Alternative Approaches to Offsetting the Competitive Burden of a Carbon/Energy Tax

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Energy-related carbon emissions in the United States rose for the fifth straight year in 1996, according to data from the U.S. Department of Energy (DOE). Emissions from the use of fossil fuels climbed to 1,454 million metric tons of carbon equivalent in 1996, an increase of 3.3 percent relative to emissions in 1995, and 8.7 percent compared to 1990. Carbon emissions in the form of carbon dioxide are the main contributor to global warming. Limited improvement in energy efficiency was a key factor in the growth in carbon emissions since 1990. Carbon emissions in 1996 were well above the level targeted in the Clinton Administration's Climate Change Action Plan. The United States is not on track for returning its greenhouse gas emissions to 1990 levels by 2000, which is a commitment made as part of the Framework Convention on Climate Change.

Fossil fuels and fossil-derived electricity are consumed in every sector of the economy: roughly a third by manufacturing industries, slightly over a third by households, and the remainder about evenly divided between non-household transportation and non-manufacturing industry, commerce, and government. Policies need to be broad-based to properly spread the incentive for efficiency improvements across sectors.

One such broad-based approach is a carbon or carbon/energy tax. A pure carbon tax is a tax on fossil fuels proportional to their carbon content, while a carbon/energy tax is a broad-based energy tax that also applies to non-carbon energy sources such as nuclear and hydro-power, and may include tax rates on fuels that reflect additional concerns, such as national security in the case of oil). A carbon/energy tax applies to all economic sectors and fossil fuel consumers proportionally to their carbon dioxide emissions or energy use. Many economists argue that a carbon/energy tax is the most efficient instrument for promoting emissions reductions. A carbon/energy tax is a market-based approach, encouraging cuts in emissions through price incentives, and provides individuals and firms with maximum flexibility in deciding when and how to achieve reductions. Moreover, the revenue from a carbon/energy tax can be used to reduce other taxes, creating additional efficiency gains.

The prospect of a carbon/energy tax increase, however, raises potentially serious concerns about the competitiveness of U.S. energy-intensive industries. Previous proposals for such taxes have not adequately addressed these concerns from either an industry or an environmental point of view. *The purpose of this study is to identify potential competitive burdens of a carbon/energy tax and to examine a range of alternative approaches to offsetting those burdens.*

Several factors suggest that increased carbon/energy taxes will be under serious consideration in the coming decade. The United States is a signatory of the United Nations Framework Convention on Climate Change (FCCC), which commits nations to the "stabilization of greenhouse gas concentrations in the atmosphere at a level which will prevent dangerous anthropogenic interference with the climate system." The FCCC mandates an ongoing negotiation process to achieve this goal. As part of that process, the United States recently announced that it supports new, tighter, binding emissions reduction targets for industrial nations. It appears likely that some market incentive system, whether in the form of a carbon/energy tax or a tradable permit system, will be part of the U.S. strategy to meet these targets.

A carbon/energy tax increase combined with recycling of the revenue through the reduction of other taxes would increase the total tax burden on energy-intensive industries and decrease the burden on other industries. The paper considers three approaches to offsetting competitive burdens:

(1) *Border tax adjustments* (BTAs) are the most straightforward way to prevent firms in low tax jurisdictions from preying on energy-intensive industries in high tax jurisdictions. The simplest and most common border tax adjustment is the "destination system," in which traded goods are subject to the taxes of the importing ("destination") country and exempted from the taxes of the exporting ("origin") country. Current U.S. taxes with border adjustments include taxes on alcoholic beverages, tobacco products, motor and aviation fuels, hazardous substances (the Superfund tax), ozone-depleting chemicals, and many smaller taxes.

U.S. leadership in clarifying that BTAs are allowed is critical for three reasons. First, it is an essential precaution to protect American jobs and industries in case the United States should decide to adopt a carbon/energy tax. Second, U.S. opposition to BTAs on carbon/energy taxes is seen as a potential barrier to their adoption. Finally, it is important to assure that BTAs are available to other nations even if the United States chooses not to adopt a carbon/energy tax, for all nations benefit from emissions reductions directly caused by such measures.

(2) An *energy efficiency credit* reduces the competitive burden of fuel taxes from increased fuel bills caused by higher fuel prices. If energy consumption per unit of output can be lowered through the adoption of new and more efficient technology, the burden of these taxes is offset to that extent. A large number of engineering studies in many nations suggest that, even at current prices, national energy efficiency gains on the order of 10 to 20 percent could be achieved by adopting available best-practice technologies. Considerable evidence exists that firms generally under-invest in technology because some of the benefits of such investments are not enjoyed by the investor but flow to other firms or to society as a whole.

Thus it is desirable, both economically and environmentally, to accompany an energy tax with a package of measures that encourage adoption of energy-efficient processes. One such measure is a tax credit for investments in energy-efficient technology, which encourages adoption of energy-efficient technologies by reducing the cost of capital devoted to those investments. The most difficult part of designing a good efficiency credit is determining which investments will be eligible. Ideally the credit should be targeted to investments with high reductions in energy consumption relative to the tax revenue foregone. However, this sort of balancing would require engineering analysis which the taxing authority is not well equipped to audit. There are several possible approaches to dealing with this problem, including: developing a list of approved technologies with high expected energy saving per unit of tax revenue lost; self-certification by firms, combined with technical audits; and basing the credit on changes in a firm's aggregate energy efficiency, rather than conducting investment-specific assessments.

(3) A number of authors have proposed offsetting the burden of a carbon/energy tax through an *investment tax credit* (ITC). The ITC was first enacted by the Kennedy administration in 1962 and repealed by the Tax Reform Act of 1986. Under the ITC in its final form, investment in qualifying depreciable property with a useful life of at least three years resulted in a 10 percent tax credit. The most important classes of qualifying property were tangible personal property, primarily equipment, and certain structures integral to manufacturing, such as bulk storage facilities.

Prior to its repeal, the ITC went primarily (~60 percent) to non-manufacturing industries, the bulk of which are not very energy-intensive. This study suggests that, if the coverage of the ITC could be restricted to energy-intensive industries or processes, or to investments that significantly reduce energy consumption, the rate of the credit could be increased substantially, thus more effectively targeting competitive effects. For instance, we could offer a 20 percent investment credit if the credit could be limited to the fifth of all investment most directly related to energy consumption.

The paper also discusses **alternative approaches to emissions reductions and competitiveness**. For example, *tradable permits* and carbon/energy taxes result in the same level of emissions reduction and have the same impact on the price of fossil fuels and derivative energy sources. A tax sets the increase in price and allows the market to choose the quantity of fuels purchased, while a permit system sets the reduction in emissions and allows the market to set the increase in fuel price. While the paper focuses on offsetting the competitive burden of carbon/energy taxes by using the revenue to reduce other taxes, some of those revenues could be used to increase expenditures in areas that promote competitiveness, such as:

- Increased federal expenditures on research in efficiency and renewable technologies;
- Demonstration and early commercialization of new technologies;
- Public/private energy research consortia;
- A revolving loan fund for efficiency investment; and
- Increased public investment in education and training.

Much of the concern about carbon/energy taxes has focused on their impact on jobs and the competitiveness of domestic energy-intensive industries. A number of policies to offset such impacts have been adopted or proposed. However, little consensus exists regarding which offset policies are best, in part due to the failure to evaluate such policies by any consistent set of criteria. We propose a list of criteria by which competitive offset strategies can be evaluated. The measures should:

- Protect or promote the competitive position of energy-intensive industries against untaxed foreign competition in domestic and international markets;
- Maintain the tax's price incentive to reduce emissions by developing new clean technologies and processes or shifting to less carbon-intensive patterns of consumption;
- Be administered and enforced consistently and at a reasonable cost (including compliance costs accrued by the taxpayer);
- Distribute the energy tax burden fairly, and be perceived as fair by the public;
- Not be unnecessarily expensive; and
- Be consistent with U.S. treaty obligations under international environmental and trade agreements, especially the FCCC and the General Agreement on Tariffs and Trade.

Several of the measures described could be effectively combined to produce positive synergies. By integrating a range of tax and non-tax approaches, it may be possible to use climate policy to promote the overall competitiveness of U.S. industry. Any credible package of revenue recycling instruments will probably employ several approaches. For example, BTAs are approximately revenue neutral and can be combined with any of the other options discussed. Labor tax reductions are necessary to offset household burdens but need to be combined with energy efficiency credits or similar spending measures in order to provide adequate offsets to energy-intensive industries and promote the adoption of new technologies. Thus a package consisting of labor tax reductions, BTAs, and some combination of energy efficiency credits and non-tax measures to promote new technology may be appropriate. A policy package including tax-shifting with border adjustments and perhaps other energy efficiency incentives would improve the overall competitiveness of U.S. manufacturing by promoting plant modernization and technological development and lowering the average tax burden on exported goods. A well-designed system of competitive offsets can place both energy-intensive products and non energy-intensive products in an improved competitive position in international markets.

As the United States moves into the 21st Century, it faces increasing environmental challenges in an environment of tightening federal budget constraints and an increasingly competitive integrated global economy. If we are to continue to preserve and improve our standard of living, this combination of challenges requires innovative approaches to environmental problem-solving that better harmonize environmental and economic goals. This means that our efforts to reduce emissions should be structured to promote U.S. production and employment if possible, or at least to try to minimize any negative impact of climate policy on the U.S. economy.

I. CLIMATE CHANGE, ENERGY TAXES, AND THE COMPETITIVENESS PROBLEM

A. Introduction

Increasing concern over the potential of human activity to cause global climate instability is leading many nations to consider or adopt international agreements and national plans to limit the emissions of greenhouse gasses. The most important of these emissions is carbon dioxide. Carbon dioxide emissions constitute more than 75 percent of total greenhouse gas emissions from the developed world and an even larger percentage of projected emissions growth.[1] Carbon dioxide is an unavoidable byproduct of all fossil fuel combustion.[2] National plans for greenhouse gas reduction typically involve both increased efficiency in energy use and switching from high-carbon fuels, notably coal, to lower-carbon fuels (such as natural gas) or to non-fossil alternative energy sources.

Fossil fuels and fossil-derived electricity are consumed in every sector of the economy: roughly a third by manufacturing industries, slightly over a third by households, and the remainder about evenly divided between non-household transportation and non-manufacturing industry, commerce, and government.[3] As a result, policies need to be broad-based in order to properly spread the incentive for efficiency improvements across sectors. In contrast, a policy of concentrating on large emitters would place a disproportionate portion of the burden of emissions reductions on a few industries in the manufacturing sector.

One such broad-based approach is a carbon or carbon/energy tax. A pure carbon tax is a tax on fossil fuels proportional to their carbon content, while a carbon/energy tax is a broad-based energy tax that also applies to non-carbon energy sources such as nuclear and hydro-power, and may include tax rates on fuels that reflect additional concerns, such as national security in the case of oil). We will be analyzing carbon/energy taxes. These taxes apply to all economic sectors and to all fossil fuel consumers proportionally to their carbon dioxide emissions or energy use. Many economists argue that carbon/energy taxes are the most efficient instrument

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[1] Intergovernmental Panel on Climate Change, *The Science of Climate Change*, Vol. 1 of *Climate Change 1995: IPCC Second Assessment Report*, Cambridge University Press, Cambridge, England (1996).

