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Accelerating the transition to a sustainable society

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ACCELERATING THE TRANSITION TO A
SUSTAINABLE SOCIETY

A Thesis

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Master of Landscape Architecture

in

The School of Landscape Architecture

by
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Dedication

For my family, whose support has made all things possible.

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Abstract

As human populations increase, available land and resources decrease, and we begin to better understand the impacts of human activity on the environment, a strategy for human development that meets both the needs of society and the environment is being increasingly called upon. This movement has come to be known as sustainability. While this term is prevalent in the design and planning communities, it is important that this concept be brought to the attention of the general public, whom will ultimately decide the success or failure of this scheme. The question then is how to begin implementation of sustainable practices, as well as how to inform the largest segments of the population about the need to do so.

The main objective of this thesis is to demonstrate that environmental taxes have the ability to begin the transition to a more sustainable society, both by addressing the goals of sustainability, and by increasing public awareness. Research gathered from this investigation is used to determine five goals of sustainability, and six results of environmental taxation. By demonstrating that the results of environmental taxation can be directly related to the goals of sustainability, it is possible to show that environmental taxes have the capacity to bring about many of the changes necessary in achieving a more sustainable society.

The ability of environmental taxes and tax shifting to promote eco-efficiency, improve environmental quality, generate revenue, bring about educational and behavioral change, create new jobs and industries, and stimulate innovation suggest that these measures may be one means of achieving a more sustainable society. This is based on the fact that many of the results of environmental taxes can be applied to more than one

of the goals of sustainability, which are the conservation of natural resources, the maintenance of diversity, distributional equity, public participation, and education. This paper does not profess to be the only answer, it is simply one possible solution to a problem that we face today, and will continue to face in growing proportions if nothing is done to address the problem.

Chapter One: Introduction, Problem Statement, Objectives, Scope, & Methodology

Introduction

Before beginning, I would like to address the subject of sustainability from a personal perspective. In my mind the need to foster a sustainable world civilization is not debatable. The materialistic world within which we live has not made us happier, nor has it provided us with more opportunity to enjoy our material possessions. Instead it has created a cycle in which we must work more and harder in order to accumulate the objects that we are told will make us happy. So we work more and buy more to meet society's expectations, never considering the consequences it is having on our health or the health of the environment. But all of these products must be made of something, and some form of energy must go into changing the raw material into the finished product. Then there is the energy used to transport the product to market, which in our day of globalization is many times not even the country in which it was produced. Eventually, the natural resources that are used in production, as well as fuel the fires of production, will be depleted or degraded to a level where they are no longer useful. A concern of many engaged in the debate is that long before this happens, if we continue on our current path, it is likely that man will have created a world that is no longer capable of supporting human life in any wholesome or meaningful way. That is why we must make the decision which path do we take? Do we continue on the path of unquenchable consumption? Or do we forge a new path, one that will provide us with the necessities of life, while also maintaining environmental quality. I propose the latter, and believe that

sustainability will play a prominent role in helping us to achieve the much needed transition to a society that understands the implications of human activity upon the earth.

Of course it will be a long road, and will require a massive overhaul of the way we currently structure our societies. The costs of this change will no doubt be huge, but as President John F. Kennedy said, “There are risks and costs to a program of action. But they are far less than the long range risks and costs of comfortable inaction” (Brown, 2001, 119). What we must consider is the long range risks and costs of our actions, or more precisely our inactions, on our children and future generations. The push to affect change will depend on the cooperation of people from all occupations and all countries. No one country can make the change for the world, but the wealthiest and most industrialized countries, who can probably receive most of the blame for our current state, should rise to the occasion and lead the world by example to a better way of life. To me it is not a question of if it is needed, instead it is a question of when and how it will be implemented.

Landscape architects have the potential to be major players in this movement due to their ability to mesh the natural sciences, social sciences, and art, as well as their international exposure. In 1969 Ian McHarg, one of the fathers of environmental landscape architecture, eloquently stated the reasons for man to live in harmony with nature:

“Clearly the problem of man and nature is not one of providing a decorative back-cloth for the human play, or even of ameliorating the grim city: it is the necessity of sustaining nature as a source of life, milieu, teacher, sanctum, challenge, and most of all, of rediscovering nature’s corollary of the unknown in the self, the source of meaning.”

(Benson, 2000).

Problem Statement

The purpose of this study is to illustrate that environmental economic instruments, specifically environmental taxes, can be implemented to facilitate and expedite the behavioral changes necessary in creating a sustainable civilization.

Objectives

The objectives of this research are to demonstrate the relation between the results of environmental taxes and the goals of sustainability. These relationships can then be used to demonstrate that environmental taxes are capable of achieving the desired effects of sustainability, and to propose that sustainability may never occur without the behavioral changes that can be accomplished through economic incentives.

Scope

The topic of sustainability is vast, the entirety of which is well beyond the scope of this thesis. The focus of this thesis is to propose one way in which the goal of a sustainable civilization may be achieved. For the purpose of this thesis the term sustainability will be used, as defined by the Bruntland Commission, as: “Development which meets the needs of the present with out compromising the ability of future generations to meet their own needs.” The objective then is not to demonstrate the formulation of environmental taxes, to suggest the appropriate rates of taxation, or even to suggest what a sustainable society may look like. Instead it is intended to demonstrate how environmental taxes can serve to reinforce and attain many of the goals of sustainability. This can be achieved by forcing our societies to take responsibility for their actions, thus moving us closer towards a sustainable society.

Methodology

In order to illustrate that environmental taxes can be implemented to facilitate and expedite the behavioral changes necessary in creating a sustainable civilization a framework for making this argument must be established. The first step will require the collection of information pertaining to sustainability, economics, environmental taxation, and the environment. This will provide a vast collection of information that will serve as the starting block for understanding the topics to be covered, as well as allowing the interrelations of the topics to become more visible. The second step will require that all of the information gathered be analyzed in order to determine its relevance to the problem statement. Once all of the information has been sorted through, eliminating extraneous information, it will be necessary to establish what the results of environmental taxation are, as well as what the goals of sustainability are. In order to make the argument that environmental taxes are capable of achieving the goals of sustainability, it is important to first demonstrate that environmental taxes have the ability to meet their environmental expectations. This will be accomplished through case studies of the effects of different forms of environmental taxation in different countries. If environmental taxes can be shown to be effective at achieving their environmental goals, the next step will be to establish criteria by which the results of environmental taxes and the goals of sustainability can be compared, determining the similarities between the two and how environmental taxation is capable of meeting the goals of sustainability. The final step will be to demonstrate that the results of environmental taxation are indeed capable of meeting the goals of sustainability, thus indicating that environmental taxation can accelerate the transition to a more sustainable society.

Chapter Two: Literature Review

Introduction

The topic of sustainability is vast, the entirety of which is well beyond the scope of this thesis. The purpose of this study is to propose one way in which the goal of a sustainable civilization may be achieved. Sustainability was first defined by the Bruntland Commission as “Development which meets the needs of the present without compromising the ability of future generations to meet their own needs” (Benson, 2000, 4). Although sustainable development may sound like an oxymoron much like ‘political science’, ‘business ethics’ or ‘military intelligence’ this was the intent. Gro Harlem Bruntland has claimed that the term was an intentional juxtaposition of two irreconcilable notions in an attempt to bring two opposing parties to the same conference table (Benson, 2000, 2). Thus far it has been moderately successful. Sustainable development has become a common topic of politics, environmentalism, economics, and design. It is commonly agreed that the four most important aspects to implementing sustainable practice are function, the economics or costs, the aesthetics of environmental projects, and education, not necessarily in that order of importance. The intent of this thesis is to explore how economic tools, especially environmental taxes, can be effectively wielded to achieve results that are both sustainable and beneficial to society as a whole. Inherently, I believe that these economic tools are not only a means to achieve sustainable development; they are perhaps the only way to educate the public about the need to change their behavior, which is critical to achieving a sustainable society. In my life if I have learned one thing it is that money talks. It would be great if people would

change for altruistic reasons, but thus far it has not happened. The bottom line is what is most important in today's society. If we can make the bottom line reflect our goals and desires as a society then we will begin to head in the right direction- that of a sustainable civilization.

However, my opinion may not convince most people that this is an effective approach in achieving more sustainable development. For that reason I have gathered information from various bibliographic sources to buttress my argument. The topics in literature that I draw from vary from sustainability to economics. All relate to attempts by man to organize and better his world. As information and technology advance, so does our understanding of our world and our impact upon it. Heightened awareness is what drives us to achieve a sustainable co-existence with the planet that supports us. Links are commonly made between the state of the environment and the condition of a society (Roe, 2000, 54). The literature review is organized by topic area and is comprised of the following topics: economic theory, environmental principles, climate change and resource use, strategies to resolve pollution problems, market based reform, subsidies, environmental tax shifting, environmental taxes, and finally the goals and objectives of sustainable development.

Economic Theory

This section provides a brief background of the foundations of our economic system from early economic theory, to current neoclassical economics. It examines the strengths and weaknesses of these systems in relation to the environment which supports human economies. Criticism of the structure of our current economic policy is addressed as well as principles and theories that have been proposed to minimize the negative

environmental effects of economic activities. This section will serve as an introduction to economic theory and highlight the need for changes, as well as providing an introduction to key terms and ideas pertinent to taxation with regard to the environment.

Pre-Neoclassical Economics

The economy can be defined as a man made system of social control- a socially structured process dedicated to the material transformation of society's scarce air, land, and water resources into commodities, or goods and services, designed to satisfy the needs and wants of the individuals that comprise that society (Mercurio, 1997, 22). The free enterprise system advocated by the United States is characterized by a vast number of decisions independently reached by producers and consumers in order to provide a certain quality of life while preserving individual autonomy (Fisher, 1995, 200). It is important to remember that economics, like all sciences, is a human convention by which we attempt to order and understand our surroundings. Economic theories are asserted, and then refined or sometimes replaced altogether as a better understanding of the process is arrived at.

Economic theory of the 18th century was related much more to the natural environment than economics of today. The French physiocrat school focused on the use of solar radiation by biotic organisms and the mechanism by which wealth is created by the land through agricultural production (Hall, 2001, 663). Later the classical economics of Adam Smith, David Ricardo, and Karl Marx centered on the distribution of wealth and its physical origins (Hall, 2001, 664). The 19th and early 20th centuries witnessed biological and physical scientists such as Podolinsky, Geddes, Soddy, and Hogben who played prominent roles in economic theory (Hall, 2001, 664).

Often times a theory is asserted that does not necessarily address the entire economic system, but instead focuses on a specific situation, or activity. This is the case of a proposal by Arthur Pigou in his 1920 book *Economics of Welfare*. In this book he makes the first arguments for an environmental tax, which became known as the Pigovian Tax Principle. This principle states that a charge should be imposed on economic actors who cause damage to others from activities such as pollution. It was argued that if the tax level was set at the rate of damage caused then the costs of that action will be fully internalized into the price of the activity (Mirovitskaya, 2001, 194). These taxes, when added to the marginal private costs of an activity, will tend to make them equal to the marginal social costs of the activity (Daly, 1999, 64).

Another theory that has environmental implications is the Coasean Redefinition of Property Rights. This idea proposes that areas that were previously public property and therefore not given value in the market system become private property whose values are protected by its new owners and thus incorporated into the market (Daly, 1999, 64). Although these economic theories, principles, and models related to the natural systems which support the economy, they had shortcomings that could not explain market functions and were thus destined to be replaced by newer, arguably more complete economic models.

Neoclassical Economics

Neoclassical economics were derived in the mid 19th century and is the economic theory that prevails today. This theory focuses on problems related to value decisions, the behavior of economic actors, and the market process. Neoclassical economics supplanted classical economics largely because of its superior mathematical rigor, and its

development of the marginal utility theory (Hall, 2001, 664). Value decisions, behavior, and the market process are in the realm of the social sciences; however the wealth that is created and distributed throughout the market is a product of the material world where all activities must obey the laws and principles of physics, chemistry, and biology (Hall, 2001, 663). Although internally consistent and mathematically advanced, neoclassical economics are not compatible with the basic laws of nature. Most production models of economics are not based on these natural laws and principles and tend to ignore them entirely (Hall, 2001, 663-664). In neoclassical economics the efficient allocation of resources is dependent on the internalization- all costs paid directly by the party responsible for them- of all costs (Conca, 1995, 152). This implies that all costs are supposed to be included in the price of a product or service. If not externalities exist which signal a market failure.

