Effects

The impacts suggested by the API/NAM studies have other problems as well. These generally relate to an underestimation of feedback effects that might otherwise overcome the initial economic drag on the economy from an energy tax. For instance, while acknowledging the reduced energy consumption that is likely to occur as a result of higher energy prices, it appears the two models fail to capture the respending of the energy bill savings which accrue to lower energy use. While the savings are not as large as the tax increase, it is nonetheless an important offsetting impact. Moreover, if adoption of the energy tax sparks broader energy efficiency efforts or investments, the entire energy tax could be offset by reductions in energy use.[34]

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32. See, "Comparison of the Economic Impact of the Clinton Administration's Proposed Btu Tax and Alternatives," op. cit., page 15.

33. See, NAM memo entitled "Preliminary econometric analysis of the Clinton proposals," to Jerry Jasinowski, et al., from Gordon Richards, February 25, 1993.

34. As discussed by Howard Geller, John DeCicco, and Steven Nadel, op. cit.; and David Morris, Michael Lewis, Irshad Ahmed and John Bailey, "Beating the BTU Tax: The 6 Percent Solution, Institute for Local Self-Reliance, Washington, DC, May 1993.

The models relied on by API/NAM have very little detail to fully describe the energy link to GDP potential. This link is examined only through aggregate energy consumption. So if you have a policy intervention which improves efficiency, even one that promotes efficiency through the price mechanism, the model, by definition, would only be able to say that GDP will be lower as a result of the higher energy prices.[35]

The API and NAM studies also fail to examine the different labor intensities among economic sectors. As established by the data in Table 2, labor intensities in the energy sectors tend to be significantly lower than all other sectors. When consumers and businesses, therefore, reduce energy consumption through cost-effective efficiency measures, they are lowering expenditures for low labor-intensive energy services and respending the savings for more labor-intensive goods and services. Such a change in the qualitative expenditure pattern can produce employment gains even when other economic effects are taken into account.

It is further unclear whether the API/NAM studies reflect the influence of downward pressure in prices resulting from lower demand for energy, especially on the price of oil.[36] If not, then it is likely that these studies overstate the economic drag created by an energy tax.

Finally, it also appears that the API/NAM analysis treats government expenditures as a sinkhole, and that funds which do not directly reduce the deficit are wasted expenditures. Yet, the multiplier effects of government expenditures can generate a significant level of economic activity. While the revenues raised from taxpayers represent a decrease in discretionary income, the money is, in fact, respent in other sectors of the economy. Again referring to the data in Table 2, the employment multipliers associated with most government purchases are higher than those from households. This reinforces the notion that a model which explores the effects of an energy tax, but which is too highly aggregated for that purpose, will understate the benefits of new expenditure patterns.

V. Conclusions

Based upon this analysis, the following conclusions seem to emerge:

(1) The modest energy tax proposed by the Clinton Administration should by itself result in a small but non-trivial reduction in energy demand. Based on historic experience and

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35. As noted in a recent forum sponsored by the U.S. Department of Energy, if we are delivering the same services to the economy using less energy, in effect we have freed up some amount of resources that could be used elsewhere in the economy. That would tend to offset (or perhaps even exceed) the negative impacts. See comments by James A. Edwards, *NEMS Conference Proceedings*, Energy Information Administration, Feb 1-3, 1993, Published May 1993, page 233.

36. This is one result of a recent study published in support of the Bush Administration's National Energy Strategy. See, Energy Information Administration, *Energy Consumption and Conservation Potential: Supporting Analysis for the National Energy Strategy*, Washington, DC, U.S. Department of Energy, 1990.

assumptions currently used by the U.S. Department of Energy in its energy forecasts, we estimate that the energy tax will reduce national energy consumption by no more than about two percent early in the next century (i.e., 5-10 years after the tax is fully phased in).

(2) Even if all the energy tax revenue is devoted to deficit reduction, the proposed energy tax will not necessarily reduce national income or employment. First, the direct energy savings will dampen the impact of the energy tax on consumers' energy bills. Second, because of the induced energy conservation, the tax will shift economic activity towards sectors of the economy that support more jobs and income than do the energy industries. We estimate that the proposed tax could have a very small **positive** impact on employment and income nationwide by 2003, with a net increase of about 40,000 jobs and $2.3 billion of additional income.

(3) The positive impacts on employment and income could be greatly increased if Federal energy efficiency efforts are expanded at the same time that the tax is phased in. By retrofitting Federal buildings, increasing funding for R&D, technical assistance, and home weatherization programs, expanding voluntary energy efficiency efforts, adopting tougher efficiency standards, and taking similar actions, the Federal government can leverage private capital and produce energy savings that more than offset the proposed energy tax. By making the economy more energy-efficient while implementing the proposed energy tax, a net **increase** of approximately 563,000 jobs could result by 2003.

(4) Our results differ from those presented by opponents of the energy tax, who claim the tax will adversely affect jobs and the economy as a whole. Opponents of the tax, such as the American Petroleum Institute and the National Association of Manufacturers, have not fully explained their analytical methodology and assumptions. But these organizations appear to be making a series of questionable assumptions and omissions that lead to their negative results. If API and NAM were to perform a more complete and fair analysis, we believe they would obtain a very different and more favorable result.

TABLE 1

PROPOSED ENERGY EFFICIENCY INITIATIVES[a]

LOW-INCOME WEATHERIZATION

Increase the Federal Weatherization Assistance Program by $500 million per year. Energy savings by 2003 - 0.15 Quads/yr.