[2] Carbon dioxide is also produced by deforestation and as a byproduct of certain industrial chemical processes, most notably the calcining of limestone in the production of cement and lime.

[3] U.S. Dept. of Energy: Energy Information Administration, *Emissions of Greenhouse Gasses in the United States, 1987-1994,* DOE/EIA-0573(87-94) (October 1995). Residential transportation fuel consumption estimate from Energy Information Administration, *Household Vehicle Energy Consumption 1991,* DOE/EIA-0464(91) (December 1993).

for promoting emissions reductions.[4] A carbon/energy tax is a market-based approach, encouraging cuts in emissions through price incentives. It provides individuals and firms with a maximum of flexibility in deciding when and how to achieve reductions. Also, the revenue from a carbon/energy tax can be used to reduce other taxes, creating additional efficiency gains. Recent research has suggested that the efficiency cost of non-revenue raising market instruments such as grandfathered tradable permits may be three times the cost of carbon/energy taxes with revenue recycling[5] and that revenue recycling increases gross domestic product (GDP)s by about 1 percent in most of the major economic models.[6]

The prospect of a carbon/energy tax increase raises potentially serious concerns about the competitiveness of U.S. energy-intensive industries. Previous proposals for such taxes have not adequately addresses these concerns from either an industry or an environmental point of view. The purpose of this study is to identify potential competitive burdens of a carbon/energy tax and to examine a range of alternative approaches to offsetting those burdens. We also go beyond mere offsets and ask whether the international competitiveness of U.S. industry can be enhanced through climate policy.

The plan of this paper. In the remainder of this section we assess the prospects for an energy tax increase and discuss the importance of addressing competitiveness concerns from economic and environmental perspectives. In Section III we identify the manufacturing sectors for which an environmental tax reform centered on a carbon/energy tax would raise serious competitiveness concerns. In the next three sections we address three potential offsets through the tax system: border tax adjustments in Section IV, an investment tax credit in Section V, and energy efficiency investments in Section VI. In Section VII, we compare the potential for competitive offsets under an environmental tax reform program and a tradable permit system,

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[4] The Economists' Statement on Climate Policy released in early 1997 was signed by 8 Nobel Laureates and more than 2600 economists, the largest number of economists ever to sign on to any public policy declaration. The Statement said in part:

> "II. Economics studies have found that there are many potential policies to reduce greenhouse gas emissions for which the total benefits outweigh the total costs....For the U.S. in particular, sound economic analysis shows that there are policy options that would slow climate change without harming American living standards, and these measurers may in fact improve U.S. productivity in the longer run.
> III. The most efficient approach to slowing climate change is through market-based policies...such as carbon taxes or the auction of emissions permits. The revenues generated from such policies can effectively be used to reduce the deficit or to lower existing taxes."

The full text of the Statement can be found at the Redefining Progress website:
http://www.rprogress.org/progsum/ecc_progsum.html.

[5] Ian W.H. Parry, Roberton C. Williams III, & Lawrence H. Goulder, *When Can Carbon Abatement Policies Increase Welfare? The Fundamental Role of Distorted Factor Markets*, NBER Working Paper No. 5967 (March 1997).

[6] Robert Repetto and Duncan Austin, *The Costs of Climate Protection: A Guide for the Perplexed*, World Resources Institute (1997).

and briefly discuss some alternative approaches to the competitiveness question. In our concluding section, we discuss integration of different tax components and the overall competitiveness of U.S. industry.

B. The Prospect of Energy Tax Increases

Although the shape of U.S. climate policy remains unclear, several factors suggest that increased carbon/energy taxes will be under serious consideration in the coming decade. The United States is a signatory of the United Nations Framework Convention on Climate Change (FCCC), which commits nations to the goal of "stabilization of greenhouse gas concentrations in the atmosphere at a level which will prevent dangerous anthropogenic interference with the climate system."[7] The FCCC mandates an ongoing negotiation process to achieve this goal. As part of that process, the United States has recently announced that it supports new, tighter, binding emissions reduction targets for industrial nations.[8] It is difficult to see how the United States can meet such targets without some market incentive system, whether in the form of a carbon/energy tax or a tradable permit system.

Much of the rest of the industrial world has either adopted or is seriously considering adopting increased energy taxes. Five nations—Denmark, Finland, the Netherlands, Norway, and Sweden —have implemented new broad-based carbon or carbon/energy taxes since 1990.[9] In addition, the United Kingdom has substantially increased its energy taxes and Germany has eliminated major coal subsidies of long standing.

The European Union has adopted a Europe-wide goal of a harmonized environmental tax reform (ETR), consisting of an increase in national carbon/energy taxes to a level equal to about 1 percent of GDP, with the revenue to be used primarily to reduce other taxes, especially social insurance payroll taxes.[10] This proposal has lost momentum, in part because it was made conditional on major trading partners (particularly the United States) adopting comparable measures. Fossil fuel taxes and prices in the United States and Canada are low relative to other

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[7] United Nations Conference on Climate and Development: Framework Convention on Climate Change, May 9, 1992, in *Report of the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change on the Work of the Second Part of Its Fifth Session,* INC/FCCC 5th Sess., 2d Part at Annex I, U.N. Doc. A/AC.237/18 (Part 2)/Add.1, reprinted in 31 International Legal Materials 851.

[8] Statement of the Honorable Timothy E. Wirth, Under Secretary for Global Affairs, on behalf of the United States of America, delivered at the Second Conference of Parties of the Framework Convention on Climate Change, Geneva Switzerland (July 7, 1996).

[9] Frank Muller, "Mitigating Climate Change: The Case for Energy Taxes," *Environment* V. 38 No. 2 p. 12 (March 1996).

[10] Commission of the European Communities, *Proposal for a Council Directive Introducing a Tax on Carbon Dioxide Emissions and Energy,* CB-CO-92-250-EN-C (Luxembourg: Official Publications of the European Communities, 30 June 1992).

industrialized nations, and these low fuel prices are widely seen as restraining the European nations from raising their own fuel taxes further. However, the idea of a European environmental tax reform was recently endorsed by the European Trade Union Confederation (ETUC)[11] and a revised European Union energy tax proposal was issued in 1997. The Europeans continue to urge the United States to adopt meaningful carbon dioxide reduction targets comparable to their own.[12]

There is an emerging scientific consensus that human actions are changing the climate, as reflected by the recent findings of the Intergovernmental Panel on Climate Change.[13] Moreover, the insurance industry has weighed in on the side of precautionary emissions reductions because of their fear of increased extreme weather events and attendant financial losses. Finally, random factors such as the political stability of the Middle East could quickly bring energy concerns back to the forefront.

Turning to the domestic front, the history of the British thermal unit (Btu) tax proposal is widely seen as an embarrassing defeat for its proponents. However, it should be noted that it is normal for a major new tax being introduced for the first time to fail. The Btu proposal bill passed the House of Representatives and failed in the Senate by only two votes. By historic standards, this is an unusual degree of political success.

If, as the United States has proposed, the industrial nations adopt a "realistic, verifiable and binding"[14] commitment on greenhouse gas emissions reductions, the United States may be driven to reconsider energy tax proposals by shortcomings in the major alternative approaches to achieving such reductions: voluntary agreements, efficiency standards, and cap-and-trade schemes. The primary current U.S. strategy for emissions reductions is to promote voluntary agreements, both directly and through the major energy utilities. This approach has certainly proven valuable in many industries. However, it has proven inadequate to achieve significant emissions reductions, as demonstrated by the failure of the United States to meet its obligation under the FCCC to return to 1990 levels by the year 2000. The 1997 Annual Energy Outlook—the primary official energy forecast of the United States—projects year 2000

[11] Joint Declaration of the European Environmental Bureau and the European Trade Union Confederation (Rome: June 7, 1996).

[12] At the June 1997 meeting of the G8, the European Union urged the United States to join them in adopting a legally binding target of 15 percent reduction in greenhouse gas emissions from 1990 levels by 2010. Associated Press Wire Service June 20, 1997.

[13] Id. footnote 1.

[14] Statement of U.S. Under Secretary for Global Affairs Timothy E Wirth, Second Conference of Parties, Framework Convention on Climate Change: Geneva, Switzerland (7 July 1996).

emissions about 15 percent above 1990 levels.[15] In addition, voluntary agreements do not appear to be adequate to address the growing energy use by households and small businesses.

Although there will doubtless be a place for efficiency standards in a comprehensive climate policy package, especially in the transportation, residential, and building sectors, attempting to achieve emissions reduction goals entirely through traditional technology-based command and control approach would require that regulatory standards be developed for a very large number of energy applications. Such a regulatory system could be complex and burdensome. Standards need to be deployed strategically and creatively to best compliment market-based incentive systems.

Tradable permit schemes, like taxes, result in an increase in the price of fossil fuels. As a result, these schemes impose essentially the same competitive burden on energy-intensive producers as taxes would. However, as explained in section VII below, it is more difficult to offset the competitive burdens of a tradable permit system than those created by a tax.

C. Importance of Competitiveness Concerns

As the United States moves into the 21st Century, it faces increasing environmental challenges in an environment of tightening federal budget constraints and an increasingly competitive integrated global economy. If we are to continue to preserve and improve our standard of living, this combination of challenges requires new, innovative approaches to environmental problem-solving that better harmonize environmental and economic goals. In the context of the climate debate, this means that our efforts to reduce emissions should be structured to promote U.S. production and employment if possible, or at least to try to minimize any negative impact of climate policy on the U.S. economy

There are also important environmental reasons to be concerned about the competitiveness of U.S. energy-intensive industries. Greenhouse warming is a global problem, and carbon dioxide contributes equally to climate instability regardless of the nation from which the emissions derive. If fuel taxes merely drive carbon-intensive production from high-tax to low-tax jurisdictions, the loss of jobs and industrial base in the former does not yield any environmental benefit. Indeed, there is likely to be a net environmental cost due to an increase in transportation-related emissions and the possibility of production in facilities using outdated and less efficient technologies.

The potential of increased energy taxes to cause production relocations has an even more troubling implication for the long-term prospect of controlling greenhouse emissions. Anticipated economic growth in the developing world will make it impossible to stabilize global

[15] U.S. Energy Information Administration, *Annual Energy Outlook 1997*, DOE/EIA-0383(97), U.S. Government Printing Office: Washington DC (1997).

greenhouse gas levels unless the greenhouse gas/GDP ratio can be lowered drastically through new efficiency and renewable energy technologies. This is true regardless of the emissions reductions that may be achieved in the industrial nations. The industrial world must lead in commercializing such technologies because developing countries lack the resources to do this on their own. Relocation of energy-intensive production to low-tax jurisdictions not only eliminates the immediate emissions reductions, but also the incentive to develop new, clean technologies. Thus it is environmentally as well as economically important to craft policies that prevent energy price increases from leading to industrial displacement, provided those policies preserve the incentive for increased energy efficiency and technological innovation.

II. BACKGROUND

A. U.S. Energy Taxes

Historically, U.S. tax policy toward energy has been a somewhat schizophrenic blend of special tax breaks for energy producers, and excise and other taxes on energy production and consumption. This confused approach is further complicated by the tradition of splitting jurisdiction over energy taxation between federal and state governments.