Externalities may signal the greatest shortcoming of the neoclassical economic model. Price is what we pay as individuals. Cost is what we pay as a society. The price we pay for products and services is often substantially lower than the environmental and social costs associated with extracting the raw materials, processing them into products, transporting the goods to market, and disposing of the wastes created throughout the process (Morris, *Mapping Environmental Taxes: Obstacles and Opportunities*, 1). When prices do not include the costs to society, consumers and producers are not accurately informed regarding the consequences of their actions or the natural factors that limit the operation of the economy (Redefining Progress, *Tax Reform for a Sustainable Economy*, 3). Externalities occur when an economic transaction between two or more parties results in an impact on a third party not involved in the transaction. There can be both positive

and negative externalities. Positive externalities occur when the social benefits are larger than the private benefits, and negative externalities occur when the social costs are larger than the private costs (Markandya, 2002, 167). An example of a positive externality is forestry where there is a direct benefit for those who plant trees, but there is also an indirect benefit for society because of a forest's ability to retain rainfall, absorb greenhouse gases, bind soil and control erosion, provide animal habitat, and provide an aesthetic amenity (EEA, *Environmental Taxes: Implementation and Environmental Effectiveness*, 15). Pollution, which is a negative externality, arises from the failure of the market to include the full costs or benefits of an economic activity. By increasing the price of pollution to reflect the social costs of an economic activity, environmental taxes assure that polluters pay both the private and social costs of their activities (Morgenstern, 3). If we shift from a view of the environment as a common good towards an ecologically based model, then the value of a company's products and services needs to account for the environmental impacts incurred as a result of creating the product or service (Fisher, 1995, 203). When externalities are not adequately factored into prices, distortions arise in the market by encouraging activities that are costly to society as a whole, even though the private benefits may be substantial (EEA, *Environmental Taxes: Recent Development in Tools for Integration*, 7). "When price systems send accurate signals about the demand and scarcity of goods and services, investment is directed into the most productive economic activities" (Mirovitskaya, 2001, 23).

To internalize these external costs a blend of tools including fiscal measures, such as environmental taxes and incentives, as well as reviewing subsidies that are environmentally damaging need to be assessed (EEA, *Energy and Environment in the*

European Union, 22). The internalization of external costs will bring about a re-allocation of resources based on their fair and efficient prices, through redistribution of costs, helping to improve social welfare (EEA, *Environmental Taxes: Recent Developments in Tools for Integration*, 8). The full internalization of costs promotes equity because consumers are forced to shoulder the full costs of purchases rather than passing these costs on to society at large (Daly, 1994, 325). To understand externalities in practice it is useful to look at the energy market. Current energy prices do not always reflect the full societal costs of an activity because prices often don't account for the impacts of energy production and consumption on the environment and in turn to human health (EEA, *Energy and Environment in the European Union*, 22). Because the prices paid by the power producers and consumers do not include external costs, incorrect market signals are given which encourages power production beyond the level of economic efficiency (EEA, *Environmental Taxes: Recent Developments in Tools for Integration*, 7). "The market is telling us to pig out, while nature is telling us just as loudly to cut it out" (Morris, *Mapping Environmental Taxes: Obstacles and Opportunities*, 1)! A well designed tax is an easy and fair way to increase the price of polluting activity so that it includes the external social costs that are otherwise ignored and not included in the price (Rhodes, *Top 10 Reasons Why We Need a Carbon Tax*, 1).

Natural scientists find three basic flaws with the theories of neoclassical economics. First the structure of the basic conceptual neoclassical model is incomplete because it is not based on the physical world and the laws governing it, especially thermodynamics. Neoclassical economics ignores the 1st and 2nd laws of thermodynamics which state that nothing occurs without energy conversion and entropy

which means that every biotic and industrial process requires the input of energy. Due to entropy valuable energy is transformed into useless heat and matter is lost or degraded. This results in pollution and the eventual depletion of resources such as fossil fuels and raw materials. The 1st and 2nd laws of thermodynamics are the most exhaustively tested and validated laws of nature, and state that it is impossible to have a process that performs work without the input of energy, however, the neoclassical model of economics purports that it can operate free of inputs or limits. It can therefore be argued that the neoclassical model is a theory of growth that fails to explain the main factor in economic growth (Hall, 2001, 664-666).

The second argument by natural scientists against the neoclassical model is that it fails to include boundaries that indicate the required physical inputs or the effects of economic activities (Hall, 2001, 666).

The final flaw of neoclassical economics is its lack of validation (Hall, 2001, 667). Economic policy is most often based on economic models, which unlike theoretical models in the natural sciences are not tested before they are applied or further developed. Validation is difficult for both classical and neoclassical economic theories because they are both based on factors of production that exist mainly in agrarian societies, within which these theories were formulated. These theories have largely been applied to the modern industrialized world with little or no revision (Hall, 2001, 667). Today's fiscal system is a product of a by gone era, a time when rapid exploitation of natural resources ensured competitiveness and was in the best interest of a country. This

is no longer the case. Today natural capital is the scarce resource, and prices must reflect the true social costs of depleting these sources in order to safeguard the economy's natural supports (Brown, 2001, 234).

Growing Opposition to Current Economic Model

When observations no longer support a theory it is time to modify or abandon that theory. This revolution has been termed 'paradigm shift.' Many believe that the time has come for a paradigm shift within our current tax system, which creates disincentives for work, savings, and investment, all of which are activities that are desirable in any economic system (Morgenstern, *Environmental Taxes: Dead or Alive?*, 15). Proponents of neoclassical economics will argue that when economic growth has made people wealthy enough, they will have the available money to clean up the damage caused by growth. This has not proven true, in fact, the environmental costs of growth seem to be increasing faster than the benefits of production, in effect making us poorer not richer (Conca, 1995, 181).

Sustainable development is development without growth. An economy that is steady in scale may continue to develop a greater capacity to satisfy human wants by increasing the efficient use of resources, improving social institutions, and clarifying its ethical priorities, not by increasing the throughput of resources (Conca, 1995, 186). A steady state economy can be defined as one whose throughput- whatever enters a system as input and exits as output- remains at a constant level and neither depletes the environment of its resources beyond the resource's regenerative capacity, nor pollutes above the environment's ability to absorb the pollution (Conca, 1995, 185). Our current through put model of economics, in which inputs are used to create an output that is used

and then discarded, is in direct opposition to natural cycles. Externalities such as solid waste, toxic waste, sewage, and pollution are largely ignored in the market system. This mind set does not even allow for the possibility of reintegrating this “waste” as an input for other economic processes, which is the norm in natural cycles where one process’s waste become the fuel for another process (Beaton, 1999, 38).

Many economists cling to the assumption that resources are infinite, otherwise they must admit that economic growth faces limits, and this is economically preposterous. When faced with the question of shrinking resources they tend to respond that technology, and ingenuity or resource substitution can continually outrun the effects of resource depletion and pollution (Daly, 1996, 34). Herman Daly, a pioneer in environmental economics stated that “It is no longer possible to treat the economic process as if it could maintain a continuous exchange with the infinite reservoir of nature,

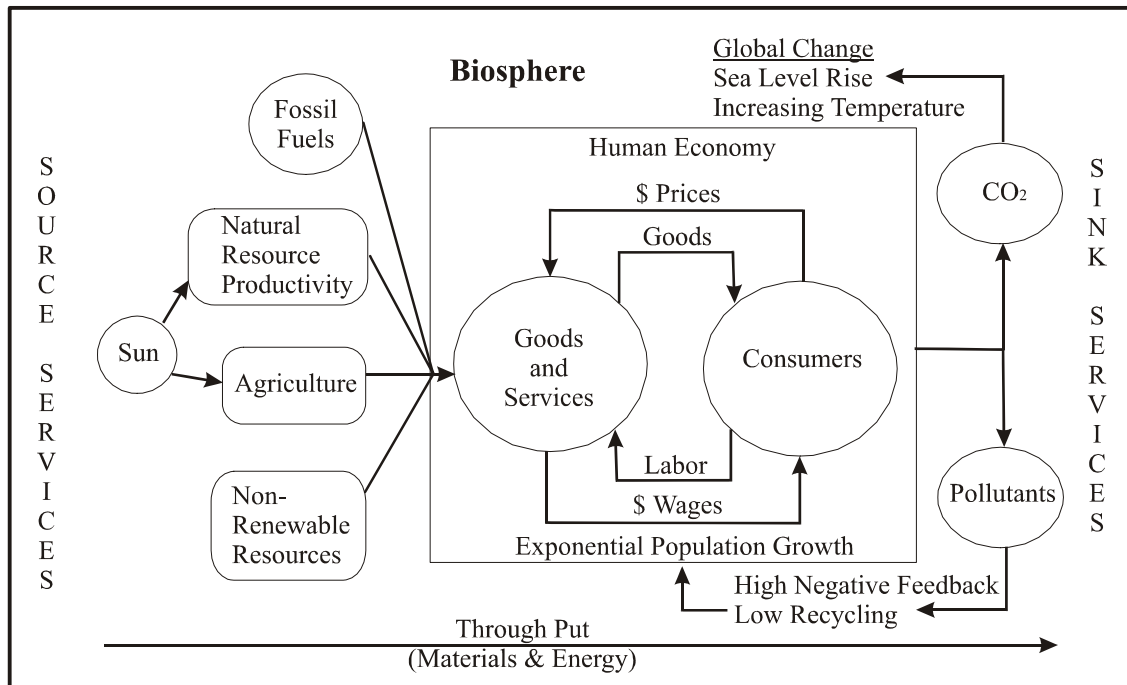


Figure 2-1 The economic cycle including environmental impacts.
Redrawn from Daly, 1999.

from which it could draw endless resources (Figure 2-1). Energy use, natural resource availability, and ecological destruction have become critical issues in the life of modern societies” (Daly, 1981, 21-22). Critics of our current tax system believe that little progress will be made in attaining or maintaining environmental quality until pollution is recognized as an economic problem and treated as such (Biniek, 1977, 1). According to Herman Daly the ideal tax scheme would function so that all of the means of raising public funds would also function as a means of attaining public goals. Income tax and inheritance taxes would be retained for their distributive effect, promoting economic equity across countries and throughout the world. Taxes designed to internalize costs would be a major element in this ideal system. Tariffs would insure national control of the national economy, and the auctioning of rights to mine or severance taxes on the use of scarce resources could set a scale for the economy as a whole. Excise and gasoline taxes would discourage the use of harmful substances or make scarce resources more readily available for primary and production needs. A land tax would end speculation in land, encouraging socially beneficial uses as well as producing measurable profits for the community. User fees would cover the costs of the services provided to monitor, prevent, and mediate environmental degradation (Daly, 1994, 330). All of this change seems quite difficult and may even appear scary at first, but it can be implemented in stages, and the results could be a society more equitable both socially and economically. As John Cage said, “I can’t understand why people are frightened of new ideas. I’m frightened of the old ones” (Goodman, *Environmental Tax Shifting in Massachusetts*, 1)!

The Rise of the Environmental Principles

The discussion of the condition of our environment and economic policy has spurred a number of theories and principles which attempt to rationalize who should bear the burden of the costs associated with environmental degradation. The Polluter Pays Principle states that the costs of pollution prevention and control should be included in the prices and output of goods and services which cause pollution as a result of their production and/or consumption (OECD, *Environmentally Related Taxes: Issues and Strategies*, 2). The producers should be required to pay fully for the cost of damages caused by pollution. The prices of goods and services produced through polluting activities should reflect these costs to consumers, resulting in changes in consumptive behavior (Mirovitskaya, 2001, 194).

Another theory closely related to the Polluter Pays Principle is the User Pays Principle, which asserts that users should be responsible for the payment of ecological services and thus contribute to reductions in material inputs and improvements in eco-efficiency (EEA, *Environmental Taxes: Recent Developments in Tools for Integration*, 2).

The Beneficiary Pays Principle, which is just the opposite of the above two principles, is a rule that requires the beneficiaries of high quality environments to compensate resource users for the costs of maintaining ecological functions, and environmental services (Mirovitskaya, 2001, 193). This principle basically says that companies should be compensated, by those who enjoy the benefits of high quality environments, for the value of resources that the companies do not harvest for production purposes or pollute through production processes.

Another theory, The Benefit Principle of Taxation follows the assumption that tax burdens should be allocated among tax payers in proportion to the benefits they receive from the provision of public goods (Mirovitskaya, 2001, 194).

Another proposal is the Tobin Tax, which is a tax on all international financial transactions. A tax of a quarter of a percent would generate \$200 billion a year based on \$1.3 trillion a day in transactions. This revenue could then be used to develop renewable energy around the world (Milani, 2000, 198). Regardless of which theory proves to allocate the costs of maintaining environmental quality in the most efficient and equitable manner, the important thing to gather from these theories and principles is that discussion is happening and change cannot be too far behind.

Climate Change and Resource Use

This section looks at the changing global climate, and current trends in resource use. The environmental costs of fossil fuel consumption are explored, relating these costs to the alteration of our climate. An analysis of resource consumption and waste generation for industrialized countries exposes the inefficiency of many production techniques currently employed. This section illustrates tangible examples of how current economic practices harm the environment, as well as how unsustainable levels of consumption are in many industrialized nations. This is intended to demonstrate the need for change both in the structure of our economic system, and in the behavior of producers and consumers.