PUBLIC HOUSING RETROFITS

Devote $400 million per year to retrofitting HUD-assisted housing. Energy savings by 2003 - 0.28 Quads/yr.

RETROFITS OF FEDERAL BUILDINGS

Devote $300 million per year to upgrading the energy performance of Federally-owned buildings. Energy savings by 2003 - 0.21 Quads/yr.

WEATHERIZATION LOAN PROGRAM

Allocate $400 million per year to state-based low-interest loan programs for housing retrofits by middle-income homeowners. Energy savings by 2003 - 0.70 Quads/yr.

SUPPORT BUILDING CODE ADOPTION AND IMPLEMENTATION

Provide $25 million per year for state-level building code adoption, training, and compliance efforts. Energy savings by 2003 - 0.50 Quads/yr.

EXPAND THE EPA "GREEN PROGRAMS"

Increase funding to $150 million per year for programs that promote voluntary manufacture of energy-efficient products and installation of energy efficiency measures. Energy savings by 2003 - 3.59 Quads/yr.

EXPAND RD&D ON IMPROVED EQUIPMENT EFFICIENCY

Increase Federal funding by $50 million per year for research, development and demonstration of new energy savings technologies, with matching funding from the private sector. Energy savings by 2003 - 0.67 Quads/yr.

TABLE 1 (cont.)

PROPOSED ENERGY EFFICIENCY INITIATIVES[a]

UNDERTAKE INDUSTRIAL ENERGY EFFICIENCY INITIATIVES

Provide $500 million per year for technical assistance, loan guarantees and interest rate buydowns, voluntary programs, and demonstration of innovative industrial process improvements. Energy savings by 2003 - 2.34 Quads/yr.

PROVIDE INVESTMENT ASSISTANCE TO VEHICLE MANUFACTURERS AND STRENGTHEN FUEL ECONOMY STANDARDS

Provide up to $2 billion per year to auto manufacturers for investments needed to make cars and light trucks more energy efficient, coupled with tougher fuel economy standards. Energy savings by 2003 - 2.64 Quads/yr.

LEVELIZE TAX BENEFITS FOR COMMUTERS

Permit and require employers to offer the same tax-free benefit to commuters who drive cars, use mass transit, or other use other non-automobile-based transport modes. Energy savings by 2003 - 0.15 Quads/yr.

(a) Funding levels refer to programs when fully phased in.

Source: H. Geller, J. DeCicco, and S. Nadel, "Structuring an Energy Tax So That Energy Bills Do Not Increase", American Council for an Energy-Efficient Economy, Washington, DC, March 1993.

Table 2. U.S. Economic Multipliers by End-Use Sector

Sector	Jobs (Total Per Million $ Expenditure)	Earnings (Wages and Salaries Per Dollar of Expenditure)
Residential	29.5	0.62
Commercial	48.0	0.99
Industrial	35.1	0.83
Energy	17.7	0.46
Efficiency Investment	41.7	0.98
Government	32.0	0.76

Notes: The total jobs and income multipliers shown in Table 2 include the direct, indirect and induced effects of each change in consumer spending. A more complete discussion of these numbers is found in the Bureau of Economic Analysis handbook, *Regional Multipliers*, U.S. Department of Commerce, Washington, DC, 1992.

Table 3. Energy Consumption in 2003 Under Different Tax Scenarios

Sector	Baseline	Tax-Only	Tax-Recycling
Residential	16,955	16,753 (1.2)	15,574 (8.1)
Commercial	13,899	13,709 (1.4)	11,673 (16.0)
Industrial	34,476	33,670 (2.3)	29,567 (14.2)
Transportation	26,766	26,227 (2.0)	23,641 (11.7)
Total	92,096	90,360 (1.9)	80,455 (12.6)

Notes: Data are in trillions of Btus. Figures in parentheses reflect percent change over the baseline scenario.

Source: Baseline data are derived from the *Annual Energy Outlook 1993*. The tax-only and tax-recycling Scenarios are calculated by the American Council for an Energy-Efficient Economy.

Table 4. Summary of Year 2003 Energy Tax Impacts		
Impact	**Tax-Only**	**Tax-Recycling**
Effective Tax Rate ($/MBtu)	$0.396	$0.396
Energy Price Increase (Percent)	5.69	5.69
Price-Induced Energy Savings (Quads)	1.7	1.7
Efficiency Energy Savings (Quads)	0.0	9.9
Total Energy Savings (Quads)	1.7	11.6
Tax Revenues (million 1991$)	$35,700	$31,900
Federal Efficiency Expenditures (million 1991$)	$0	$4,500
Private Efficiency Expenditures (million 1991$)	$0	$18,600
Net Energy Bill Savings (million 1991$)	$11,900	$75,900
Net Consumer Savings (million 1991$)	-$23,800	$29,900
Net Job Impact (actual)	39,000	563,000
Net Earnings Impact (million 1991$)	$2,300	$13,900

Table 5. Summary of 2003 Impacts By Level of Price Elasticity

Impact	Low Elasticity (-0.20)		Mid-Elasticity (-0.33)		High Elasticity (-0.50)	
	Tax-Only	Tax-Recycling	Tax-Only	Tax-Recycling	Tax-Only	Tax-Recycling
Energy Savings (%)	1.2	11.9	1.9	12.6	2.9	13.6
Net Jobs (Actual)	3,000	526,000	39,000	563,000	90,000	615,000
Net Earnings (million 1991$)	$1,400	$13,100	$2,300	$13,900	$3,400	$15,000

Source: Calculations by the American Council for an Energy Efficient Economy as referenced in the main report.