Major tax subsidies to energy production include: the percentage depletion allowance, which allows fuel producers to take depreciation on fuel stocks in the ground (often well in excess of their purchase price); expensing of intangible drilling costs and mining exploration and development costs, which under normal tax rules should be capitalized; and the Section 29 nonconventional fuels credit for coal bed methane. Although the tax subsidies to fossil fuel production were substantially reduced by the Tax Reform Act of 1986, these and related provisions still provide tax subsidies to energy producers in excess of two billion dollars per year. [16]

At the same time, there are a variety of federal and state taxes on fossil fuel production and consumption. On the federal level, most of these taxes fall into one of two categories. The first category consists of taxes to provide public infrastructure that is used jointly with fuel consumption, such as roads or waterway improvements. These taxes serve as a proxy for user fees on the use of roads, waterways, and other public infrastructure. The second category consists of trust fund taxes for the amelioration of injuries to workers, consumers, or the public associated with energy production or consumption. Examples include a tax on gasoline to pay for the cleanup of leaking underground storage tanks and a small tax on coal to provide benefits to miners disabled by black lung. At the state level, many states also impose severance taxes on fuels removed from the ground. These are justified either to fund public land remediation costs, or under the theory that the states are the ultimate owners of natural resources within their

[16] U.S. Office of Management and the Budget, "Tax Expenditures," in *Budget of the United States Government*, Government Printing Office, Washington DC (Annual: 1995-1997 volumes).

boundaries. It should be noted that motor fuel taxes at current levels generally do not cover the full social cost of roads and driving.[17]

B. The Taxation of Business Enterprises

In dollar terms, the two most important taxes on business enterprises are the corporate income tax (and parallel taxes on partnerships and individual proprietorships) and the business half of payroll taxes.[18] Business payroll taxes are the larger of the two and is the largest single category of tax on businesses. The federal government collects about nine dollars of employer-paid payroll taxes for each five dollars of corporate income tax. Over the last three decades, corporate income taxes as a share of GDP have fallen by nearly half, from 4.0 percent of GDP in 1966 to 2.3 percent in 1996.[19]

For tax purposes, business income consists of business revenues less costs. Costs include current operating expenses such as wages and interest payments, the cost of materials and other purchased inputs such as advertising, and the cost of capital consumed in the manufacturing process. Of these, capital consumption is by far the most difficult to measure. A disproportionate share of the internal revenue code is devoted to a system of rough-justice rules intended to match the years in which capital costs are deductible to the income stream a capital asset generates. For assets with a useful life greater than one year, the costs of acquisition must be capitalized and cannot simply be currently deducted. If the asset has a determinable life (as opposed to assets like real estate or corporate stock that do not wear out) then the taxpayer is allowed to deduct a share of the cost of the asset each year over its useful life, a process called depreciation. The cost of the asset less depreciation is called the basis of the asset. If the asset is sold for more (less) than the basis, the difference is referred to as a capital gain (loss).

In recent decades, Congress has adopted a variety of provisions intended to encourage investment by lowering the cost of capital. Such provisions reduce business costs, although their effectiveness in increasing total investment is controversial. Such provisions include accelerated depreciation and the investment tax credit (ITC). Accelerated depreciation allows a taxpayer to take depreciation faster than the asset normally wears out. An investment tax credit provides a reduction in tax equal to a percentage of the cost of the asset. Credits are more valuable than equal dollar deductions because a dollar of credit reduces tax liability by a dollar while a dollar of deduction reduces taxable income by a dollar and reduces tax liability by a dollar times the

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[17] Mark A. Delucchi, *The Annualized Social Cost of Motor Vehicle Use in the United States, 1990-1991*: Summary of Theory, Data, Methods, and Results, Research Report UCD-ITS-RR-96-3 (1), Institute of Transportation Studies, University of California Davis (1997).

[18] Most payroll taxes are paid half by the employer and half by the employee.

[19] U.S. Office of Management and the Budget, "Historical Tables" in *supra* note *16 Budget of the United States* (1997).

tax rate, currently equal to 32 percent for most enterprises subject to the ordinary corporate tax. (The alternative minimum tax is discussed below).

C. Environmental Tax Reform and Competitive Offsets

Increased energy taxes raise the after-tax price of energy and thereby increase the cost of producing goods that use energy (or energy-intensive materials) as an input to manufacturing. These increases in production costs can have negative impacts on the competitiveness of an industry if the increases cause it to increase the sale price of its product or to reduce its rate of productivity improvement.

In this study we will examine several alternative approaches to offsetting the competitive burden of an energy tax through other changes in the tax system.

Border tax adjustment. Border tax adjustment is a common approach to dealing with competitiveness problems caused by taxes on goods that move in interstate or international trade. Border adjustment provides a system of charges and rebates imposed at the border that are designed to place exports on a level field with untaxed foreign goods and imports on the level with taxed domestic goods. Non-discriminatory border tax adjustments are allowed under the major international trade agreements.

Revenue recycling. One approach to reducing or reversing competitive impacts is to use the revenue raised by energy taxes to reduce other taxes on business. If the reduction in other taxes paid by an enterprise is as great or greater than the increase in energy taxes paid by that enterprise, there is no increase in net tax burden, no increase in the cost of production, and no competitive burden. Revenue recycling approaches include both reductions in broad-based taxes (such as payroll and income taxes) to offset the energy tax burden on average firms and also more focused tax measures intended to offset the burden on energy-intensive firms and industries.

Investment tax credits. An investment tax credit reduces the tax rate on income from new capital investment in equipment and certain structures, making it easier to for firms to invest in newer, more energy-efficient equipment. We examine the potential of an ITC to offset the burden of a carbon/energy tax on an industry-by-industry basis.

Energy efficiency credits. Efficiency credits are similar to an ITC except that the credit is targeted to investments that improve energy efficiency or reduce energy consumption. They have the advantage of being targeted to the energy-intensive processes and products most affected by the energy tax increase. Because efficiency credits are focused on a narrower tax base, they can offer a higher credit rate than an ITC for any given level of revenue allocation. They provide an independent incentive for efficiency improvement, thus increasing the effectiveness of the carbon/energy tax in promoting emissions reductions. We discuss problems in the design and administration of such credits and examine efficiency credits or credit-like programs adopted by the U.S. federal government, the state of Oregon, and Denmark.

III. Identifying Industry Burdens

A. Overview

A carbon/energy tax increase combined with recycling revenue through reduction of other taxes would increase the total tax burden on energy-intensive industries and decrease the burden on other industries. In Section III, we perform an industry-by-industry analysis of the potential competitive burden of a reference tax scenario. Section III.B describes the reference tax-shifting scenario that we will use to identify the size and industrial distribution of representative changes in the tax burden.

The reference proposal is intended to be typical of environmental tax reform proposals but no claim is made that it is in any sense the "optimal" proposal. The qualitative results of this analysis should hold for most tax reform proposals centered around a carbon/energy tax. The purpose of the reference tax proposal is to demonstrate the need for measures to offset competitive burdens, identify the industries most affected, and quantify the burden to be offset. Based on the analysis below, we believe that the demonstration of need and the identification of industries requiring special treatment is relatively stable across a wide range of energy taxes and realistic revenue recycling options. However, the industry-by-industry quantitative estimates of net tax burden may vary by a larger amount depending on the choice of tax rates on different energy types and on the precise form of revenue recycling selected.

This analysis is based on the 1991 Manufacturing Energy Consumption Survey (MECS) and figures are reported in 1991 dollars and are based on 1991 employment, investment, etc. for consistency. A $50 carbon/energy tax in 1991 dollars is roughly equivalent to $55 in 1996 dollars (using the implicit GDP deflator). Over the last five years there have been no major changes in the energy/output or labor/output level for the manufacturing sector as a whole. Larger variations may have occurred at the detailed industry level.

B. Description of the Reference Tax Proposal

1. The carbon/energy tax

The reference fuel tax is a $50/ton carbon tax. A carbon/energy tax is widely seen by policy analysts as the preferred tax instrument for climate protection policy. Moreover, the relative ranking of tax burden between fuels (coal > oil > natural gas) of a carbon/energy tax is seen as a good proxy for overall environmental impact. The $50/ton rate is approximately half the level of the European Union carbon/energy tax proposal. The $50 rate taken as a stand-alone policy is not is not high enough to stabilize U.S. carbon dioxide emissions but is high enough that it could constitute a significant component of a package of climate protection measures.

Exemptions. Our reference tax proposal has no exemptions or preferential rates, except a feedstock exemption for carbon from purchased fuels physically incorporated into the final product, e.g., plastics, petrochemicals, and some fertilizers. The feedstock exemption is justified because the fuels incorporated into the product do not produce emissions into the atmosphere. However, unlike the Administration's 1993 Btu tax proposal, we do not include "electron donor" uses of fuels, such as the reduction of iron ore by coke, to be a feedstock use except to the extent that the carbon remains in the final product. The tax does not apply to carbon in wood or other fuels from renewable biomass sources.

Treatment of electricity. For the purpose of assessing the impact of a carbon/energy tax on industries using electricity, we assume that the tax on the fuels used to produce that electricity are fully passed on to the industrial electric consumer. Carbon content will be imputed to electricity based on the average U.S. fuel mix for utility-based fossil generation. Most proponents of higher energy taxes do not favor a massive switch-over to nuclear or large-scale hydropower, which have their own environmental problems. We follow the lead of the Clinton Btu and European Union proposals in imposing an equalizing charge on these sources, which we set equal to the average tax rate on fossil-produced electricity. In order to provide an incentive for moving toward less polluting alternatives, electricity from wind, solar, biomass, geothermal, and other renewable sources is untaxed. Again, this follows the pattern of the 1993 Btu and E.U. proposals.

2. A labor tax reduction

The reference tax proposal includes partial revenue recycling through a reduction in both the employer and the employee share of payroll taxes. The reader should not take the particular form of this reduction too seriously. Rather, the payroll tax cut should be regarded as representing one of a wide range of proposals that could reduce the cost of labor, education, training, or human capital, many of which would have qualitatively similar distribution across industry. Throughout this paper we use "labor tax reduction" as a shorthand for this family of tax offsets.

There are several reasons why the reference tax is assumed to reduce labor taxes. The most important is that about 35 percent of the carbon/energy tax is born by the household sector. Some form of reduction in labor taxes is necessary to prevent households from having a substantial net tax increase. The second is that experience with environmental tax reform proposals around the world suggests that they will be designed to support a credible claim that they will create jobs and improve the economic condition of most working people. Some version of a cut in labor taxes or a per capita "eco-bonus" is included in the European Union's carbon/energy tax proposal and in tax-shift proposals in Germany, Switzerland, and several Nordic countries. Even the U.S. Btu tax proposal included an increase in the earned-income tax credit, essentially a cut in labor taxes for low-income households. Finally, as shown in the next section, a labor tax cut effectively offsets the tax burden of industries that are not energy intensive.