Climate Change

Global climate change is no longer considered a possible phenomena, it is now a generally established fact. If we intend to avoid future problems we must shift away

from our reliance on fossil fuels to less polluting and more sustainable energy sources such as solar, wind and geothermal energy. This shift will occur naturally since fossil fuels are limited and these sources will become more and more expensive as their availability becomes scarcer (Rhodes, *Are Energy Taxes a good Idea?*, 1). There are three primary environmental costs associated with the consumption of fossil fuels. First there are changes in world temperatures, which result in more destructive storms, caused by higher water surface temperatures which provide more energy to drive storm systems. Secondly there are rising seas, caused by thermal expansion and melting ice, which threaten to decrease land mass at a time when populations are exploding. The final cost is heat waves and drought, which serve to reinforce one another, and threaten agricultural production (Brown, 2002, 61). Even major companies involved in fossil fuel extraction and refinement see the need for change. John Brown, CEO of British Petroleum, said in 1997; “The time to consider the policy dimensions of climate change is not when the link between greenhouse gases and climate is conclusively proven, but when the possibility cannot be discounted and is taken seriously by the society of which we are a part” (Brown, 2001, 99). That time is now.

Resource Use

In today’s industrialized nations it is astounding to see the amount of natural resources consumed to produce the quality of life that we feel is a birthright. If every country were to consume resources at a rate equal to that of many industrialized nations there would simply not be enough material to go around. Take for example a study, by the Worldwatch Institute, of Germany, Japan, the Netherlands, and the United States, who consume between 45 to 85 metric tons of natural material per person per year

(Figure 2-2). These same countries account for 11 to 25 metric tons of material outputs into the environment per person per year. If hidden resource flows are included these ranges raise to between 21 to 86 metric tons of waste per person per year. These hidden

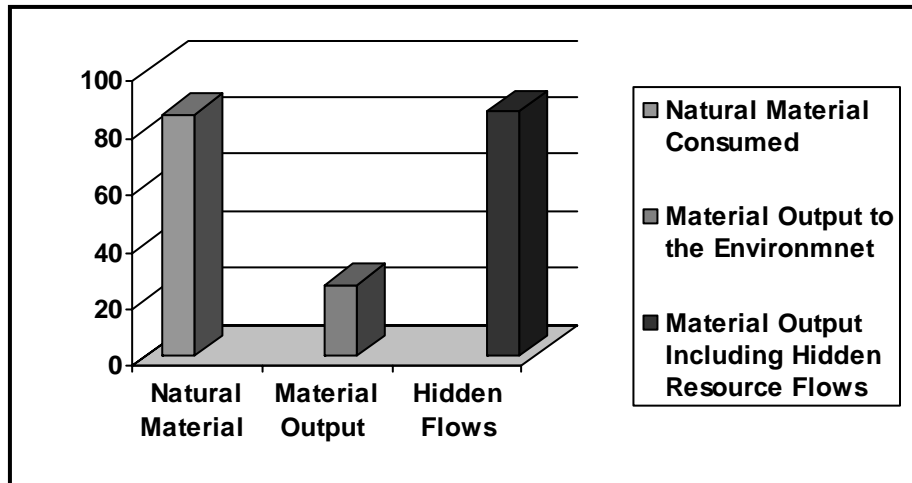


Figure 2-2. Natural Material Consumption and Output by Industrialized Nations Source Worldwatch Institute, *Wasting the Material World*

flows account for 75 percent of the total materials used by industrialized economies and are easily ignored because activities such as mining, earth moving, and erosion do not enter the economy as commodities bought or sold and are thus not accounted for in a country's gross domestic product. In industrialized nations one-half to three-quarters of annual resource inputs are returned to the environment in the form of waste within a year. Since many raw materials are imported, the environmental impacts of these activities, such as air and water pollution, and environmental degradation are often felt far from the economies that benefit from them (World Resource Institute, *Wasting the Material World: The Impacts of Industrial Economies*, 1-2).

However, this does not mean that we should abandon the use of these resources altogether. As Colin Price argues, a universally strict interpretation of sustainability,

which permits no individual aesthetic resource to be damaged, would not only arrest human development, but may reverse it traumatically. If a resource might be preserved only by preventing its use, it ceases to be a resource. Sustainable use of non-renewable resources is unintelligible, except in terms of sustaining the flow of general services offered by a particular resource. A scenario is sustainable if fossil energy resources are consumed to expedite replacement with, and investment in, renewable substitutes such as wind or hydroelectric power. What matters to consumers is availability of electricity, not the location or means of its generation (Price, 2000, 36).

A strategy, that has come to be known as eco-efficiency, could be used much in the way Price suggests we should use our natural resources. Eco-efficiency is the practice of improving the productivity of energy and material inputs in order to reduce resource consumption and decrease the levels of pollution per unit of output (World Resources Institute, *Are Business and Industry Taking Sustainability Seriously?*, 1). The seven factors that influence eco-efficiency are: The reduction of the material intensity of goods and services, the reduction of the energy intensity of producing goods and services, reduction of toxic dispersion, enhanced material recyclability, maximizing the sustainable use of renewable resources, extending product durability, and increasing the service intensity of goods and services (World Resources Institute, *Are Business and Industry Taking Sustainability Seriously?*, 1). Although eco-efficiency is not the answer in itself, it could be a movement that accelerates the transition to an environmentally benign economy, while also educating the public about the need for change and the large role that consumer behavior can play in the conversion.

Strategies to Resolve Pollution Problems

This section investigates different strategies, such as regulations, incentives, pollution charges, and taxes that can be used to combat polluting emissions. The strengths and weaknesses of each strategy are discussed, revealing that each strategy has specific goals that it is best suited to achieve. Since no one strategy can be entirely effective alone, it begins to demonstrate how these policies can be used in conjunction to achieve the desired environmental results.

Regulations, Incentives, Pollution Charges, and Taxes

As the environmental movement has gained momentum, a number of strategies have been introduced to combat the proliferation of pollution and polluting activities. To date these strategies can be divided into four main categories, which are direct government regulation, incentives, pollution charges, and taxes. All of these attempt to minimize the levels of pollution discharge, but each seeks to accomplish these reductions in different manners.

Federal environmental protection regulations, often called command and control regulations, use standards on the amount of pollution allowed to be emitted or discharged by a single source, or specify standards which control the pollution abatement technology that must be employed by a given industry. Over the last twenty years this technique has been effective in controlling the pollution levels from large stationary sources of pollution such as factories or power sources. Although successful at controlling point sources of pollution, this strategy has proven to be inefficient due to the high administration costs involved with implementing these regulations. Command and

control regulations have also proven difficult to administer to non-point pollution sources such as automobiles, where issues of enforcement, cost of enforcement, and manpower limit the effectiveness of the regulations (USGAO, 1993, 8-9).

Incentives are another means of limiting the levels of pollution released into the earth. Incentives can take the form of grants, payments, tax incentives, and subsidies such as investment tax credits or accelerated depreciation on pollution control equipment (Biniek, 1977, 1-2). This form of control seeks to reward those companies and individuals who voluntarily practice environmentally benign activities.

The third type of control, pollution charges, can be divided into two main categories: User charges, and surcharges. User charges are a service charge on the cost of the treatment or disposal of waste products, such as effluent charges, or landfill charges. Surcharges are similar to user charges, but are an additional charge based on the discharge of waste over a certain limit. A surcharge is an effective way to ensure that the costs of treatment or disposal are distributed equally among all users based on the amount of the service the individual or company requires (Biniek, 1977, 1-2).

The final control mechanism is taxes, which once again has two categories, although the two forms of taxes are designed to have quite different results. The first form of taxation is a punitive tax, which seeks to establish a tax rate that will promote decreased levels of pollution by a company or individual by altering consumer behavior. Basically punitive taxes will allow an activity to continue but the consumer or producer will be “punished” in the form of a tax if they choose to continue an activity that society has deemed environmentally harmful. The second form of taxation is an excise tax, which is a tax on any market good or service that pollutes. The intent of this type of tax

is not to change behavior, although it is capable of doing so, it is instead intended to generate revenue that can be used to combat polluting activities and for public education (Biniek, 1977, 1-2).

It is generally agreed that no one of these strategies to resolve pollution problems is one hundred percent effective by itself. Instead it is suggested that a mix of the four above mentioned controls will be the most effective means to combat pollution. Since each strategy has distinct advantages and disadvantages it is important to apply each technique to the area of the market where it will be most effective as well as most efficient in producing the desired effects.

Market Based Reform

This section covers market based reforms from a general explanation of what they are to specific examples of market based reforms. It demonstrates their economic viability by maximizing market strengths and minimizing market weaknesses. Market based reform has broad appeal and is cost effective, allows for future growth, and provides continued incentive for change and innovation, demonstrating the ability of market based reform to benefit both society and the environment.

A Market Based Approach to Pollution Control

Market based incentives affect the estimated benefits and costs of different actions in an attempt to influence consumer thought and behavior so that the most environmentally correct choices are made (Jenkins, 1994, xiii). This technique uses profit maximization as an incentive to persuade polluters to reduce pollution levels (Mirovitskaya, 2001, 197). Market based reform relies on the strengths of the market system for affecting change, while seeking to minimize the weaknesses of the market

system. The three strengths of the market system are its efficient allocation of scarce resources, its ability to balance supply and demand, and its ability to set prices that reflect both scarcity and abundance. The weaknesses of the market system, as currently structured, are a failure to incorporate the indirect costs of providing goods or services into prices, failure to properly value natural services, and a failure to respect the sustainable yields of natural systems such as fisheries, forests, rangelands, and aquifers (Brown, 2003, 206).

There are four major advantages of market based incentives when compared to regulation. The first is cost effectiveness. Market based incentives are more flexible than command and control regulations, so more control can be achieved at lower economic costs. Market based incentives also provide continuing incentive to reduce emissions. As opposed to command and control regulations where once a certain level of emissions control is achieved there is no further incentive to continue reductions, market based incentives allow a firm to continue saving as it continues to decrease the levels of pollution emissions. This promotes research and development of new technologies and processes. Another advantage of market based incentives is the lower compliance and administrative costs for both government and industry. Since the regulations are applied through the market system there is less need for government oversight, and the oversight that is required can be accomplished by a much smaller force, saving money. The final advantage of market based incentives is the accommodation for growth of existing firms, and the ability of new firms to enter the market. This promotes competition, and allows the companies that are capable of the most efficient production with the minimal amount of pollution discharge to grow into industry leaders (Jenkins, 1994, 41). Market based

economic instruments affect society's decisions on resource use by accurately pricing goods and services, and levying charges on services provided. They also allow flexibility in the way a firm can achieve pollution control such as a change in the process, technology development, or product modification, which encourages the most cost effective solution (Hawkins, 2000, 383).

Market based solutions have broad appeal, and may therefore easily gain acceptance. Environmentalists like the environmental impacts associated with market based incentives, conservatives like the tax simplicity of this system, business leaders applaud its adherence to market principles, and taxpayers welcome the tax relief that it would provide (Redefining Progress, *Environmental Tax Reform: A Market Based Solution*, 2). Market based approaches have been endorsed by 2,500 economists, including 8 Nobel laureates, as an effective tool in combating global climate change (Redefining Progress, *Tax Reform for a Sustainable Economy*, 4).

The first market based incentive occurred in 1974, when the United States government implemented an emission trading program to help polluters meet the Clean Air Act (USGAO, 1993, 10). Since that time market based incentives have been expanded to include emission trading, deposit and refund systems, public disclosure of information on a firms or products environmental impacts, and pollution taxes (USGAO, 1993, 10). Much like the strategies to resolve pollution problems, no one market based incentive can stimulate all of the change necessary. However, when used in concert one incentive can help support another, and the sum of market based incentives will be greater than the impacts of an individual incentive.

Subsidies

This section analyzes subsidies from an overview of what they are to how they affect market prices. Negative and positive subsidies are examined demonstrating that subsidies can have both good and bad environmental effects. Specific examples of subsidies in use in the energy, automobile, and logging industries provide a sense of the impacts of subsidies on price, consumer behavior, and environmental quality. Different professional opinions are included as to the role subsidies will have in the transition to a more sustainable civilization.

Subsidies and the Environment

Subsidies are direct transfers, favorable pricing policies, or favorable tax treatment(s) designated for specific economic activities. They are an economic tool used to direct the market by stimulating investment and/or by altering the prices of certain goods or services (Mirovitskaya, 2001, 23). Subsidies affect the relative price of a resource usually tending to make it more desirable when compared to other alternatives (Markandya, 2002, 49).

For years subsidies have been used by governments to stimulate industry, and to decrease the costs of production. This was not done to put money into the pockets of large companies, but was instead intended to increase employment, increase the competitiveness of national companies in global markets, and make possible the production of low price goods that would be consumed in large quantities promoting economic growth. Although well intentioned these subsidies are a part of neoclassical economic theory, and as such, largely ignore the environmental damage that occurs as a result of their use.

While many subsidies threaten the health of our environment, recently policy makers have begun to realize the potential of subsidies to promote environmentally responsible production and consumption. Since subsidies are a tool that can be used to direct the market, policy makers understand that by influencing relative pricing they can begin to change consumer and producer behavior. These changes in behavior may signal a shift to a more sustainable society, however providing subsidies for environmentally responsible behavior is not the solution in and of itself.

Everyday we spend large amounts of money to create weapons of mass destruction, fuel dirty and dangerous polluting technologies, and financially support huge companies that concentrate the world's wealth into the hands of a few (Sandler, *A Green Tax Shift Policy Approach to Financing Local-to-Global Public Goods*, 1). Each year the taxpayers of the world are forced to fund \$700 million in subsidies for activities that are environmentally destructive. The question is why should we pay to destroy our own planet (Brown, 2003, 214)? The Organization for Environmental Co-operation and Development identifies three mediating factors on the level of damage resulting from subsidies. The first is the impact of a subsidy on the level and composition of an output. The second is environmental policies that are in place to mitigate the damage resulting from the subsidy. And the final factor is the assimilative capacity of the environment (Markandya, 2002, 49).

Besides damaging our environment, subsidies make it difficult for small or new companies offering alternative products to compete with larger well established industries that are the beneficiaries of large government subsidies. One means to combat this is through full cost pricing, or the internalization of all production costs (Brown, 2002, 71).

Another possible solution is to remove all subsidies, both direct and indirect, from all forms of production making small companies competitive with the larger entrenched companies (Daly, 1994, 291). Instead of passing legislation that subsidizes “good” activities, we should retract subsidies to “bad” activities, which would result in the internalization of all costs of a given activity, reflecting its true environmental costs in its price (Morris, *Mapping Environmental Taxes: Obstacles and Opportunities*, 6). These “bad” activities that are currently heavily subsidized are: Energy production, resource extraction, commerce and industry, agriculture and forestry, and the creation of weapons of mass destruction (Sandler, *A Green Tax Shift Policy Approach to Financing Local-to-Global Public Goods*, 1). If subsidies are removed from all forms of production the economic playing field will be leveled, with all prices reflecting the true costs of production, allowing the market to operate efficiently and consumers to dictate the direction the economy will move. Simply augmenting “bad” subsidies with “good” subsidies makes no sense because it means that tax payers are being asked to pay large amounts of money to artificially lower the price of certain goods or services, while receiving a net environmental effect of equalization at best.

Subsidies in the Energy, Auto, and Logging Industries

A look at how subsidies affect major industries such as the energy industry, the automotive industry, and the logging industry will begin to shed some light on the level to which these subsidies distort the market. The energy industry is one example of where decreased subsidies will have a positive environmental impact (Markandya, 2002, 49). Between 1990 and 1995, in the European Union, energy subsidies focused on the support of fossil fuels and nuclear power despite the environmental impacts and risks associated

with these fuel sources (EEA, *Energy and Environment in the European Union*, 22). From 2001 to 2006 fossil fuel and nuclear energy companies in the United States will benefit from nearly \$26 billion in federal tax or spending subsidies, resulting in cheap energy at the expense of the environment (Goodman, *Environmental Tax Shifting in Massachusetts*, 7).

In the United States the unpaid costs to society of driving, which includes lung disease, noise pollution, and emissions, are estimated at \$218 billion a year (Worldwatch Institute, *Shifting Tax Burden to Polluters Could Cut Taxes on Wages and Profits by 15 Percent*, 1). The United States government then subsidizes auto use through the construction and maintenance of highways, highway patrols, and other motorist supports to the tune of \$111 billion per year more than is collected from taxes on motor fuel, vehicle purchases, and license plates (Brown, 2001, 243). The net effect is that the public is faced with a burden of \$329 billion annually to cover the costs of auto usage. The worst part of this is that individuals who do not even own cars are forced to pay their share of the costs to subsidize the industry as well as clean up the damage that results.

Logging is another industry that reaps the benefits of government subsidies. For years the government has paid for the construction and maintenance of logging roads into our National Forests. The revenue generated from the deforestation of these parks, which our taxpayer money goes to support, is not even returned to the public, unless you consider the artificially low price of wood products. Between 1992 and 1997, the U.S. General Accounting Office estimates that the U.S. Forestry Service lost \$2 billion in taxpayer monies on the subsidizing of commercial logging in our National Forests (Sierra Club, *Sierra Club Supports Keeping Public Lands Open to All People*, 2). Then the

government proposes programs such as the Recreation Fee Demonstration Program (Fee-Demo) which charges recreational user fees for the use of public lands that are already supported by federal tax dollars.

“It does not make economic or environmental sense to charge fees for low-impact recreational activities while subsidizing extractive industries that waste American taxes and wreak havoc on the environment. Why should we tax American people but foot the bill for big corporations?”
(Sierra Club, *Sierra Club Supports Keeping Public Lands Open to All People*, 2).

Environmental Tax Shifting

This section focuses on what environmental tax shifting is and how it works. An examination of what tax rates would be increased as well as what tax rates could potentially be reduced is included. The economic, social, and environmental benefits of a tax shift are proposed. The means of implementation and suggestions of complementary policy measures to increase the effectiveness of tax shifting are included.

What is Tax Shifting?

Tax shifting is a new concept based on simple economic principles which proposes that the tax burden can be reduced on working individuals, while increasing environmental protection without harming the economy. By raising taxes on the things we want less of, such as pollution and waste, we can cut taxes on working men and women promoting activities that we do want, such as employment and investment (Franz, *The Environmental Tax Shift*, 1). Tax shifting involves changing the composition of taxes, but not the level of taxation. It involves reducing income taxes and offsetting this reduction with taxes on environmentally harmful activities (Brown, 2001, 236). The idea behind tax shifting is that by raising taxes on products and activities that society wants to discourage we will encourage more environmentally responsible behavior by individuals

and business (Brown, 2002, 242). Green tax reform, which is another term for tax shifting, distinguishes between private property or that which is created by labor, and common property or that which is provided by nature. Green tax policy seeks to shift taxes from wages and other private property to common property. Reducing taxes on labor increases purchasing capacity, while reducing taxes on capital encourages efficiency. Increasing taxes on common property decreases speculation and private profiteering and is a means to conserve and equitably share the earth's resources (Sandler, *A Green Tax Shift Policy Approach to Financing Local-to-Global Public Goods*, 1).

Tax Increases and Cuts

Environmental tax shifting seeks to increase taxes on common property, or natural resources and services. This would mean increasing the level of taxation on seven main categories: Land sites according to land value; lands used for timber, grazing, and mining; emissions into the air, water, or soil; oceanic and freshwater sources; the electromagnetic spectrum; satellite orbit zones; and oil and minerals (Sandler, *A Green Tax Shift Policy Approach to Financing Local-to-Global Public Goods*, 1-2). These increases in taxes would then be offset by reductions in the levels of taxation of four main categories: Wages and earned income; productive and sustainable capital; sales, especially for basic necessities; and homes and other buildings (Sandler, *A Green Tax Shift Policy Approach to Financing Local-to-Global Public Goods*, 1-2). Pollution taxation has the potential to raise more than \$1 trillion annually worldwide, which could

be used to cut taxes on wages and profits by up to 15 percent, while unaffecteding the total revenue raised (Worldwatch Institute, *Shifting Tax Burden to Polluters Could Cut Taxes on Wages and Profits by 15 Percent*, 1).

Benefits

Environmental tax shifting would provide incentives for better environmental performance and protection, continue to raise revenue at the same or higher levels as currently, reduce other taxes that would in turn stimulate the economy, and ensure distributional equity and fairness (Goodman, *Environmental Tax Shifting in Massachusetts*, 2). Shifting the tax base to throughput encourages greater efficiency and internalizes external costs associated with resource depletion and pollution (Daly, 1996, 90). Although it is necessary to generate revenue through taxation, the current tax system distorts the market by discouraging employment and investment. It is better to economize throughput due to its high external costs and maximize labor because of the high social benefits associated with reducing unemployment (Daly, 1999, 64). Shifting taxes from labor conserves resources and makes hiring additional labor more attractive and will act as a stimulus to the entire economy (Milani, 2000, 195-196). A cut in payroll taxes would tend to raise average worker incomes, perhaps decreasing the number of working poor (Worldwatch Institute, *Shifting Tax Burden to Polluters Could Cut Taxes on Wages and Profits by 15 Percent*, 2). Shifting taxes away from income towards indirect taxes is beneficial because it can help to reduce structural problems in the economy (Morgenstern, *Environmental Taxes: Dead or Alive*, 13). Tax shifting would also benefit land development and land use by providing incentive to protect open space and promote reinvestment in cities and urban areas, encouraging denser development and

ensuring that alternatives to low density sprawl are available and affordable, and would help reduce dependence on the automobile (Goodman, *Environmental Tax Shifting in Massachusetts*, 16).

Implementation and Effectiveness

An effective environmental tax shift must be composed of certain elements to ensure that it functions fairly and properly. It is recommended that the shift be revenue neutral. That means that no extra revenue is required; rather there is just a change in where the revenue is derived from (Milani, 2000, 195). If there are extra revenues they should be returned to consumers by lowering other taxes. A partial or total exemption should be made for energy intensive industries in order to ensure competitiveness. Provisions should also be made that hold harmless small businesses and/or low income households for reasons of fairness (Morris, *Mapping Environmental Taxes: Obstacles and Opportunities*, 4). A tax shift can be designed to span the whole economy such as taxing an air pollutant emitted from many sources while reducing another tax to ensure revenue neutrality. Or a tax shift may be concentrated within a specific sector or activity so that the new tax and the resulting tax offset are limited to that activity alone, such as increasing the price of driving while reducing transit fares for public transportation (Goodman, *Environmental Tax Shifting in Massachusetts*, 3). Herman Daly believes that a tax shift should be revenue neutral, but that some form of an income tax should be retained. This income tax would not be for the purpose of generating revenue, but would instead be used to redistribute wealth from high incomes to low incomes, thus maintaining progressivity in the tax system (Daly, 1996, 90).

There are a number of complementary policy measures that can increase the effectiveness of a tax shift. The first is the elimination of subsidies to industries that damage the environment. Another is to implement tax refunds as opposed to tax exemptions for lower income households. This will help to maintain the incentive of the tax. A third complementary measure is for items whose demand does not decrease as a result of small changes in price, is to increase the tax rate, in a visible and easily understood manner, in order to decrease consumption to the desired level. The final measure is to expand the tax base to include more products and services that are detrimental to the environment (Brown, 2002, 244). Although green taxes diminish their own sources of revenue by forcing these sources to clean up, the economy would be healthier and more efficient, as well as reducing health costs and other expenses of the state (Milani, 2000, 197). In 44 economic studies of environmental tax reform in Europe, it has been concluded that the impact on the gross domestic product is positive, the impact on employment is positive, and emissions are reduced (Franz, *The Environmental Tax Shift*, 2).

Current Sources of Tax Revenue

Current government spending in the United States is primarily financed through taxes on both labor and capital income. These taxes tend to distort economic behavior by reducing employment and investment below levels that maximize economic efficiency (Parry, *Choosing Wisely When it Comes to Climate Policy*, 1). 90 percent of the world's \$7.5 trillion tax revenue is raised from taxes on work and investment while less than 5 percent comes from taxes on environmentally destructive activity, figure 2-3 (Worldwatch Institute, *Shifting Tax Burden to polluters Could Cut Taxes on Wages and*

Profits by 15 Percent, 1). Tax shifting accounts for only 3 percent of the worldwide tax revenue (Brown, 2002, 241). Between 1990 and 1993 environmental taxes as a share of total tax revenue increased 10 percent, while taxes on personal and corporate income

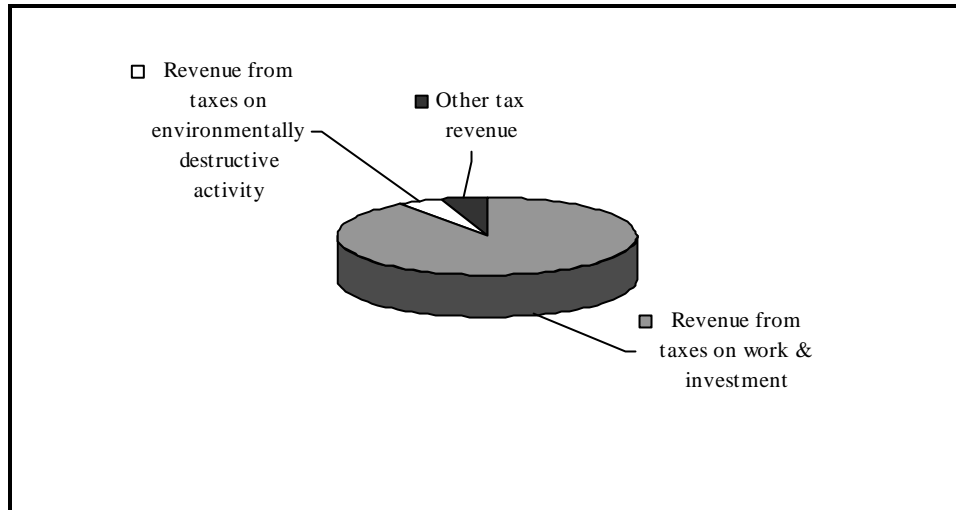


Figure 2-3. Current Sources of Total Tax Revenue. Source: Worldwatch Institute, *Shifting Tax Burden to Polluters Could Cut Taxes on Wages and Profits by 15 Percent*.

slightly decreased signaling the beginnings of a tax shift (Morgenstern, *Environmental Taxes: Dead or Alive?*, ii). Although environmental tax shifts appear to be on the rise there is still a long way to go before the tax system will adequately promote the activities vital to any healthy economy.