For purposes of our analysis the reduction in labor taxes is set at approximately the level required to offset the burden of the carbon/energy tax on the household sector. We use the bulk of the revenue (70 percent) to create a standard deduction against the major federal payroll taxes. In essence this is equivalent to a $180 per worker credit against the employer portion of the payroll tax, and a similar credit against the employee portion. The employee tax reductions are set to be equal to the burden of the carbon/energy tax on households. Unlike the earned income tax credit, the standard exemption is not be recaptured as income increases

We leave the remaining 30 percent of the revenue as unallocated because we are convinced that some revenue should be used to fund a variety of other programs, such as industrial energy efficiency tax credits and low-income home weatherization programs. In Section V below we analyze the effect of using half of this revenue to fund an investment tax credit.

C. Burden Analysis

Tax burden is calculated by assuming the industry initially bears 100 per cent of the carbon/energy tax on the fuels they consume. None of the tax is assumed to be passed back to fossil fuel suppliers, nor do we assume any reduction in fuel consumption in response to the tax. The reason for this assumption is to set an upper bound on the industrial tax burden. Given the uncertainties in estimates of behavioral response to tax changes, we believe that such upper-bound analysis is prudent when identifying industries which require special treatment (though it would obviously nor be appropriate if used to estimate the impact of the tax on national emissions). For the same reason, when calculating price impacts we assume that 100 percent of the tax is passed on to output price.

Although the approach used tends to overestimate the direct impact of the tax on industry, it may underestimate the tax born by industries for which the cost of energy-intensive raw materials is a large fraction of the value of their product. The degree of such underestimation depends on the nature and size of competitive offsets adopted. If an offsetting tax reduction is large enough to eliminate the net tax increase on the industry supplying the energy-intensive material, then there is no indirect burden from the energy tax.

If competitive offsets do not fully offset the price increase on raw materials, indirect burden would have to be estimated on an industry-by-industry basis. Under the assumption of full pass-through of cost increases, the increase in the price of a manufactured good caused by an increase in the price of a raw material is equal to the percentage increase in the price of the raw material times the cost of that raw material as a share of the value of the manufactured good. For example, if the cost of steel is 20 percent of the sale price of a manufactured item, and the price of steel is increased by 6 percent by a carbon/energy tax, then the indirect tax burden on the manufactured item is 1.2 percent of its price. For most industries these indirect price effects will be small compared to the direct price effects.

D. The Distribution of Burden by Industry under the Reference Proposal

1. Distribution of burden within manufacturing

Table 1 shows the carbon/energy tax burden, labor tax reduction and net tax burden as percentages of the value of shipments for manufacturing industries, by two-digit standard industrial classification (SIC). Manufacturing industries (SIC 20-39) as a group have a higher energy/employment ratio than the rest of the economy. As a result these industries have a net increase in tax burden under the reference scenario. However, this increase is small: slightly under six-tenths of 1 percent.

Within manufacturing, energy use is highly concentrated in a few industries. At the level of two-digit SIC industries, only five industries would see increases in excess of 1 percent: Paper (SIC 26), Chemicals (SIC 28), Petroleum and Coal Products (SIC 29), Stone Clay and Glass (SIC 32) and Primary Metals (SIC 33). Only the primary metals industry has a price increase greater than 2 percent. See Table 1, Column 6. These industries constitute 21 percent (by value of shipments) of manufacturing industry.

Even within the most energy-intensive industries energy use tends to be concentrated in the primary process subsections of the industry. This can be seen by examining industries at the four-digit SIC level. For instance, in the paper industry by far the greatest energy consumption is by paper mills, pulp mills and paperboard mills. When these segments are excluded, residual paper—accounting for almost four-fifths of the value of shipments—receives a modest tax decrease. See Table 2, Column 6. This pattern holds true in all the energy-intensive industries. Table 2 displays similar results for the Primary Metals and Stone Clay and Glass industries.

For industries with carbon/energy tax burdens of a quarter of a percent of shipments of less, the net tax burden under the reference proposal is either negative (a net tax reduction) or approximately zero. Slightly over 40 percent of manufacturing is in this category.

2. The need for competitive offsets

The results in the previous section suggest that an analysis of competitive burdens should focus on industries at a highly disaggregated level. Table 3 shows all the four-digit SIC industries with a net tax burden as a percentage of shipments of 1 percent or more. There are 28 such industries. The table is arranged in descending order of net tax burden as a percentage of value of shipments. For these high energy industries the average net tax burden is 3.3 percent. Industries in the least energy intensive 86 percent of manufacturing have a net tax increase of slightly over one-tenth of 1 percent of shipments.

Twenty-three four-digit SIC industries, constituting approximately 12 percent of manufacturing, would have a net tax burden above 2 percent of shipments. As the table shows, some of these industries would see quite substantial increases in their cost of production. For instance, the lime,

Table 1. Effect of the Reference Tax Proposal on Manufacturing Industries (2-digit SIC)

SIC		Value Shipments	Carbon Tax	Labor Tax Cut	Net Tax Change	Reference with BTAs	ITC	Reference with ITC
Code	Industry Groups and Industries	($ bill.)	($ mill.)	($ mill.)	(% Shipments)	(% Shipments)	($ mill.)	(% Shipments)
20	Food and Kindred Products	388	1,456	346	0.29%	-0.09%	412	0.18%
21	Tobacco Products	32	40	9	0.10%	-0.03%	26	0.01%
22	Textile Mill Products	66	571	140	0.66%	-0.21%	115	0.48%
23	Apparel and Other Textile Products	65	99	225	-0.19%	-0.34%	35	-0.25%
24	Lumber and Wood Products	71	343	148	0.28%	-0.21%	122	0.10%
25	Furniture and Fixtures	40	90	109	-0.05%	-0.27%	35	-0.14%
26	Paper and Allied Products	129	1,931	146	1.39%	-0.11%	397	1.08%
27	Printing and Publishing	157	260	349	-0.06%	-0.22%	229	-0.20%
28	Chemicals and Allied Products	292	4,224	199	1.38%	-0.07%	669	1.15%
29	Petroleum and Coal Products	158	3,067	27	1.92%	-0.02%	182	1.81%
30	Rubber and Misc. Plastics Products	101	569	197	0.37%	-0.20%	214	0.16%
31	Leather and Leather Products	9	20	25	-0.06%	-0.27%	5	-0.11%
32	Stone Clay and Glass Products	60	1,301	112	1.99%	-0.19%	132	1.77%
33	Primary Metal Industries	133	4,202	159	3.04%	-0.12%	253	2.85%
34	Fabricated Metal Products	157	574	319	0.16%	-0.20%	214	0.03%
35	Industrial Machinery and Equipment	244	522	416	0.04%	-0.17%	363	-0.11%
36	Electronic and Other Electric Equipment	198	489	335	0.08%	-0.17%	358	-0.10%
37	Transportation Equipment	364	691	383	0.08%	-0.11%	479	-0.05%
38	Instruments and Related Products	127	222	211	0.01%	-0.17%	198	-0.15%
39	Misc. Manufacturing Industries	37	66	85	-0.05%	-0.23%	37	-0.15%
Total Manufacturing Industries		2826	20,735	3,940	0.59%	-0.14%	4,441	0.44%

Table 2. Energy-Intensive Industries and Subindustries

SIC	Industry Groups and Industries	Value Shipments ($ bill.)	Carbon Tax ($ mill.)	Labor Tax Cut ($ mill.)	Reference Tax (% Shipments)	Reference with BTAs (% Shipments)	ITC ($ mill.)	Reference with ITC (% Shipments)
32	**Stone Clay and Glass Products**	60	1301	112	2.0%	0.2%	132	1.8%
3211	Flat Glass	2	56	3	2.5%	0.1%	7	2.2%
3221	Glass Containers	5	113	8	2.1%	0.2%	11	1.9%
3229	Pressed and Blown Glass nec.	4	76	8	1.8%	0.2%	12	1.4%
3241	Cement Hydraulic	4	519	4	13.6%	0.1%	16	13.2%
3274	Lime	1	168	1	23.8%	0.1%	3	23.4%
3296	Mineral Wool	3	64	4	2.1%	0.1%	7	1.8%
32xx	Residual Stone Clay & Glass	41	304	84	0.5%	0.2%	75	0.4%
33	**Primary Metal Industries**	133	4202	159	3.0%	0.1%	253	2.9%
3312	Blast Furnaces and Steel Mills	41	2412	42	5.8%	0.1%	95	5.6%
3313	Electrometalurgical Products	1	79	1	7.1%	0.1%	3	6.8%
3321	Gray and Ductile Iron Foundries	7	146	18	1.8%	0.3%	20	1.5%
3331	Primary Copper	4	34	1	0.8%	0.0%	6	0.7%
3334	Primary Aluminum	6	932	5	15.0%	0.1%	10	14.8%
3339	Primary Nonferrous Metals nec	4	84	3	2.2%	0.1%	9	2.0%
3353	Aluminum Sheet Plate and Foil	11	92	6	0.8%	0.1%	20	0.6%
33xx	Residual Primary Metals	59	423	84	0.6%	0.1%	80	0.4%
26	**Paper and Allied Products**	129	1931	146	1.4%	0.1%	397	1.1%
2611	Pulp Mills	3	103	4	3.4%	0.1%	22	2.7%
2621	Paper Mills	18	1340	31	7.3%	0.2%	90	6.8%
2631	Paperboard Mills	8	485	12	6.1%	0.2%	42	5.5%
26xx	Residual Paper	100	4	154	-0.2%	0.2%	144	-0.3%

Table 3. Effect of the Reference Tax Proposal on Manufacturing Industries (4-digit SIC)

SIC Code	Industry Groups and Industries	Value Shipments ($ bill.)	Carbon Tax ($ mill.)	Labor Tax Cut ($ mill.)	Reference Tax (% Shipments)	Reference with BTAs (% Shipments)	ITC ($ mill.)	Reference with ITC (% Shipments)
3274	Lime	0.7	168	1	23.8%	-0.29%	3	23.4%
3334	Primary Aluminum	6.2	932	5	15.0%	-0.08%	10	14.8%
3241	Cement Hydraulic	3.8	519	4	13.6%	-0.10%	16	13.2%
2812	Alkalies and Chlorine	2.7	268	2	9.9%	-0.07%	14	9.3%
2813	Industrial Gases	3.2	270	2	8.4%	-0.07%	14	7.9%
2873	Nitrogenous Fertilizers	3.2	257	2	8.0%	-0.05%	16	7.5%
2621	Paper Mills	18	1,340	31	7.3%	-0.17%	90	6.8%
3313	Electrometalurgical Products	1.1	79	1	7.1%	-0.11%	3	6.8%
2631	Paperboard Mills	7.8	485	12	6.1%	-0.15%	42	5.5%
3312	Blast Furnaces and Steel Mills	40.8	2,412	42	5.8%	-0.10%	95	5.6%
2819	Industrial Inorganic Chemicals nec	17.6	678	19	3.7%	-0.11%	36	3.5%
2063	Beet Sugar	2.3	85	2	3.6%	-0.08%	5	3.4%
2822	Synthetic Rubber	4.1	150	3	3.6%	-0.07%	9	3.4%
2823	Cellulosic Manmade Fibers	1.5	55	2	3.5%	-0.16%	3	3.3%
2611	Pulp Mills	2.9	103	4	3.4%	-0.14%	22	2.7%
2046	Wet Corn Milling	7.1	201	2	2.8%	-0.03%	27	2.4%
3211	Flat Glass	2.1	56	3	2.5%	-0.15%	7	2.2%
2869	Industrial Organic Chemicals nec	53.1	1,282	24	2.4%	-0.04%	194	2.0%
3339	Primary Nonferrous Metals nec	3.7	84	3	2.2%	-0.07%	9	2.0%
3221	Glass Containers	4.9	113	8	2.1%	-0.17%	11	1.9%
3296	Mineral Wool	2.9	64	4	2.1%	-0.14%	7	1.8%
2911	Petroleum Refining	145.4	2,954	17	2.0%	-0.01%	166	1.9%
2865	Cyclic Crudes and Intermediates	10.7	206	6	1.9%	-0.05%	33	1.6%
3321	Gray and Ductile Iron Foundries	7.1	146	18	1.8%	-0.25%	20	1.5%
3229	Pressed and Blown Glass nec.	3.9	76	8	1.8%	-0.20%	12	1.4%
2824	Organic Fibers Noncellulosic	11.1	177	11	1.5%	-0.10%	39	1.1%
2821	Plastics Materials and Resins	29.6	436	14	1.4%	-0.05%	88	1.1%
2874	Phosphatic Fertilizers	5	53	2	1.0%	-0.05%	15	0.7%
Total Energy-intensive Sectors		402.5	13,649	250	3.33%	-0.06%	1,004	3.1%
Rest of Industry		2550.8	7,308	4,043	0.13%	-0.16%	3,001	0.0%
Total Manufacturing Industries		2,826.1	20,735	3,940	0.59%	-0.14%	4,441	0.4%