Environmental Taxes

This section is a comprehensive evaluation of environmental taxation with regards to what they are and how they operate, why environmental taxes should be used, how they can be implemented, evaluating their economic and environmental effectiveness, and barriers to their implementation with proposed solutions. An assessment of important ideas and theories in the field of environmental taxation, such as the double dividend theory, are made. And the three broad categories of environmental taxation:

Cost covering charges, incentive taxes, and fiscal taxes are examined outlining the different forms of taxes that are available under each broad category, as well as the inherent strengths and weaknesses of each.

What They Are

Environmental taxes are measures that impose either a tax on a product or activity deemed environmentally damaging by society, or provide a tax benefit to a product or activity that is beneficial to the environment (Environmental Tax Policy Institute, *Environmental Tax Policy Institute*, 1). They can broadly be classified as any tax levied on an environmentally relevant tax base such as emissions to air or water, energy sources, motor vehicles, or waste (OECD, *Environmentally Related Taxes in OECD Countries: Issues and Strategies*, 1). Environmental taxes can be summed up by the statement “Tax waste, not work; tax bads, not goods; pay for what you take, not what you make, and the polluter pays” (Sandler, *A Green Tax Shift Policy Approach to Financing Local-to-Global Public Goods*, 1). It makes more sense to tax “bads” like pollution, as opposed to taxing “goods” such as work, savings, and investment, which are activities we want to encourage (Morgenstern, *Environmental Taxes: Dead or Alive?*, 1).

Environmental taxes operate through the market system with governments setting the price of the environmentally destructive activity in the tax rate, and the market determining how much of a given activity will occur at that price (Brown, 2001, 248). Taxes cause firms to reduce their levels of pollution to the point at which the cost to further decrease pollution levels equals the cost of the tax (USGAO, 1993, 20). The revenue generated from environmental taxes can be used for many different purposes. It can be used to alleviate a budget deficit or contribute to a budget surplus. It can be used

to finance discretionary increases in government expenditures. Revenues can be used to make reductions in other more distortionary taxes. It can be used to address concerns of competitiveness or to increase public acceptance of environmental taxes (OECD, *Environmentally Related Taxes: Issues and Strategies*, 5-6). The revenues from environmental taxes can also be used to fund the transition for energy-intensive companies, to provide assistance to low-income households, or to provide incentives for business and industry to achieve energy efficiency and develop cleaner techniques and processes (Redefining Progress, *Environmental Tax Reform: A Market-Based Solution*, 1).

When environmental taxes were first proposed many supporters of the new taxes claimed that environmental taxation had the ability to claim a double dividend. That is that when coupled with tax shifting, environmental improvement would result- dividend 1- and that this could be accomplished at little or no cost- dividend 2 (Morgenstern, *Environmental Taxes: Dead or Alive?*, 1). The way this works is that environmental taxes can both reduce pollution emissions and reduce the overall economic costs associated with the tax system. This would be possible through the use of revenues from environmental taxes in reducing taxes that discourage work and investment. If environmental taxes were used to reduce taxes on labor income, unemployment and pollution could be reduced simultaneously, the double dividend (Parry, *Choosing Wisely When it Comes to Climate Policy*, 2). Recent research by Bovenberg, Goulder, and Parry shows that the double dividend theory may not prove true. They do however, conclude that although the policy instruments may cost more to implement than initially thought,

which was free, environmental taxes have the ability to reduce some of those costs based on how the revenue generated from the tax is used (Morgenstern, *Environmental Taxes: Dead or Alive*, 1-3).

The Evolution of Environmental Taxes

In 1920 Arthur Pigou proposed the first environmental taxes in his book *Economics of Welfare*, arguing that taxing emissions would reduce pollution in the most efficient manner possible (Morgenstern, *Environmental Taxes: Dead or Alive?*, 2). Then these ideas were largely forgotten until the 1970's when command and control regulations on emissions, and environmental quality were introduced (EEA, *Environmental Taxes: Implementation and Environmental Effectiveness*, 13). Command and control policies appeal to bureaucracies as a means to regulate activity rather than allowing market forces to operate more efficiently (Hawkins, 2000, 382). However, these command and control policies are inefficient because they require compliance with the same standards by all sources of pollution regardless of the compliance costs, and they provide little incentive for technical improvements once compliance is achieved (Hawkins, 2000, 383). The piling of regulation upon regulation resulted in confused priorities, misappropriated resources, and public confusion over what the standards are. This leads to over regulation and under enforcement. It is difficult to enforce because the laws are difficult to interpret, and there is an inadequate number of motivated, experienced, and reasonable enforcers (Hawkins, 2000, 382-383).

This led to an increased interest in market based incentives such as environmental taxes, tradable permits, and deposit refund systems in the 1980's. This interest was stimulated by new orientation towards markets and the deregulation of public policy.

There was an increasing recognition that there are limitations to government especially with regards to command and control systems of environmental regulation. There were concerns that regulations may not be capable of coping with emerging environmental problems, although these regulations would impose large economic costs. There was also a desire to further implement the Polluter Pays Principle and internalize external costs, with a need to spread environmental policies to agriculture, the transport industry, tourism, and employment. This resulted in the need for a more cost effective and flexible tool to achieve environmental goals (EEA, *Environmental Taxes: Implementation and Environmental Effectiveness*, 13).

Types of Environmental Taxes

There are three primary types of environmental taxes. The first is cost covering charges which are designed to cover the costs of environmental services and abatement measures. The second is incentive taxes which are designed to change the behavior of producers and consumers. And the third is fiscal environmental taxes which are intended to raise revenue. Figure 2-4, will demonstrate the major categories of environmental taxes and what policy instruments are used under each broad category.

Cost Covering Charges

Cost covering charges stipulate that those who use the environment are responsible to cover or contribute to the costs of monitoring or controlling their use. The effectiveness of these systems arises from both their revenue use and their impact on the price, exhibiting the scarcity of natural resources and sinks. There are two sub-categories

**Economic Instruments for Environmental Protection
And Natural Resources Management**

Charge Systems

1. Road Tolls
2. Access Fees
3. Pollution Charges
4. User Charges
5. Betterment Charges
6. Impact Fees
7. Administration Charges

Financial Instruments

1. Ecofunds/Environmental Funds
2. Financial Subsidies
3. Soft Loans
4. Grants
5. Location/Relocation Incentives
6. Subsidized Interest
7. Hard Currency at Below Equilibrium Exchange Rates
8. Revolving Funds
9. Sectoral Funds

Fiscal Instruments

1. Pollution Taxes
2. Product Taxes
3. Input Taxes
4. Export Taxes
5. Import Tariffs
6. Tax Differentiation
7. Royalties and Resource Taxes
8. Land Use Taxes
9. Investment Tax Credits
10. Accelerated Depreciation Subsidies

Market Creation

1. Tradable Emissions Permits
2. Tradable Catch Quotas
3. Tradable Development Quotas
4. Tradable Water Shares
5. Tradable Resource Shares
6. Tradable Land Permits
7. Tradable Offsets/Credits

Bond and Deposit Refund Systems

1. Environmental Accident Bonds
2. Environmental Performance Bonds
3. Land Reclamation Bonds
4. Waste Delivery Bonds
5. Deposit Refund System
6. Deposit Refund Shares

Liability Systems

1. Legal Liability
2. Non-Compliance Charges
3. Joint and Several Liabilities
4. Natural Resource Damage Liability
5. Liability Insurance
6. Enforcement Incentives

Property Rights

1. Ownership Rights
2. User Rights

Figure 2-4. Economic Instruments for Environmental Protection and Natural Resources Management. Redrawn from Hawkins, 2000, 385.

associated with cost covering charges, which are user charges and earmarked charges.

User charges are paid by the individual or firm that receives a specific environmental service. Whereas earmarked charges use the revenue generated from the charge to fund environmental programs that are not in the form of a specific service to the source of the charge. The main shortcoming of cost covering charges is that normally only a part of the total cost is actually covered by polluters (EEA, *Environmental Taxes: Recent*

Development in Tools for Implementation, 13). Charge systems are usually applied to protect resources from waste emissions and discharges (Hawkins, 2000, 384). Charges may strengthen incentives to reduce an activity, or can generate revenue for environmental management (Mirovitskaya, 2001, 196).

The most direct way to apply a charge on harmful pollutants or waste material is to tax at the point of release of airborne emissions, water effluents, and solid waste (Jenkins, 1994, 48). A pollution charge is a price or fee per unit of pollution discharged. It attempts to create a price equivalent to the external costs of an activity. A profit maximizing company will lower the levels of pollution up to the point at which the price to be paid per unit of pollution equals the cost of additional pollution abatement (Markandya, 2002, 187). Pollution charges serve as both an incentive to reduce emissions, and a means to generate revenue that can be used to invest in pollution control or reduction equipment (Markandya, 2002, 203). Product charges are fees added to the price of a product or production input that cause pollution or require a special disposal system. This method allows users to choose the most cost effective means of pollution reduction (Markandya, 2002, 191). Effluent and emissions charges are paid by polluters based on their levels of discharge. This charge can either be based on the volume of emissions or on the concentration of pollutants in the emissions. This system does not ban the emissions or dictate the technology that must be employed to reduce the emissions, instead it allows the polluter to choose to pay the emission charge, treat the effluent in order to limit the charge, or reduce production of the emission (Mirovitskaya,

2001, 198). Administrative charges are fees paid to the authorities for services such as chemical registration, or the enforcement and implementation of environmental regulations (Markandya, 2002, 192).

Incentive Taxes and Financial Instruments

Incentive taxes are an environmental tax levied with the intention of changing environmental behavior. The level of an incentive tax may be set based on estimates of the cost of the environmental damage, or the price signal sufficient to achieve the environmental objectives. Although the purpose is not to raise revenues, money will be generated because the activity will probably not be reduced to zero. These revenues can be used to further encourage behavioral change through grants, subsidies, or tax incentives (EEA, *Environmental Taxes: Recent Developments in Tools for Integration*, 13-14). Financial instruments include the use of subsidies or investments to accelerate the development of environmentally sound techniques (Hawkins, 2000, 386).

Bonds and deposit refund systems are based on the advance payment for the economic externality imposed. These costs can then be recouped as long as certain conditions or measures are met (Hawkins, 2000, 387). The objectives of this system are to protect public health and welfare, encourage recycling, reduce the burden on solid waste disposal systems, and reduce litter (Jenkins, 1994, 53). Performance bonds are most commonly used in mineral extraction, forestry, and waste management (Hawkins, 2000, 387). Market creation is the establishment of national or international markets defined by the total allowable pollution or discharge within a given market. The currency of that market is credits or permits which may be traded among the companies or individuals operating within that market. This system allows those who are most

efficient in their control of emissions to transfer or sell their additional emissions credits to those firms having higher abatement costs (Hawkins, 2000, 386). In a market system the government sets the allowable amount of a given activity and allows the market to set the price of the permits as they are auctioned off (Brown, 2001, 248). Environmentalists have often regarded tradable permits as a “license to pollute.” This is not true; instead this scheme limits the total scale of pollution, generates public revenue, and allows for efficient reallocation among individuals (Daly, 1996, 53). The advantages of tradable permits are the high degree of certainty that pollution control objectives can be met, they are flexible enough to accommodate industry growth without sacrificing environmental quality, and since the scheme is quantitative it is unaffected by inflation (Jenkins, 1994, 60). An example of a tradable permit system in action in the United States is the one set up to limit emissions of sulfur dioxide, a greenhouse gas. By the year 2000 emissions had been reduced to half of the 1980 level, at a savings of \$2-3 billion per year, when compared to less flexible regulations (Worldwatch Institute, *Shifting Tax Burden to Polluters Could Cut Taxes on Wages and Profits by 15 Percent*, 2).

Fiscal Environmental Taxes

Fiscal environmental taxes are designed to raise revenues for government income (EEA, *Environmental Taxes: Recent Developments in Tools for Integration*, 14). Fiscal instruments include pollution taxes, input taxes, product taxes, export taxes, import tariffs, tax differentiation, royalties and resource taxes, land-use taxes, investment tax credits, and accelerated depreciation subsidies (Markandya, 2002, 186). Although intended to raise revenue, these taxes can also change consumer and producer behavior by altering the relative prices of products.