cement, primary aluminum, and chlor-alkali industries would all have price increases of 10 percent or greater. The largest (in terms of shipments) industries in the energy-intensive category would suffer smaller, but still significant, price increases: steel (6 percent), industrial inorganic chemicals (4 percent), industrial organic chemicals (2 percent), and petroleum refining (2 percent).

Most of these energy-intensive industries are not very labor intensive. As a result, for these industries, as opposed to the less energy-intensive industries discussed in the previous section, the offsetting labor-oriented tax reduction would not be adequate to address competitiveness concerns. However, as column 7 of Table 3 shows, the combination of border tax adjustments and a labor tax reduction would improve the competitive position of these industries in international markets, albeit by a small amount. This is because the border tax adjustment removes the effect of the energy tax increase on prices while preserving the effect of the labor tax decrease.

IV. OFFSETTING COMPETITIVE BURDENS: BORDER TAX ADJUSTMENTS

A. The Nature of Border Tax Adjustments

Border tax adjustments (BTAs) are the most straightforward way to prevent firms in low-tax jurisdictions from preying on energy-intensive industries in high tax jurisdictions. There are several kinds of border tax adjustments, but the simplest and most common is the "destination system," in which traded goods are subject to the taxes of the importing ("destination") country and exempted from the taxes of the exporting ("origin") country. For instance, gasoline trucked from Toronto to Buffalo is exempted from paying gasoline tax in the origin nation, Canada, and subject to state and federal gasoline tax in the destination jurisdiction, New York/United States. BTAs are a necessary part of a tax on in-jurisdiction consumption, and are a nearly universal feature of sales, excise, value added and other taxes. Current U.S. taxes with border adjustments include taxes on alcoholic beverages, tobacco products, motor and aviation fuels, hazardous substances (the Superfund tax), ozone-depleting chemicals, and a large number of smaller taxes.

A BTA system would apply to fuels and electricity moving in international trade in the same way that current state and federal taxes on fossil fuels are border adjusted. It is also possible to do border adjustment on the tax imposed on energy used to produce energy-intensive exports (such as metal ingot and certain bulk chemicals), thus maintaining the competitiveness of exports. A comparable tax would be imposed on imports of energy-intensive basic materials to put foreign firms on a level playing field in the home market. Several existing U.S. taxes include such BTAs on taxed raw materials used to produce an untaxed final product, including the Superfund tax on hazardous substances and the ozone-depleting chemicals tax. The BTA systems under these two taxes is described below.

When a nation places a tax on consumption of a product, it requires a BTA on imports to assure that products produced outside of the nations borders but consumed within them are taxed.

Similarly, exports consumed outside of the nations borders are not a part of national consumption. Thus, a BTA system rebating any previously paid tax on the export of the product is necessary. A consistent system of destination-type BTAs also prevents double taxation of goods that move in international trade. Because BTAs are required for consistent treatment of a consumption tax base they are regarded as a normal part of the tax and not as a form of local favoritism. A BTA system on energy-intensive goods is a natural part of a tax on fuels used to produce goods consumed domestically.

B. Administrative Issues

A BTA system for carbon/energy taxes need be no more complicated than the BTA systems already in place for many other taxes. For instance, the United States administers border tax adjustments on hundreds of chemicals under the Superfund hazardous substances excise tax. BTAs apply to all taxed chemicals, and to products manufactured primarily from taxed chemicals.

It should be noted, however, that energy is an input to the manufacture of nearly every product that moves in international trade. If BTAs had to be done on the energy content of every product, the system would be extremely burdensome and probably unworkable. To keep a BTA system within the bounds of administrative feasibility, it is necessary to limit BTAs to products for which the tax burden of the carbon/energy tax exceeds a *de minimus* rate, say 2 percent of the industry value of shipments. This would limit BTAs primarily to the 23 industries listed in the preceding section. Moreover, if the tax were phased in over a number of years, in the early years only a few extremely energy-intensive products would require BTAs. This gradual introduction of BTAs on a few products each year would ease the process of developing a BTA system on a new tax.

The Superfund tax has a two-tier system for estimating the content of taxable product in untaxed chemicals which incorporate taxed chemicals in their manufacture. If the producer documents the amount of taxed chemical used in the manufacture, the tax is based on the documented amount. Otherwise, it is based on the amount of the taxed chemical which is used to manufacture the that product under the predominant method of production in the United States This system of administering BTAs on products manufactured using taxed substances was examined by a GATT conciliation panel[20] and held GATT to be consistent with international trade rules. The Ozone-Depleting Chemicals (ODC) Tax has similar BTA provisions, except that it also applies to products manufactured with taxed substances but not physically incorporating them, such as electronic parts cleaned with ODCs. BTAs on the embodied carbon in energy-intensive goods would be administratively identical to the BTAs on these existing taxes.

[20] GATT Panel Report *United States - Taxes on Petroleum and Certain Imported Substances*, L/6175, BISD 34S/136, 154 ff., adopted on 17 June 1987.

It should be noted, however, that, as with any major new tax, many questions about BTA design remain to be answered. In particular, the designation of categories of goods to be border-adjusted and the administrative procedures for such adjustment remain to be designed. These design issues, though not novel, are often complex. Moreover, our experience with initiatives to prevent evasion under the federal gasoline excise and the ozone-depleting chemicals tax[21] tells us that careful thought needs to be given to enforcement concerns before the tax is put in place.

Perhaps the most difficult issue is the degree to which finished goods which use energy-intensive raw materials should be border-adjusted. In the event of complex manufactured items such as aircraft, the percentage increase in the price of the final product caused by the increase in the price of aluminum and steel is likely to be negligible, especially if the aerospace industry also benefits from an offsetting reduction in labor taxes, capital taxes, focused energy efficiency credits or the like. In such cases, the competitive benefit of the BTA is likely to be outweighed by its administrative burden on international trade and on domestic taxpayers. On the other hand, products with less value added to energy-intensive materials—for instance, aluminum sheet, or rough-cast engine blocks—may require BTAs. It is important to develop a principled approach to making such determinations which is administrable by the taxing authority and not unduly burdensome to the taxpayer. An initial basis for such an approach might be an extension of the *de minimus* rule described above. This approach would make BTAs available if the sum of the direct carbon/energy tax burden and the indirect burden exceeds some threshold level, perhaps 2 percent.

C. BTAs under International Trade Law

1. The nature of the controversy—carbon tax

Some members of the international trade community argue that BTAs on taxes on carbon embodied in energy-intensive traded goods are or should be barred by the General Agreement on Tariffs and Trade (GATT). BTAs on the fuels themselves are widely used and universally accepted as GATT-compliant. Opponents of BTAs on embodied energy make two basic arguments. First, many GATT experts take seriously the conclusion of the never-adopted Tuna-Dolphin decision that trade measures could be based only on taxes on *products*, and not on taxes on *processes*. Second, some legal scholars argue that the rebate of taxes on embodied fuels is barred by the GATT Subsidies Code's ban on rebating *prior stage cumulative indirect taxes.*

2. Process and product taxes

The argument that BTAs are not allowed on process taxes is based on a misunderstanding of the history of the GATT BTA rules. The GATT allows BTAs on taxes which fall "directly or

[21] J. Andrew Hoerner, "Taxing Pollution: How Excise Taxes on CFCs Provide Financial Incentives for a Faster Phase-out," in Elizabeth Cook, ed., *Ozone Protection in the United States,* Washington DC: World Resources Institute (1996).

indirectly" on like products.[22] It was the intent of the original GATT negotiators that process as well as product charges be border adjustable.[23] The process/product distinction proposed by the Tuna-Dolphin Panel, like the Tuna-Dolphin decision itself, has never been adopted by the GATT contracting parties or by the World Trade Organization. Moreover, numerous scholars have observed that the process/product distinction itself was rooted in a misunderstanding by the panel of the GATT rules governing BTAs.[24]

3. Prior stage cumulative indirect (PSCI) taxes

A "prior-stage" tax is a tax levied directly or indirectly on goods or services used to make the traded product. Taxes on manufacturing inputs are PSCI taxes if they are also "cumulative." The GATT Subsidies code states that a tax is cumulative "if the goods or services taxed at one stage of production are used in a succeeding stage of production." Border adjustment of carbon/energy taxes is clearly not barred by the ban on PSCI taxes, for two reasons. First, the Uruguay Round Amendments to the GATT specifically excluded taxes on fossil fuels from the scope of the PSCI tax ban. See the Agreement on Subsidies and Countervailing Measures, Annex II, footnote 61. Second, energy taxes are not PSCI taxes because they do not cumulate. Although energy is used in every phase of the manufacturing process, each unit of fuel is taxed only once. This contrasts with the standard example of a PSCI tax, the cascade tax. A cascade tax is a tax on the value of all products sold, including goods used as materials in the manufacture of other goods. Cascade taxes cumulate, because the tax on, for example, sheet steel used to make an automobile, becomes part of the cost of manufacturing the automobile and the tax is *itself taxed again* when the automobile is sold. Cascade taxes were once common in Europe, but are now extinct in all but a few developing nations, having been replaced by VATs.

[22] GATT Art. III:2

[23] This language was first introduced by U.S. negotiator Oscar B. Ryder at the London Preparatory Committee as part of the process of drafting the charter of the Havana Charter, the precursor to GATT. The Brazilian delegate, Mr. Rodrigues, demanded to know what was meant by the addition of the term "or indirectly." Mr. Ryder replied that the language was to allow border adjustments on "a tax, not a tax on a product as such, but on the processing of a product, which are covered by the word 'indirectly' here." Quotations from EPCT/A/PV/9, pp. 18-19. See also EPCT/C.II/11; EPCT/C.II/W.5, p.5; and EPCT/W/181, p. 3, referred to in the GATT Analytical Index 1993. For a discussion, see Paul Demeret and Raoul Stewardson, Environmental Taxes and Border Tax Adjustments, Liege, Belgium (1993), p. 9.