An example of a pollution tax is a tax on carbon emissions. A carbon tax has three main objectives. The first is to encourage a reduction in energy use, and a maximization of efficiency resulting in lower carbon pollution emissions. It also encourages the use of fuels that are less carbon intensive and therefore less polluting. A final goal of a carbon tax is to generate revenue that will allow tax cuts on beneficial activities (Goodman, *Environmental Tax Shifting in Massachusetts*, 22). A carbon tax will push the economics of supply and demand towards energy efficiency. If the price of a given commodity goes up its demand tends to go down (Rhodes, *Top 10 Reasons Why we Need a Carbon Tax*, 1). A carbon tax could start low and gradually rise over the course of 20 years allowing automobiles and production facilities to live out their useful lives, as they are gradually replaced by less polluting models. Making these tax increases publicly known ahead of time indicates an economy's direction and encourages consumers and producers to plan ahead (Worldwatch Institute, *Shifting Tax Burden to Polluters Could Cut Taxes on Wages and Profits by 15 Percent*, 3).

Environmental taxes on final products are the best way to battle environmental problems related to consumer demand for particular products or services. These taxes serve to increase consumer awareness of the implications to the environment of using certain products or services through the price. This system allows consumers flexibility in their reaction to the tax (Jenkins, 1994, 51). Tax differentiation is used to guide consumption towards products that are environmentally safe. A positive charge is applied to polluting products while a negative charge, or subsidy, is applied to an environmentally benign product or service (Markandya, 2002, 192). Liability systems involve purchasing insurance against total or partial liability for the cost of pollution.

These can be seen as direct financial incentives that deter companies from polluting processes (Hawkins, 2000, 387). The property rights system is used primarily in developing countries. It is intended to slow the rate of natural resource use and depletion. In this system private land is converted to communal ownership thus allowing communities to share in the economic benefits of maintaining the asset (Hawkins, 2000, 387).

Why Environmental Taxes?

Well designed environmental taxes provide improvements in four critical areas. The environment, innovation and competitiveness, employment, and the tax system (Ribeiro, *Environmental Taxes: Implementation and Environmental Effectiveness*, 1-2). Environmental taxes create a price signal that forces polluters to account for the costs of pollution when making production or consumption decisions. Taxes are flexible policy instruments that minimize the control costs associated with achieving an environmental goal and provide continued incentive for technical innovation and overall reductions in polluting emissions (OECD, *Environmentally Related Taxes: Issues and Strategies*, 2). Since environmental taxes incorporate externalities into the price of a good or service they discourage pollution, raise revenue, and alter consumer behavior (Milani, 2000, 195). Due to a green tax's reliance on a price mechanism, it tends to operate more efficiently with a lower overall cost, when compared to standard regulation. And because they are flexible they promote the greatest level of pollution mitigation by companies able to achieve change at the lowest cost, as well as encouraging the research, development, and implementation of new technologies (Morgenstern, *Environmental Taxes: Dead or Alive?*, 4).

There are a number of arguments as to why environmental taxes should be implemented. They are extremely effective instruments at internalizing externalities. They provide incentives for producers and consumers to change their behavior towards a more eco-efficient use of resources. In order to reduce their levels of taxation companies will invest in innovative technologies and organize structural changes. Taxes reinforce compliance with regulations, which will continue to play an important role in maintaining environmental quality. Environmental taxes have the ability to generate revenue that can be used to offset other taxes, or spent to mitigate environmental deterioration. They have also proven effective in combating non-point pollution sources such as auto emissions, waste, and chemicals used in agriculture (Ribeiro, *Environmental Taxes: Implementation and Environmental Effectiveness*, 2).

The incentive effect generated by environmental taxes would cause decreased usage or production of a product being taxed. The taxes may target consumers or producers, but in all cases they affect both by altering the relative price of products, thus changing behavior. Taxes provide a continuing incentive to look for new methods of decreasing pollution in an attempt to save money, whereas regulations provide no further incentive once the standard is met (EEA, *Environmental Taxes: Implementation and Environmental Effectiveness*, 17). The increased costs of production would cause many companies to reassess their production techniques, and as these costs are passed down to the consumer they will begin to reanalyze their consumptive behavior (Fisher, 1995, 203). Environmental taxes create the opportunity for individuals to save money by changing their behavior, and the amount of taxed items that they consume (EEA, *Environmental Taxes: Recent Developments in Tools for Integration*, 5). Since polluters

will be forced to choose the most cost effective means to limit pollution, the burden will be lifted from society as a whole (USGAO, 1993, 20). Incentives can also be made in the form of tax deductions for alternative products which are more environmentally friendly, such as the IRS's \$2000 tax deduction for hybrid vehicles (Minnesota Sierra Club, *Car Tax Deduction for Hybrid Cars*, 1). Not only do environmental taxes generate financial incentive for environmentally responsible behavior, they also provide "soft signals" that increase public attention, awareness, and concern over the issue to which they relate (EEA, *Environmental Taxes: Recent Developments in Tools for Integration*, 3).

If the price of one material, product, or process is increased by taxation a new market for innovation and technology will arise that attempts to substitute or more efficiently use this item (EEA, *Environmental Taxes: Implementation and Environmental Effectiveness*, 18). This innovation and change within a country or company will bring an advantage over slower moving nations and companies, allowing these "first-movers" to establish themselves as leaders in an industry, as well as generating revenue from the marketing of their processes or technologies (EEA, *Environmental Taxes: Implementation and Environmental Effectiveness*, 34). New jobs will be created as there will be a need for the design and implementation of industries such as building retrofitting, alternative transport, and recycling (Milani, 2000, 197). In industrialized nations labor tends to be more expensive and taxed at a higher rate than materials. Environmental taxes can discourage waste and generate an economy that is more labor intensive and uses less capital (Milani, 2000, 195).

Since taxes will not completely stop most activities, revenue will be generated by an environmental tax. This revenue may then be reallocated to support environmental

mitigation, or to lower the levels of other taxes. A shift from taxes on labor, capital, and savings, to the environment increases economic efficiency and welfare (EEA, *Environmental Taxes: Implementation and Environmental Effectiveness*, 18-19). All taxes cause distortions, but environmental taxes have the ability to reduce some of these distortions by using the revenue from environmental taxes to reduce the levels of more distorting taxes such as the income tax (Morgenstern, *Environmental Taxes: Dead or Alive?*, 2).

Implementation

On May 16th and 17th, 2001 at an EU Ministerial Council meeting it was agreed that applying environmental economic activities in a standard fashion to all nations would prove inefficient, even detrimental to some nations. It was instead suggested that:

“The implementation of instruments such as tradable permit systems, environmentally related taxes, and the phasing out of support programs that are environmentally damaging in agriculture, fisheries, transport, energy, manufacturing, and elsewhere should be pursued, and applied according to national circumstances”
(OECD, *Environmentally Related Taxes: Issues and Strategies*, 1).

This meeting began to address the methods by which green tax reform could be implemented. The importance of this meeting is the understanding among the delegates that tax laws and systems have to be tailored both to suit an individual country or locations needs, and to achieve the desired environmental goals. Blanket measures will tend to prove inefficient and ineffective. There are four critical design issues for any environmental tax. First the characteristic of a given environmental problem must be recognized and understood. Second a competent authority must be selected to legislate, implement, and monitor the tax. The third and fourth factors are the establishment of a suitable tax base, and a suitable tax rate (Jenkins, 1994, 43).

Environmental taxes are best suited for situations where the relationship between the polluting action and its impact on the environment can be easily understood (Jenkins, 1994, 43). These taxes should indicate to polluters that their tax burden is in proportion to the environmental and health risks associated with their actions (USGAO, 1993, 25). Taxes may require their implementation in stages, as was the case with the German energy tax (Brown, 2002, 241). It would generally be easier to monitor pollution taxes on products rather than emissions, however, product taxes penalize all users of that product (USGAO, 1993, 4-5). The successful implementation of an environmental tax requires advance studies of the potential effects of the proposed tax/policy package. It should involve early involvement of tax and fiscal authorities. Direct public consultation should be employed so that those who feel the effects of the tax feel that they have had an equal say. The tax should be announced early so that people can have a grace period to begin to adjust to the upcoming change. Environmental taxes tend to have far superior effectiveness when introduced as part of a policy package containing complementary measures. The tax should be imposed gradually to allow for another grace period of adjustment. The revenues that are generated should be recycled back to tax payers, related sectors, or to reduce other taxes. The incentive effect should be gradually increased by gradually increasing the real price signal of an activity over time, and by reducing exemptions. Finally a key measure to successfully implement an environmental tax is to design evaluation measures into the tax system so that it will be easy to determine its effectiveness (EEA, *Environmental Taxes: Implementation and Environmental Effectiveness*, 12).

Evaluating Effectiveness

When evaluating environmental taxes it is important to remember what they are designed to accomplish. They are intended to improve integration of environmental protection requirements, to internalize external costs, to promote eco-efficiency, to provide incentives for pollution abatement at a minimal cost, to encourage innovation, to generate revenue that may be used to finance environmental activities, to fund reductions in other taxes, and to reinforce other environmental policy instruments (EEA, *Environmental Taxes: Recent Developments in Tools for Integration*, 38). Thus far evaluations of environmental taxes reveal environmental benefits, and appear to be cost effective when compared to other control mechanisms. Incentive taxes tend to be effective when the tax is set at a rate sufficiently high enough to encourage abatement measures. The use of revenues collected from cost covering charges for environmentally related expenditures seems to increase the effectiveness of these charges. It has also been discovered that some taxes prove effective over relatively short periods of time (2-4 years) and thus compare favorable to other environmental policy tools. While other taxes, such as energy taxes, often require longer periods, often times at least 10 years to show positive results (EEA, *Environmental Taxes: Implementation and Environmental Effectiveness*, 9).

A 1992 study by Shackleton, comparing four models of the U.S. economy, to analyze the effects of imposing a carbon tax while recycling the tax revenues in various ways, concluded that “The costs of a carbon tax may be largely and perhaps even fully offset by taking advantage of its efficient value and using the revenues to cut existing taxes that discourage capital formation or labor supply” (Morgenstern, *Environmental*

Taxes: Dead or Alive?, 6). It has also been suggested that blanket exemptions for polluting products or rebates to heavily polluting industries can significantly reduce the effectiveness of taxes in decreasing pollution and reduce incentives for developing and implementing new efficient technologies (OECD, *Environmentally Related Taxes in OECD Countries: Issues and Strategies*, 3).

Barriers to Implementation and Solutions

Although environmental taxes seem capable of providing many benefits for the environment, the economy, and society, certain concerns have been voiced about possible negative side effects of their implementation. These concerns include the possible negative effects on income, competitiveness, employment, inflation, and income distribution (EEA, *Environmental Taxes: Recent Developments in Tools for Integration*, 4). Some people fear that environmental taxes may in fact be a regressive tax. This means that they would impact more on low income households. For instance an energy tax may mean that a larger percentage of a low income family's wages may have to be spent on higher priced electricity when compared to an upper or middle class family, leaving the lower income family with less disposable income. However, a complete assessment of the taxes effects would have to include the secondary impacts of compensation payments, tax reductions, and the induced employment effects. It is also important to look at the distribution of environmental benefits that arise from the tax, since lower income families tend to live in the areas most affected by pollution and therefore stand to benefit the most from their reduction (OECD, *Environmentally Related Taxes: Issues and Strategies*, 5). Many fiscal authorities agree that some environmental taxes by themselves are regressive, but they point out that terraced tax schemes, rebates

to lower income families, or the use of revenue from environmental taxes to finance a basic income for lower income families can serve to neutralize the regressive aspects of these taxes (Milani, 2000, 197). The Organization for Environmental Co-operation and Development warns that reduced tax rates for low income households can reduce the overall environmental effectiveness of the taxes and should thus be avoided. Instead other, more direct, measures should be used to compensate low income households. This will maintain the price signal of the tax, providing the proper incentive to change behavior, while still reducing the impact of the tax on lower income families (OECD, *Environmentally Related Taxes: Issues and Strategies*, 5).

Terraced tax schemes, or tax free thresholds, allow tax free consumption of products deemed necessary for survival, such as water or energy, up to a certain level, with rising levels of taxation based on levels of consumption. This can lessen the impact of taxes on lower income families and small firms, while still providing the incentive to use less of the taxed item (EEA, *Environmental Taxes: Implementation and Environmental Effectiveness*, 35). An example of a tax free threshold in action can be seen in Setubal, Portugal where households are allowed to purchase 25 cubic meters of water a month tax free, while usage over this level is taxed in three progressive levels (Worldwatch Institute, *Shifting Tax Burden to Polluters Could Cut Taxes on Wages and Profits by 15 Percent*, 3).