[24] See, e.g., Paul Demeret & Raoul Stewardson, "Border Tax Adjustment Under GATT and EC Law and General Implications for Environmental Taxes," *Journal of World Trade*, Vol. 28, No. 4 (1994); Hoerner and Muller, *Carbon Taxes for Climate Protection in a Competitive World*, Swiss Ministry for Foreign Economic Affairs (forthcoming 1997).

D. United States' Role in the BTA Debate

The Trade and Environment Committee of the World Trade Organization is engaged in ongoing negotiations on the impact of trade rules on environmental measures, negotiations which have repeatedly examined the BTA question and which could issue findings on that question at any time. In the interim, the threat of a GATT challenge to BTAs continues to deter nations from adopting such adjustments.

U.S. leadership in clarifying that BTAs are allowed is critical for three reasons. First, it is an essential precaution to protect American jobs and industries in case the United States should ever itself decide to adopt a carbon/energy tax. Second, U.S. support is particularly important because the United States has been a leader in the creation of the World Trade Organization and the world trade regime, and also because the United States has traditionally been hostile to the expansion of BTAs on taxes on manufacturing inputs. As a result, U.S. opposition to BTAs on carbon/energy taxes is widely seen as a potential barrier to their adoption, even though the United States has not yet adopted a formal position. Finally, it is important to assure that BTAs are available to other nations even if the United States chooses not to itself adopt a carbon/energy tax. It is in the United States' interest to make it easier for other nations to adopt taxes, both because the United States and all nations benefits from the emissions reductions directly caused by such measures, and because all nations benefit from the emissions reductions flowing from a tax-induced acceleration in the development of efficiency technologies and renewable alternatives to fossil fuels.

V. Offsetting Competitive Burdens: An Investment Tax Credit

A. Nature and History of the Credit

A number of authors have proposed offsetting the burden of a carbon/energy tax by reducing the tax burden on capital. This section examines the potential of an investment tax credit (ITC) to offset the burden of our reference tax proposal.

The ITC was first enacted by the Kennedy administration in 1962 and repealed by the Tax Reform Act of 1986. Under the ITC in its final form, investment in qualifying depreciable (or amortizable) property with a useful life of at least three years resulted in a tax credit equal to 10 percent of the investment. The most important classes of qualifying property were tangible personal property, primarily equipment, and certain structures integral to manufacturing, such as bulk storage facilities. In between 1980 and 1985 roughly $18 billion of ITC was awarded each year (current dollars). About 40 percent of this went to manufacturing industries.

B. Methodology

Based on inflation and the increase in equipment investment since the first half of the 1980s, we estimate that a 10 percent ITC would have cost $27 billion in 1991 (1991 dollars). Because industry investment rates vary considerably from year to year, with an investment cycle for some industries of 20 years or more, 1991 industrial investments rates are not adequate indicators of the benefits of an ITC for different industry sectors. We therefore constructed 20-year average investment rates by two- and four-digit SIC industry (1972-1991) as a percentage of value of shipments.[25] These rates were then multiplied by the 1991 shipments to estimate the distribution of the benefits of an ITC by industry.

This analysis does not assume that an ITC would be included in the alternative minimum tax base. If the ITC is assumed to be in the AMT base, firms covered by the AMT would receive no benefit from the credit. This would reduce both the cost of the provision and its effectiveness as an offset to a carbon/energy tax. The AMT is further discussed in section VI.C below.

Our reference proposal recycled 70 percent of the revenue through labor tax reductions, half of which (35 percent) went to industry. For our ITC analysis, we assumed that half of the unallocated revenue—an additional 15 percent of the carbon/energy tax revenue—was returned to industry through an ITC, raising the total revenue recycled to industry and commerce to 50 percent. This amount of revenue is sufficient to fund a 4 percent ITC. Results of this calculation are shown in columns 8 and 9 of Tables 1, 2 and 3.

C. Results by Industry

When the ITC is included, many of the non-energy intensive industries have negative or zero net tax burdens. Table 3 shows that the additional return of revenue through the ITC is sufficient to bring the average net tax burden on the lease energy-intensive 86 percent of industry down to zero. A close analysis of the ITC and labor tax columns shows that the ITC is somewhat more tightly correlated to energy consumption than the labor tax reduction. However, the ITC is only marginally more effective than labor tax reductions in addressing the tax burden on the most energy-intensive industries. For example, the net tax burden on cement falls from 13.6 percent of shipment to 13.2 percent. This pattern is repeated across energy-intensive sectors, e.g., aluminum (15.0 percent to 14.8 percent), steel (5.8 percent to 5.6 percent) chlor-alkali (9.9 percent to 9.3 percent) and industrial gasses (8.4 percent to 7.9 percent).

This analysis addresses only the changes in direct tax burden—it does not include the economic benefit of reduced energy consumption or increased productivity due to newer, more efficient equipment.

This small reduction in tax burden on energy-intensive industries is somewhat surprising given that we have increased the proportion of the total energy tax revenues recycled to industry by more than a third (from 35 percent to 50 percent). This result reflects the extreme concentration of industrial energy consumption in a few processes. Although energy-intensive industries also

[25] Investment rates were calculated by the author from unpublished data used to construct the NBER Manufacturing Productivity Database. Data set provided by Dr. Eric Bartelsman.

tend to be capital-intensive, this analysis demonstrates that the concentration of energy use is much greater than the concentration of capital services.

Prior to its repeal, ITC went primarily (~60 percent) to non-manufacturing industries, the bulk of which are not very energy-intensive. Within manufacturing, more than half of the ITC goes to industrial sectors with net tax increases under our reference proposal of less than half of 1 percent. This suggests that, for any given level of revenue commitment, if the coverage of the ITC could be restricted to energy-intensive industries or processes, or to investments that significantly reduce energy consumption, the rate of the credit could be increased substantially, thus more effectively targeting competitive effects. For instance, we could offer a 20 percent investment credit if the credit could be limited to the fifth of all investment most directly related to energy consumption. Although this paper does not make quantitative estimates of the share of equipment involved in energy conservation or in energy-intensive processes, we are confident that it is less than a fifth of all investment.

In the next section we discuss how a credit limited to energy efficiency investments or to energy-intensive processes could be designed and administered.

VI. Offsetting Competitive Burdens: An Energy Efficiency Credit

A. Overview of the Efficiency Credit Approach

The competitive burden of fuel taxes comes from increased fuel bills caused by higher fuel prices. If energy consumption per unit of output can be lowered through the adoption of new and more efficient technology, the burden of these taxes is offset to that extent.[26]

A large number of engineering studies in many nations have suggested that, even at current prices, national energy efficiency gains on the order of 10-20 percent could be achieved by adopting available best-practice technologies.[27] This figure appears to be roughly constant over the last twenty years despite considerable improvement in industrial energy efficiency throughout the OECD over that period, suggesting that the process of adopting existing efficiency technologies leads to learning about new opportunities for further efficiency gains. [28] There is considerable evidence that firms generally under-invest in technology because some of

[26] Howard Geller, John DeCicco & Steven Nadel, *Structuring an Energy Tax So That Energy Bills Do Not Increase*, American Council for an Energy-Efficient Economy, Washington DC (1993).

[27] Intergovernmental Panel on Climate Change Working Group III Second Assessment Report, *The Economic and Social Dimensions of Climate Change* (1996).

[28] Michael Grubb, Thierry Chapuis, & Minh Ha Duong. "The Economics of Changing Course: Implications of Adaptability and Inertia for Optimal Climate Policy," Energy Policy 23(4/5):417 (1995).

the benefits of such investment are not enjoyed by the investor, but rather flow to other firms or to society as a whole. [29]

Thus it is desirable, both economically and environmentally, to accompany an energy tax with a package of measures that encourage the adoption of more energy-efficient processes. One such measure is a tax credit for investments in energy efficiency technology. Such a credit encourages adoption of energy efficiency technologies by reducing the cost of capital devoted to those investments. Models of such credits include a short-lived federal efficiency credit, the generous Danish credit system which accompanies their carbon/energy tax, and the Oregon state energy efficiency investment credit.

B. Designing an Efficiency Credit

The most difficult part of designing a good efficiency credit is determining which investments will be eligible. Ideally the credit should be targeted to investments with high reductions in energy consumption relative to the tax revenue foregone. However, this sort of balancing would require engineering analysis which the taxing authority is not well equipped to audit. Tax officials are trained in financial, not engineering analysis.

There are several possible approaches to dealing with this problem, none of which is perfect. First, the Environmental Protection Agency or Department of Energy could develop a list of approved technologies, technologies with high expected energy saving per unit of tax revenue lost. The tax credit would be available for any investment in an approved technology. This approach requires considerable technical expertise and administrative resources on the part of the certifying agency, and can suffer from problems of delay in approving new technologies.

A second approach is self-certification by firms, combined with technical audits. Firms desiring an investment credit would present an engineering analysis of the energy savings from the proposed investment, and its cost. Again, the investment would have to meet a pre-determined threshold of carbon/energy savings per unit of tax credit to be approved. Because of the potential for tax avoidance by presenting inflated carbon savings estimates, a system of engineering audits would be required. This is essentially the approach of the Oregon system described below.

The low-income housing investment credit provides an interesting model of fiscal federalism that might be applied to an energy credit using a self-certification approach. Under the low-income housing credit, credits are distributed to the states, which then administer a competitive application process, awarding the limited supply of credits to the development projects which offer the greatest benefit to low income households. In essence, private developers bid for the

[29] For a review of the evidence that private research creates external benefits, see Zvi Griliches, "The Search for R&D Spillovers," *National Bureau of Economic Research Working Paper No. 3768* (1991). For a discussion of the impact of such spillovers on environmental policy, see Hoerner et al., Promoting Growth and Job Creation through Emerging Environmental Technologies," Washington DC: *National Commission on Employment Policy*, April 1995.

limited supply of credits. Oregon has a similar application process with a limited supply of energy efficiency credits. States will often be more familiar with local conditions and with local applicants. However, such a state-based assessment process may be burdensome to firms with plants in several states which wish to maintain a uniform technology across their plants. In addition, the recent cutbacks in state energy offices has reduced the number of states which are well positioned to assess industrial energy efficiency proposals.

A final approach is to base the credit on changes in a firm's aggregate energy efficiency, rather than conducting investment-specific assessments. A firm would apply for an investment credit based on the firm's total investment in equipment of all kinds and its reduction in aggregate carbon emissions.[30] Credits would be granted to firms that meet a specified ratio of carbon reduction per dollar of credit.

The advantage of the aggregate efficiency approach is that it can be audited based entirely on accounting, with no engineering analysis. A firm's total carbon consumption can be measured by the carbon/energy tax it pays on fuels and electricity, an auditable financial measure. Moreover, this approach provides firms with complete flexibility in technological choice. However, assuming the credit is only available for energy-intensive processes and products, for firms with a changing mix of product lines with different levels of carbon intensity this approach would have to be applied on a product-by-product basis. The administrative complexity of this disaggregation may offset the benefits of flexibility and accounting-based administration. Another drawback is that, so far as we are aware, such a "pure accounting" approach has not yet been tested anywhere.