Competitiveness is another issue, especially for large companies who must compete with companies from other countries, who may not employ the same taxes or regulations. To date environmental taxes have shown no signs of reducing the competitiveness of any sector (OECD, *Environmentally Related Taxes in OECD*

Countries: Issues and Strategies, 2). Some believe that environmental taxes may even enhance competitiveness through innovation and company restructuring (EEA, *Environmental Taxes: Implementation and Environmental Effectiveness*, 34). Take for example Denmark, Norway, and the Netherlands the three most competitive countries in the European Union even though they are also three of the most progressive countries in terms of environmental taxation (EEA, *Environmental Taxes: Implementation and Environmental Effectiveness*, 34). In order to maintain competitiveness between domestic product and imported product, environmental tariffs could be implemented which require that all imports pay a similar level of tax to domestic products ensuring competitiveness in domestic markets. Similarly export rebates can be granted to ensure a domestic company's ability to compete overseas (EEA, *Environmental Taxes: Implementation and Environmental Effectiveness*, 35).

Another area of concern is over the effects of environmental taxes on employment. As has already been stated, green taxes can allow for reductions in other taxes, especially payroll taxes. Reducing taxes on payroll makes hiring new people less expensive and therefore stimulate employment, while it can also attribute to increased wages for those already employed. In Europe, most environmental taxes are part of a package plan that decreases payroll taxes, inducing the generation of new jobs, which is a high priority since unemployment in the EU is around 11 percent (Worldwatch Institute, *Shifting Tax Burden to Polluters Could Cut Taxes on Wages and Profits by 15 Percent*, 2).

Sustainable Development

This section will examine sustainable development in an attempt to isolate the goals and objectives of sustainability. The purpose of this is to create a criteria by which it may be determined that environmental taxes can be used to accelerate the transition to a sustainable society, either through achieving similar goals, or providing the catalyst of change.

Goals and Objectives

Sustainability is a form of efficient growth that seeks to conserve natural resources, while also restoring and providing for human health and environmental quality (Hill, 2000, 294). In order for sustainable development to be realized we must focus on three major components: Economic sustainability, social sustainability, and environmental sustainability, see figure 2-5 (Benson, 2000, 5). These components must address the integration of environmental, economic, and social concerns; intergenerational equity; and international justice (Mirovitskaya, 2001, 74). Although the

<p><u>Ecological Sustainability</u> Development is in harmony with ecological processes</p> <p>Biodiversity</p> <p>Conservation and protection of natural resources</p>		
<p><u>Economic Sustainability</u> Development is economically efficient and competitive.</p> <p>Development also takes into consideration the needs of future generations.</p>	<p><u>Social Sustainability</u> Development reinforces the individual's control over their own lives.</p> <p>The results of development are distributed equitably</p>	<p><u>Cultural Sustainability</u> Development is in harmony with the cultural concepts of the individuals involved.</p>

Figure 2-5. Components of Sustainability. Redrawn from MacFarlane, 2000, 152.

environmental, economic, and social concerns may be the most publicly well know and debated component, intergenerational equity, and international justice will be just as

crucial to the successful implementation of any plan of action. Intergenerational equity is the fair distribution over time of income, wealth, and access to social services and natural resources. This will require current generations to desist from the depletion of natural resources and environmental services for its own consumption unless investments are made with the proceeds set to provide future generations at least equal, if not greater, benefit (Mirovitskaya, 2001, 244). In essence a sustainable society will ensure that they do not consume or degrade available resources to the point at which there will not be access to these resources or the benefits derived from these resources for their children or grandchildren. However, this does not imply that a resource should not be consumed simply to ensure that it will continue to exist. If for example coal reserves are depleted in the production of a solar/wind inexhaustible energy generation system, then in effect we are bestowing a better, cleaner technology upon future generations at the cost of a resource that is environmentally destructive, and may no longer be necessary to support the quality of life of future generations. International justice implies that the changes implemented in order to transition to a more sustainable society be uniform internationally so as not to benefit one country while hurting another. This concept is important in ensuring that production does not move from a country with strict environmental regulations to a country with lower environmental standards, resulting in a net environmental improvement of zero when viewed globally, as well as economic losses in the country that loses the production capacity. It is also an important concept in that it recognizes the correlation between poverty and environmental mismanagement

and degradation. An important step in achieving a sustainable world civilization will be economic equity between nations, thus breaking the cycle of poverty that threatens us both socially and environmentally.

In 1991 the Club of Rome defined a sustainable society as a society

“that is based on a long term vision in that it must foresee the consequences of its diverse activities to ensure that they do not break the cycles of renewal; it has to be a society of conservation and generational concern. It must avoid the adoption of mutually irreconcilable objectives. Equally it must be a society of social justice because great disparities of wealth and privileges will breed destructive disharmony”

(Mirovitskaya, 2001, 103).

According to Kendle, Rose, and Oikawa the concept of sustainability embodies four different philosophies. First, we will best conserve that which we use and value and that links between nature and people must be fostered not broken. Secondly, the right sort of development will provide a key to successful environmental protection. Thirdly, biodiversity conservation needs to be addressed throughout society, not only in reserves. And finally, environmental care is a responsibility of everyone and that developing the capacity for this to occur will be an important task (Kendle, 2000, 286).

This leads us to a consideration of the goals and objectives of a sustainable society. Roderick Lawrence asserts that there are five main objectives of sustainable development. The first is providing guarantees that economic activity does not over exploit natural resources or exceed the capacity of the earth to adjust to the impacts of human activities upon which sustenance is based. The second goal is to ensure that ecological integrity and resilience to change is maintained by the amount and diversity of natural resources, and other environmental assets. The third goal is to reduce the

inequalities between human societies' and within specific human settlements by authorizing institutions to be key actors in reconciling the environmental and social consequences of human resource use. The fourth goal is to maintain human well being and quality of life by promoting broader participation in the decision making process, especially at the local community level. The final goal is fostering an ethical framework, and moral values and attitudes that give more consideration to future generations and the non-human components of the world (Lawrence, 2000, 5).

During the "Earth Summit" in Rio de Janeiro, Brazil in 1992, a document known as Agenda 21 was produced which outlined six major themes of sustainable development. These themes are quality of life on earth, the efficient use of the earth's natural resources, the protection of our global commons, the management of human settlements, chemical use and the management of waste, and sustainable economic growth (Mirovitskaya, 2001, 94).

Steve Dodds has also formulated a list of objectives for the implementation of sustainable development. He believes that we must ensure that economic activity does not undermine the natural and other capital upon which the economy is based. We must maintain ecological integrity and resilience particularly through maintaining critical natural and environmental assets. We must encourage greater equality of, and establish the proper institutions to regulate, human resource use in order to reduce the impacts of this use. We must achieve non-declining well being, particularly through encouraging broader participation in decision making. And finally, we must foster ethical frameworks and attitudes that give greater weight to future generations and the non-human world (Dodds, 2000, 29-30).

The purpose of this section is to formulate a set of goals or objectives for sustainable development. By looking at the theories of Lawrence, MacFarlane, Dodds, and the United Nations a set of five major goals of sustainability can be established. The first goal is the conservation of natural resources both for production purposes and for the environmental services they provide. The second is the maintenance of diversity of natural resources and natural systems in order to preserve the earth's ability to cope with the impacts of human development, as well as protecting our global commons. The third is a reduction in the inequalities of wealth and resource availability both within countries and among nations, thus improving the overall quality of human life. The fourth is an increase in public participation in the decision making process. And the final goal is to impart moral values and attitudes to society that will benefit both future generations and the non-human components of the world. These goals will be used in analyzing how economic instruments, particularly environmental taxes, can be used to facilitate the changes needed to achieve a sustainable society.

Conclusion

From economics, to climate change, to resource use, the range of topic areas explored in this literature review reveal the degree to which change is needed to achieve a sustainable society. This thesis is not just about taxes, or sustainable design, but is instead focused on how economic instruments, especially environmental taxes, can be used to begin the behavioral transition from a society of mass consumption and waste, to a society that values and protects the natural environment that allows us to prosper both economically and spiritually. This thesis does not profess to answer how sustainability will happen, but instead offers one possible means to achieve the goal of sustainability.

The main barrier to realizing a sustainable existence is educating the public. I contend that money is the subject that all persons understand, and that by tying sustainability directly to economic decisions individuals will become more educated about the need for change and the role they can play as an individual in this change. As I said earlier it is not a question of if, it is a question of when and how.

Chapter Three: Analyzing the Environmental Effectiveness of Green Taxation

Introduction

This chapter will examine four European countries, Denmark, the Netherlands, Sweden, and the United Kingdom, analyzing particular environmental taxation policies and the environmental impacts of these taxes. The purpose for this section is to determine if environmental taxes are indeed effective at achieving their environmental objectives. If they are not it will be impossible for them to aid in the transition to a sustainable society. The selected countries and tax schemes were chosen to demonstrate the various applications of environmental taxation from the minimization of waste, to the control of greenhouse gas emissions. In this chapter an evaluation will be made of: Denmark's energy tax; the Netherlands' water pollution charges, and waste disposal charges; Sweden's hydrocarbon and nitrous dioxide emissions tax, vehicle tax, battery charge, and fertilizer tax; and the United Kingdom's landfill tax, and mineral extraction tax.

In order to evaluate the effectiveness of an environmental tax it is important to understand the reasons for their implementation. Environmental taxes broadly serve seven main functions. These intended functions are: To improve the integration of environmental protection requirements, to internalize external effects, to promote eco-efficiency, to provide incentives for pollution abatement at minimal cost, to encourage innovation, to generate revenue that may be used to finance environmental activities or to finance reductions in other more distortionary taxes, and finally to broaden the range of policy instruments and reinforce other environmental policy instruments (EEA,

Environmental Taxes: Recent Developments in Tools for Integration, 38). An environmental tax does not necessarily have to serve all of these functions, but all environmental taxes are used to reinforce existing policy measures (EEA, *Environmental Taxes: Recent Developments in Tools for Integration*, 38). This leads to difficulty in a general methodological evaluation of the effects of a tax, separated from the other components of a policy package which will tend to exert their own impact on the environmental issue which the policy addresses. Another difficulty in determining the effectiveness of an environmental tax is that many taxes have not been implemented for long enough to obtain an accurate signal about their effectiveness, or the environmental problem which they address may take one to two decades to exhibit any significant change. Due to these limitations in evaluating the effectiveness of environmental taxation there is little literature that tries to quantify the results of green taxes beyond a theoretical basis. Therefore, all of the information included in the following case studies has been obtained from the European Environmental Agency's *Environmental Taxes: Recent Developments in Tools for Integration* unless otherwise noted.

Denmark

Energy Tax

The Danish energy tax is among the highest in the world covering fossil fuels such as oil, coal, and natural gas, as well as electricity (53). These energy taxes were introduced in the late 1970's during the oil crisis, because of the effects of the increased price of oil on Denmark, who at the time had a 95 percent dependence on foreign resources (53). In the 1980's the rates of these taxes were increased to maintain the price incentive against decreasing prices of crude oil in the world market (53). In the 1990's

energy taxation began to be viewed as a primary policy instrument to combat climate change, as opposed to a tool to minimize Danish dependence on foreign resources (53).

In 1992 a CO₂ tax was introduced to households and extended to industry in 1993. Between 1994 and 1998 environmental taxation became part of the first phase of an ecological tax reform. This package included a gradual increase in CO₂ taxation, a modification of energy taxation on industry, which abolished the reimbursement for taxes paid for space heating, and a new tax on SO₂ emissions (53). The design of the CO₂ tax is of particular importance because it accounted for competitiveness. The rates for this tax differ according to the use of energy (the process) and are further differentiated based on whether or not an environmental agreement has been reached between the company and the regulating body. Rather than being exempted, heavy processes are taxed at a reduced rate, light processes are taxed at a slightly reduced rate, and the tax rate for energy consumption for space heating is equal for both households and industry. If voluntary environmental agreements are reached, which may include energy audits with the obligation to invest according to specific criteria; a further rate reduction can be obtained by heavy processes and partially obtained by light processes. This design allows for the largest energy saving potentials, which usually tends to be for the heating of a building, to be exploited without degrading a company's competitiveness (53). Another feature of this tax package is the provision of subsidies for energy investments (53). The primary objective of this tax reform is not to generate revenue for the government, but instead to recycle the tax revenue back to the private sector. This is

achieved through incentives for energy saving measures and by a reduction in the marginal labor income tax by a total of 2 percent of the Danish gross domestic product (53).