C. Investment Credits and the Alternative Minimum Tax (AMT)

Firms in many of the most energy-intensive industries are chronically covered by the AMT. The AMT applies a lower tax rate to a higher tax base calculated by eliminating many forms of tax preference. If an efficiency credit would be limited by the AMT, this would greatly reduce its effectiveness. Congress has shown reluctance to exclude new tax benefits from those added to the AMT base. However, the case for excluding efficiency credits from the AMT base is unusually good, as the purpose of this credit is to partially offset, through the income tax, an increase in non-income tax burden. Thus there is no sense in which the reduced income tax burden results in a "free ride."

[30] A slightly more complicated formulation of the carbon reduction test is necessary to avoid unjustified provisions of credits to shrinking firms and denial of credits to growing firms. Instead of comparing carbon consumption in the base year and the subsequent year, base-year consumption would be compared to the subsequent year's carbon consumption times the ratio of current to base-year value added.

D. Assessing Efficiency Credits

A stand-alone efficiency credit, however effective, is probably inadequate to offset industrial competitive burdens. This is because its benefit is uneven across firms and industries. A credit provides the most assistance to firms and industries that are using old, inefficient technology or that enjoy a rapid rate of innovation and capital turnover.

The environmental incentive of a credit is potentially substantial. The emission reductions caused by a credit go beyond the efficiency gains achieved by the recipient firms. By accelerating the development and commercialization of new clean technologies, a credit can promote emission reductions in all firms that adopt the technology, whether or not they receive the credit. The administrative and compliance burden of efficiency credits with different designs vary considerably. However, even the technology-specific forms of eligibility determination are administrable, as the examples below demonstrate.

A credit might be seen as unfairly benefiting firms that have dragged their feet in adopting high environmental standards, especially if the credit is generous enough to provides its beneficiaries with a major cost advantage. High credit rates have also been associated with tax shelters. To avoid these problems, the credit rate should not exceed 10-20 percent of equipment value. Similarly, the credit could be seen as violating the polluter-pays principle by providing subsidies to polluters. However, if the purpose of the credit is to provide transitional assistance to firms facing new, tighter standards, then it does not violate the polluter-pays principle.[31] The revenue loss from a credit will vary with its scope and rate, but should not exceed a modest fraction of the total tax revenue.

An efficiency credit program would both amplify a carbon/energy tax's environmental benefits and reduce its economic burden. By reducing cost of capital and lowering fuel bills through enhanced technical efficiency, the credit enhances the competitiveness of eligible firms. If the carbon/energy tax has an effective system of border tax adjustments, the addition of efficiency credits may in some cases leave fuel-intensive firms in a better competitive position than if no tax were enacted. The credit also promotes development of new clean technologies for both domestic use and export. Thus it is likely to be a desirable component of an overall tax package.

E. Three Models of Energy Efficiency Credits

1. The U.S. federal energy efficiency credit

From October 1, 1978 to December 31, 1982 the federal government provided a 10 percent tax credit against investments in "energy property" used in a trade or business. Under the Energy

[31] OECD, Recommendation of the Council on Implementation of the Polluter-Pays Principle, Recommendation C(74)223, adopted Nov. 14, 1974, reprinted in 14 ILM 234 (1975); see also Sanford E. Gaines, "The Polluter-Pays Principle: From Economic Equity to Environmental Ethos," 26 *Texas International Law Journal* 463-96, 476 (1991).

Tax Act of 1978 [32] energy property included a short list of energy conservation equipment. The Treasury department was authorized to extend that list by regulation. The Windfall Profits Tax Act of 1980[33] clarified the standard of review to be used by the Secretary in determining technologies to be added to the list, providing a long list of factors to be considered.[34]

The original list of industrial energy efficiency equipment covered by the credit consisted of 12 items: (1) a recuperator; (2) a heat wheel, (3) a regenerator, (4) a heat exchanger, (5) a waste heat boiler, (6) a heat pipe, (7) an automatic energy control system, (8) a turbulater, (9) a preheater, (10) a combustible gas recovery system, (11) an economizer, or (12) an other property of a kind specified by the secretary by regulation.[35]

Because of the short duration of the credit and the complexity of the findings required by the 1980 Act, relatively few new technologies were added by regulation before the credit expired. However, the credit provides an example of one approach to efficiency investment credits: the approved-technology list. The major lesson of the federal credit experience is that this approach requires a more streamlined evaluation system to be effective. In the context of a carbon/energy tax a simple energy cost-reduction payback analysis would probably be sufficient. The task of conducting such analyses should be given to the Department of energy rather than to the Treasury.

2. The Danish model

The government of Denmark has enacted one of the worlds most aggressive programs of promoting energy efficiency through the tax system. A carbon/energy tax has been imposed on industrial fuel use, distinguishing three types of energy use: 1) space heating, 2)heavy (energy-intensive) processes, and 3) all other uses. The taxes are gradually phased in over the 1996-2000 period. When fully phased in, these taxes will be about equal to $340 per ton of carbon on heating, $14 on heavy processes[36] and $51 on light processes[37]. The Danes appear to be

[32] Pub. L. No. 95-618, 92 Stat. 3174, codified at 26 U.S.C. Sec. 39-48. See especially I.R.C. 46(a) (1979).

[33] Pub. L. No. 96-223, 94 Stat. 229, codified at 26 U.S.C. Sec. 39-48.

[34] Among the factors to be considered was whether other federal subsidies made the credit unnecessary, whether the credit would increase demand for the item; whether there is sufficient production capacity to meet this demand; the use of energy to produce the item; the useful life of the item; and a number of other factors.

[35] IRC Sec. 48(k)(5), Public Law 95-618, Nov. 9, 1978, 92 Stat. 3197.

[36] Heavy processes are those for which a carbon/energy tax of $28/ton exceeds 3 percent of value added for an average enterprise, considering only its energy-intensive operation.

[37] Based on current exchange rates of DKK=$0.17 U.S. and converting a tax measured per metric tonne of carbon dioxide to a tax on short tons of carbon. Tax rates on individual fuels are not strictly proportional to their carbon content but rather have both a carbon and an energy component. These figures represent the average burden per ton of carbon for

committed to the tax approach. A recent government assessment found that "Danish experience over many years is that we have not damaged our competitiveness because of green taxes. In addition, we have developed new exports in the environmental area."[38]

A generous system of tax rebates and investment grants is available for firms that adopt energy agreements with the government. These incentives amplify the market signal of the tax itself. Almost 90 percent of the carbon/energy tax on fuels used for heavy processes is rebated if the firm undergoes an energy audit and agree to adopt all efficiency-improving investments which have paybacks of four years or less. The value of reduced fuel consumption is calculated based on the full tax rate rather than the reduced heavy-industry rate. For light processes, a smaller rebate—about 25 percent when the tax is fully phased in—is available to firms which have tax liabilities in excess of 3 percent of value added. The investment requirement for these firms is based on a six-year rather than a four-year payback requirement. No rebate is available for the tax on fuels used for heat. The industrial heating fuels tax is being increased to equal a similar tax on home heating fuels. Energy agreements also include a number of other terms, such as adopting effective energy management, accounting and reporting systems and employee education and motivation.

The Danish system involves extensive industry-government negotiations and has a fairly high administrative overhead, especially in the early years when about 4 percent of the total revenue collected from industry is devoted to administration of the efficiency mandate. Administrative costs remain roughly constant but fall to about 2 percent of revenues as the tax rate increases.

In addition to the energy tax reductions, a large fraction of the total energy tax revenue — about one quarter in the first four years—is earmarked for an energy efficiency investment grant program. The grant program is regarded as a transitional measure to assist industry in adapting to higher energy prices and achieving emissions reductions. Over a five year period the grant program is phased out and the revenues redirected to further reduce labor taxes. Up to 30 percent of the cost of investment is available from the grant program. Grant applications are approved on a case-by-case basis. Grants are awarded based on a financial and engineering analysis demonstrating that the project has a payback in terms of energy saving of at least two but not more than seven years, and that the investment would not be undertaken but for the grant.

all fuels.

[38] Danish Ministry of Economic Affairs, "Environmental Taxes, Tax Reform and the internal Market -- Some Danish experiences and Possible Community Initiatives," *in Environmental Taxes and Charges -- National Experiences and Plans*, European Foundation for the Improvement of Living and Working Conditions, Luxembourg (1996).

3. The Oregon State energy efficiency investment credit

The state of Oregon provides a 35 percent credit against investment over a five-year period for approved energy efficiency investments.[39] Projects must produce "substantial " energy savings in order to be eligible. Substantial is defined as 50 percent of the energy used to heat water, 10 percent of the energy used to heat a building, 10 percent of a commercial or industrial process load, or 30 percent of a waste heat stream for heat recovery projects.

The Oregon system is basically a self-certification and audit approach. Projects must be approved by the Oregon Department of Energy (ODoE). Application processing generally takes less than 30 days. The ODoE is authorized to approve up to $40 million in investments ($14 million in credits) a year.

This program has been in operation since 1980 and has approved credits for investments amounting to roughly half a billion dollars. According to an unpublished survey conducted by the Oregon State University Survey Research Center on behalf of the ODoE, approximately half of the investment projects either would not have gone forward without the credit or involved more extensive conservation measures than would have taken place without the credit.

VII. ALTERNATIVE APPROACHES TO EMISSIONS REDUCTIONS AND COMPETITIVENESS

A. Tradable Permits vs. Environmental Tax Reform

Under standard economic theory, a carbon/energy tax and a tradable carbon emissions permit system which result in the same level of emissions reduction will have the same impact on the price of fossil fuels and derivative energy sources such as electricity. A tax sets the increase in price and allows the market to choose the quantity of fuels purchased, while a permit system sets the reduction in emissions and allows the market to set the increase in fuel price.

Tradable permits can be auctioned, in which case the similarity to a tax is further increased in that both systems yield the same revenue, under conventional economic theory. Alternatively, tradable permits can be grandfathered —provided to current fossil fuel producers in a fixed ratio to current production. The United States employed such a system of grandfathered production allowances to reduce the production of ozone-depleting chemicals. A tax was also applied to those chemicals at the same time to provide an incentive for even more rapid phase-out.

Caps and taxes vary in their allocation of environmental and economic risk. Tradable permits provide certainty in the level of emissions, at the cost of potentially high economic costs if the nation is slow in developing emission reduction alternatives. This risk is greatest if the economy grows faster than anticipated. Such rapid growth coupled with rigorous caps could result in fuel

[39] O.R.S. 469.185 - 469.225

shortages or skyrocketing fuel prices. Taxes provide certainty in the level of economic cost of reductions, at the expense of potentially high emissions if the nation is slow in developing emission reduction alternatives or grows faster than anticipated.

Given the current unpopularity of new taxes and the relatively recent defeat of the Btu tax, there has recently been increased attention given to the grandfathered permit approach. Grandfathered permits are seen as less tax-like than auctioned permits because they do not raise revenue. In addition, a grandfathered permit system would provoke less opposition from fuel producers, who spearheaded the campaign against the Btu tax.

A grandfathered permit system with permits distributed to fuel producers is essentially equivalent to a government-enforced fossil fuel cartel. For a given level of emissions reductions it results in the same price increase as a tax, but the revenue flows to the fuel producers rather than to the government. Such a system would actually make fuel producers better off than if no regulation were imposed.

For energy-intensive industries, however, a permit system would produce the same competitive burdens as a comparable tax. From an industry perspective it matters little if the price increase is caused by a permit or a tax system. However, the permit system has two major disadvantages relative to a tax. The first is that energy price increases, unlike tax energy tax increases, may not be border adjusted under GATT law, at least as it now stands. The second is that, because under a grandfathered permit system all the revenue goes to fossil fuel companies rather than to government, there is no revenue to fund labor or capital tax cuts, efficiency credits, or other competitive offset programs. Thus a grandfathered permit system would place U.S. competitiveness at greater hazard than an equivalent tax. An analysis of the results of 16 major economic models found that policies like grandfathered permits which do not raise or recycle revenues cost the U.S. economy about 1 percent of GDP relative to a carbon/energy tax or auctioned permit system with revenue recycling.[40] Recent research has suggested that, for plausible U.S. greenhouse gas emission reduction levels, the economic cost of market instruments which fail to recycle revenue is about three times the cost of a tax-shifting approach.[41]

There has been some discussion within the Clinton Administration of instituting a grandfathered permit system for large industrial fuel users, rather than at the fuel producer level. This approach reduces the competitive burden of the permit system on industry relative to a permit system for fuel producers. However, it suffers from several serious deficiencies. First, the number of taxpayers increases enormously, and with it the administrative and compliance burden. Second, in many industries large industrial facilities and firms compete directly with small facilities or firms. A permit system applying only to large emitters would advantage small unregulated

[40] Id at note 6.

[41] Id at note 5.

emitters relative to large regulated emitters. To the extent that such a permitting system resulted in the displacement of production in large plants with production in small plants, it produces market disruption and inefficiency without any corresponding environmental gain.

B. Non-tax Approaches to Competitive Offsets

This paper has focused on offsetting the competitive burden of carbon/energy taxes by using the revenue to reduce other taxes. In the alternative, some of those revenues could be used to increase expenditures in areas that promote long- and short-term competitiveness. Examples of such policies include:

1. **Increased federal expenditures on basic research especially in efficiency and renewable technologies.** Fundamental technological change is the primary engine of long-term economic growth.[42] Declining private research suggests that America's long-term growth prospects may depend on a more active role for the federal government in funding fundamental research in areas related to commercial activity.[43]

2. **Demonstration and early commercialization of new technologies.** Often the largest barrier to the adoption of new technologies is passing the early demonstration/commercialization hurdle.[44] Federal demonstration and purchasing programs, have played an important role in commercializing technologies including railroads, semiconductors, computers and the internet. Government-sponsored R&D is responsible for many commercially important energy efficiency technologies.[45] However, such programs are likely to succeed only if they have the active support and participation of industry leaders.

3. **Public/private energy research consortia.** Private industry is generally best positioned to know what research is most needed to promote their competitive position. However,

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[42] Edward F. Dennison, *Trends in American Economic Growth*, 1929-1982, Washington, DC: Brookings Institution, 1985; E.F. Dennison, *Why Growth Rates Differ*, Washington, DC: Brookings Institution, 1985. For a surveys of the literature, see Angus Madison, "Growth and Slowdown in Advanced Capitalist Economies," *Journal of Economic Literature* 25, June 1987; and Michael Boskin & Lawrence Lau, "Contributions of R&D to Economic Growth," in Bruce Smith & Claude Barfield, ed., *Technology, R&D, and the Economy*, The Brookings Institution, Washington DC (1996).

[43] Jack Eisenhauer, *Corporate R&D in Transition*, Energetics Inc. for U.S. Department of Energy Office of Science Policy (forthcoming 1997); for a discussion of the importance of research to the chemical industry, see Dan Steinmeyer, *The Chemical Industry in the USA: The Role of Energy and the Impact of Energy Prices*, Monsanto (1997).

[44] Office of Technology Assessment, U.S. Congress, *Industry, Technology and the Environment: Competitive Challenges and Business Opportunities*, Washington, DC: U.S. Government Printing Office, 1994.

[45] Howard Geller and Scott McGaraghan, *Successful Government-Industry Partnership: The U.S. Department of Energy's Role in Advancing Energy-Efficiency Technologies*, Research Report No. E961, American Council for an Energy-Efficient Economy: Washington DC (1996).

industry is often prevented by competitive pressures from making research investments which may have long paybacks or may benefit the industry as a whole, rather than their individual firm. Through public/private research consortia, it may be possible to combine the benefits of public research funding with private industry know how. Such consortia played an important and effective role in developing substitutes for ozone-depleting chemicals.[46]

4. **A revolving loan fund for efficiency investment.** Often companies which are temporarily cash-constrained are unable to pursue economically rational investments because of difficulties in accessing external capital markets. Frequently these are the very companies most in need of modernization. Revolving loan funds for investments in energy efficiency and renewables can address this problem of liquidity constraint. Many state development authorities (e.g., New York[47]) have good experience with revolving loan funds as a development tool.

5. **Increased public investment in education and training.** Ultimately, the primary driver of U.S. economic growth is the skills of our people. In studies of the determinants of the location of new investment between states and nations, workforce skills are always in the top four or five items.[48] Provided it can be targeted efficiently, investment in increased education and training may be an effective device for promoting American competitiveness.

VIII. CONCLUSION

A. Assessing and Assembling Offset Packages

Much of the concern about carbon/energy taxes has been focused on their impact on jobs and the competitiveness of domestic energy-intensive industries. A number of policies to offset such impacts have been adopted or proposed. However, there is little consensus on which offset policies are best. In part this lack of consensus is due to the failure to evaluate such policies by any consistent set of criteria. In part B of this section we propose a list of criteria by which alternative competitive offset strategies can be evaluated.

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[46] Therese Keane, *The International Cooperative for Ozone-Layer Protection (ICOLP) 1990-1995,* Washington DC: Masterprint (June 1995).

[47] Elliott and Wiedenbaum (April 1994)

[48] John P. Blair and Robert Premus, "Major Factors in Industrial Location: A Review," *Economic Development Quarterly* vol. 1 no. 1 (1987). Note that state and national taxes are generally not among the top five factors in making plant siting decisions. As to this point, *see also* Robert Lynch, *Do State and Local Tax Incentives Work,* Economic Policy Institute: Washington DC (1996)

So far, this paper has examined competitive offsets in isolation from each other. However, several of the measures described here could be effectively combined to produce positive synergies. Indeed, by integrating a range of tax and non-tax approaches, it may be possible to use climate policy to promote the overall competitiveness of U.S. industry. In part C below we conclude with a brief examination of the potential for assembling policy packages to promote overall competitiveness.

B. Assessing Alternative Offset Options

In our judgment, any measure or package of measures to offset the competitive burdens of carbon/energy taxation should meet the following six criteria:

1. **Effectiveness.** The measure(s) should be effective in protecting or promoting the competitive position of energy-intensive industries against untaxed foreign competition in both domestic and international markets.

2. **Environmental Incentive.** The measure(s) should maintain the tax's price incentive to reduce emissions, whether by developing new clean technologies and processes or by shifting toward less carbon-intensive patterns of consumption.

3. **Administrability.** It should be possible to administer and enforce the measure(s) consistently and at a reasonable cost (including compliance costs accrued by the taxpayer).

4. **Fairness, Actual and Perceived.** The measure(s) should distribute the energy tax burden fairly and should be perceived as fair by the public.

5. **Revenue Loss.** The measure(s) should not be unnecessarily expensive.

6. **Consistency with U.S. Obligations.** The measure(s) should be consistent with U.S. treaty obligations under international environmental and trade agreements, especially the Framework Convention on Climate Change and the General Agreement on Tariffs and Trade.

These criteria are discussed in greater detail in our companion paper, *Carbon Taxes for Climate Protection in a Competitive World.*[49]

[49] Andrew Hoerner & Frank Muller, *Carbon Taxes for Climate Protection in a Competitive World*, American Council for an Energy-Efficient Economy, Washington, DC (forthcoming). An earlier version of this paper was commissioned by the Swiss Federal Office for Foreign Economic Affairs.

C. Assembling a Competitive Offset Package

None of the competitive offsets discussed in this paper is perfect. Labor tax cuts offset the burden on households and low-energy industry, but do little for high-energy industry. Across the board cuts in capital taxation appear to have a similar impact on industry, but do not offset household burdens. Targeted efficiency investment credits provide more focused relief and promote the adoption of new technology, but vary considerably in their effectiveness across firms and across years. Border tax adjustments are extremely effective in offsetting international competitive burdens on energy-intensive firms, but do not especially promote new technology and do not offset the competitive burden of a carbon/energy tax on firms which are not energy-intensive.[50] Additional non-tax approaches are discussed in Section VII above.

However, the offsets described above are not mutually exclusive. Indeed, any credible package of revenue recycling instruments will probably employ several of them. BTAs are approximately revenue neutral,[51] and can be combined with any of the other options discussed. Labor tax reductions are necessary to offset household burdens, but need to be combined with energy efficiency credits or similar spending measures in order to provide adequate offsets to energy-intensive industries and promote the adoption of new technologies. Thus a package consisting of labor tax reductions, BTAs, and some combination of energy efficiency credits and non-tax measures to promote new technology may well be appropriate.

Under the rules of the GATT/WTO, some taxes—including energy and fuel taxes—can be border adjusted and others—such as payroll and income taxes—cannot. Where an industry faces similar burdens under two different taxes, one border adjustable and one not, the tax which is not border adjustable will impose a higher competitive burden than the one which is. Thus a reduction in a non-adjustable labor tax, funded by an increase in a border-adjustable energy tax, will improve the competitive position of such an industry. Thus a policy package including tax-shifting with border adjustments and perhaps other incentives for energy efficiency would improve the overall competitiveness of U.S. manufacturing by promoting plant modernization and technological development and by lowering the average tax burden on exported goods.

Under the GATT, nations are forbidden to impose BTAs on taxes on wages, income or profits.[52] On the other hand, in Section III.C we argue that under a proper reading of the negotiating history BTAs on energy taxes are GATT-legal. Thus the shift from labor to energy as a tax base can reduce the overall competitive burden of the tax system. Labor-intensive industries receive the competitive benefits of lower labor taxes. Energy-intensive industries receive the benefit of

[50] We assume here that BTAs will apply only to energy-intensive products in order to keep the system administrable.

[51] U.S. exports and imports have comparable energy intensity. However, BTAs would lose a small amount of money in the United States if we continue to run a persistent trade deficit.

[52] *Working Party Report on Border Tax Adjustments*, BISD 18S/97, p. 101, para. 13-14 (1970).

lower labor taxes, the investment tax credit, and any non-tax measures, while the additional burden due to energy taxes is relieved at the border. As a result, a well-designed system of competitive offsets can place both energy-intensive products and non energy-intensive products in an improved competitive position in international markets.