Evaluations

Denmark's high energy taxes have provided a continued incentive for energy savings, and promoted the spread of other tax free energy sources (53). The taxes have affected consumer behavior resulting in less energy consumption by end users through the use of insulation, a reduction in room temperatures, and an increase in the use of energy efficient equipment. They have also resulted in a shift from taxed fuels to tax free fuels, and increased the use of natural gas, the cleanest burning of the fossil fuels (53-54). From 1970 to 1990 the net consumption of energy for space heating fell by 10 to 15 percent (54). The Danish Energy Package has had little effect at the macro-economic level due to its gradual increase over five years and the full recycling of the tax revenue. The energy package generates 2 billion Danish kroner annually, which is transferred back to consumers via investment subsidies, reductions in labor market contributions, and the reduction of fees (54). The significance for employment has been marginally positive. Labor intensive divisions of the manufacturing and service sector receive a net profit, while businesses with high energy consumption are additionally taxed (54). The secondary policy instrument of investment subsidies had a significant effect on energy conservation measures. The CO₂ taxes and supplementary instruments stimulated innovation in energy process, usually implemented by the specific enterprise, such as heat recovery systems (54).

The Danish Ministry of Economic Affairs has stated that “Danish experience through 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” (54). Denmark has become the third largest producer of wind turbines, generating over 650 million euro and 10,000 jobs in 1996 alone (54). Denmark has also become a strong market for energy saving products such as energy efficient refrigerators, capable of decreasing energy requirements by up to 35 percent, which have increased in usage from 40 percent in 1994 to 85 percent in 1996 (54-55).

The environmental taxes on energy have largely fulfilled the environmental expectations of the Danish government. The CO₂ tax is responsible for a reduction of CO₂ emissions by 1 million tons between 1988 and 1995. In 1999 total Danish CO₂ emissions totaled 55.7 million tons, a reduction of 9 percent of the 1988 levels, with emissions levels dropping every year since 1994. Since 1980 energy efficiency has improved by 50 percent (55). The environmental effect of the tax on sulfur emissions has achieved better than expected results. The sulfur content of fuel gas oil has been reduced from 0.2 percent to 0.05 percent, occurring within a few weeks of the taxes introduction. The sulfur content of heavy fuel oil has similarly been reduced from 0.2 percent to 0.05 percent. The sulfur content of coal has been reduced by about a third. The tax has had a positive impact on the development of sulfur purification plants and technology (55). And between 1980 and 1995 SO₂ emissions decreased by 67 percent while the gross domestic product grew by 36 percent (OECD Working Party, 2000, 58), and from 1995 to 1997 SO₂ emissions have decreased another 24 percent (55).

The Netherlands

Pollution and Resources

The Netherlands employ a number of environmental taxes designed to meet different environmental goals. The focus of this study will be on taxes levied with regard to water usage, water pollution, and waste disposal. Currently a system of charges on water pollution levied by state and regional water boards is used to control polluting emissions into the country's water sources. These charges are primarily intended to finance waste water treatment and water quality management (63). In 1995, two new environmental taxes were introduced pertaining to groundwater extraction, and waste disposal in landfills. The tax on groundwater extraction is intended to compensate for the price difference between groundwater, and surface water that requires more treatment and is, therefore, more expensive (63). The tax on waste disposal in landfills is designed to compensate for the price difference between land filled waste, and incinerated waste, which although more costly is considered environmentally preferable (63). This tax is also intended to raise awareness and in turn decrease waste. In 1999, a 17.5 percent value added tax was applied to drinking water intended to create an incentive for more efficient water use. Under this scheme the first 60 gallons of water are tax free allowing basic necessities to be met without incurring a tax burden. This policy is expected to conserve between 5 and 10 million cubic meters of water annually (63). In order to maintain the price incentive of their environmental taxes, The Netherlands has recently linked and indexed all of their environmental taxes to rates of inflation, thus preventing these taxes from providing false price signals (63).

Evaluations

Thus far, the charges on water pollution have been high enough to induce an incentive effect for industry to reduce the amount of polluted emissions discharged (63). A 1997 study found that the tax on drinking water has resulted in up to an 8 percent decrease in usage by households and up to a 12.6 percent decrease in usage by industry (64). The tax on groundwater extraction has reduced self extraction of groundwater, for purposes other than drinking, from between 6 to 35 percent for industry, and from between 9 to 51 percent for agriculture (64). Although some reductions have been made, an exemption for small scale extraction by households and agriculture has led to an increase in groundwater extraction (64). This demonstrates the need to eliminate or minimize exemptions in an environmental taxation scheme in order to maintain the price incentive. If a tax is considered to unfairly burden a particular segment of the tax base it is better to seek alternative methods to reimburse these users, so that the behavioral changes desired by the taxation will still be promoted. The tax on land filled waste can be seen as moderately successful at best. The volumes of household waste have been increasing, and per unit generation of municipal waste is high among OECD countries (OECD Working Party, 2000, 183). However, two promising results have occurred that may signify a change in consumer behavior. The first is that about 55 percent of all waste is recycled in The Netherlands. The rates of paper, cardboard, and glass recycling are among the highest of OECD countries. Also a system of separating biowaste for composting, and household waste at its origin has proven successful and is expected to continue to improve (OECD Working Party, 2000, 183).

Sweden

Transport

Between 1989 and 1997 a tax on hydrocarbons and nitrous dioxide was levied on domestic transport. However, this tax was abolished, despite achieving significant environmental gains, in 1997 because of EU Single Market concerns (67). Sweden applies a system of differentiated vehicle taxes based on environmental classification. In 1993, the sales tax on the most polluting cars (class 3) was increased by 2,000 Swedish kronor, while the tax on the least polluting vehicles (class 1) was lowered by 4,000 kronor. Eight years later a tax of 2,500 kronor was levied on the purchase of all diesel autos older than 1994 (67). Since 1989 vehicle emission standards in Sweden have required the use of three way catalytic converters to limit the emissions of greenhouse gases (OECD Working Party, 2000, 229). A vehicle scrapping charge has been in effect since 1975, designed to generate revenue that is used to pay the premiums when unused cars are delivered to an authorized car scrapping firm (67). In order to offset the increase in taxation for private automobile ownership and usage in 2001, the value added tax on public transport was decreased from 12 percent to 6 percent, promoting the use of public transport (67).

Evaluations

The tax on domestic air transport led the domestic airline to overhaul the engines in their fleet resulting in a 90 percent reduction in hydrocarbon emissions (67). Not only did this tax produce hard incentives to decrease polluting emissions, it also produced soft signals which raised the level of environmental awareness within the aviation industry, and led to more consideration of the environmental implications of corporate decisions

(67). Between 1993 and 1996, the number of newly registered cars belonging to class 1 or class 2 increased from 16 to 75 percent. However, since the tax differentiation of the vehicle tax amounted to only a few percent of the purchase price of the vehicle, the change in purchasing patterns is most likely attributed to soft signals such as better consumer information and awareness (67). The vehicle scrapping charge has achieved its goal of preventing scrap cars from being abandoned, but has not increased the rate at which older cars are scrapped, therefore, not significantly reducing the emissions they produce (67). This section is important because it demonstrates the ability of environmental taxes to produce soft signals and incentives that can ultimately change both producer and consumer attitudes and behavior.

Pollution and Resources

In 1992, a NO₂ charge of 40 kroner per kilogram of NO₂ emitted by large stationary plants (Roseveare, 2001, 13) was introduced, based on recorded emissions regardless of the fuel used (67). Originally this charge was only applied to large combustion plants, but in 1996 and 1997 the tax was expanded to include all facilities producing over 25 GWh of energy per year (Roseveare, 2001, 13). The revenues generated by this charge are returned to payers in proportion to their share of total energy production, creating an incentive to minimize NO₂ emissions per unit of energy (67). The structure of this tax is such that any producer with emission levels lower than the industry average will receive net benefits, and those producers with emissions over the industry average will face a net cost (Roseveare, 2001, 13). In 1996 three different environmental charges were applied to batteries depending on their content. Alkaline mercury oxide batteries are charged at a rate of 23 kroner per kilogram. Nickel cadmium

batteries are charged at a rate of 46 kronor per kilogram. And lead batteries are charged at a rate of 40 kronor per kilogram. Sweden has established itself as a leader among OECD countries in the field of chemical products management (OECD Working Party, 2000, 229). Since 1994, a tax on commercial fertilizers containing nitrogen (SEK 1.80 per kg) and a tax on the cadmium content of phosphorous fertilizers (SEK 30 per gram of cadmium exceeding a concentration of 5 prams per ton of phosphorous) has been employed to limit the amount of these chemicals added to the environment (67).

Evaluations

The NO₂ charge created an incentive to monitor and limit NO₂ emissions in the energy sector (68). Between 1990 and 1996 NO₂ emissions per unit of energy produced fell by 60 percent, while total emissions of NO₂ fell by 50 percent from about 24,500 tons in 1990 to about 12,500 tons in 1996 (68). Total emissions showed a smaller decline, however, the amount of energy generated during this period increased by 25 percent (Roseveare, 2001, 13). The battery charges have not had any direct impact on consumer purchasing behavior, but they have generated revenue that is used to finance their proper disposal. Soft effects have also been felt from the battery charge with collection rates having increased to almost 100 percent for lead batteries, 60 to 70 percent for mercury batteries, and 35 percent for nickel cadmium batteries. At its current rate, the fertilizer tax is expected to reduce the total nitrogen use in fertilizers by 10 percent, while the effects of the cadmium charge in fertilizers still unknown (68).

The United Kingdom

Pollution and Resources

“As the cradle of the Industrial Revolution, the U.K. has had a long experience of the problems that economic development can bring for the environment, including resource depletion, pollution, and the degradation of the urban and rural landscape” (OECD Working Party, 2000, 257). In 1996 the United Kingdom introduced a landfill tax, intended to act as an incentive to reduce the quantity of land filled waste (70). The rates were set at 11 British pounds per ton of non-inert wastes, rising by 1 pound each year until 2004, and 2 pounds per ton of inert wastes (71). The revenue generated by this tax is set to be recycled to business in the form of a reduction in Employers’ National Insurance Contributions (71). Beginning in April 2002, a tax of 1.60 pounds per ton of aggregate extracted was levied to cover the environmental costs associated with quarrying including noise, dust, visual intrusion, loss of amenity, and damage to biodiversity (71). The environmental benefits of the aggregate extraction tax will come through the price of aggregates better reflecting their true social and environmental costs, as well as encouraging the use of recycled aggregate. The revenues from this tax will be used to finance a 0.1 percent reduction in Employers’ National Insurance Contributions, and a new ‘sustainability fund’ directed at providing environmental benefits to areas subject to the environmental deterioration caused by aggregate extraction (71).

Evaluations

The landfill tax has been successful at changing behavior throughout the waste sector. This change could be further exploited by a continued increase in the level of taxation (71). Many companies are now investing in Material Recovery Facilities

(MRF's) that seem to be directly motivated by the landfill tax (71). Although only 29 percent of companies were active in material re-use, recycling, and minimization prior to the tax, 64 percent of companies have become focused on recycling, re-using, or minimizing their waste since implementation of the tax (71). Once again this shows how a monetary incentive can be used to alter consumer and producer behavior.

The United States

The United States was the first country to implement a market based incentive in 1974, when an emission trading program was established in order to help companies meet the Clean Air Act (USGAO, 1993, 10). This market based approach to control the emissions of sulfur dioxide, a greenhouse gas, has resulted in a reduction by one half of the 1980 levels of emissions by the year 2000, at a savings of \$2-3 billion per year for business and government (Worldwatch Institute, *Shifting Tax Burden to Polluters Could Cut Taxes on wages and Profits by 15 Percent*, 2). Although this was a major step forward, little has been done since then at the national level to implement market based instruments to protect the environment. Instead, individual state and local governments have taken the lead when it comes to utilizing market based reform to achieve environmental goals. This is evident in practices such as New York's solid waste tax, Panama City's wastewater charges, and deposit refund systems created by states such as Massachusetts, Connecticut, Delaware, Maine, and Vermont.

This is troubling in that the country that is considered by many to be the only remaining world super power has been so slow to react nationally to the need to protect our environment and the services it provides. One can only wonder why a system, such as the tradable emissions program for sulfur dioxide, which has proven environmentally

and economically successful, would not be used as a blueprint to develop other programs to protect the environment.

The United States professes to act in the best interest of the world when we remove dictators or help establish democratic governments, but if the result of our intervention is only to create a country that is modeled after the United State's ideals of producing as much of a given product as possible at the lowest cost, with little regard for the environment, we are actually doing the world a disservice. The United States should take on the full responsibility of being a world power, by not only assisting countries in need, but by also acting as a role model demonstrating various ways to meet the needs of a country's economy without jeopardizing environmental quality. By incorporating innovative technology and policy we can begin to demonstrate to the world a strategy to meet human needs while also protecting the environment. This will not only benefit us environmentally, it will also benefit our economy as our technologies can be sold or shared with other countries meaning that jobs will be created to produce, install, and maintain these technologies that help protect the environment. People will also be needed as consultants and educators to ensure that policies and technologies are implemented correctly, and that a proficient local force understands how to repair and maintain these systems once established. The United States has come along way in a short time. Much of this advancement can be attributed to production techniques that largely ignore the environment upon which production relies. It is now time to move forward as a world power, determining how we can provide human comforts while maintaining and promoting environmental quality, so that other countries that look to the United States for guidance will be directed down the proper path .

Chapter Four: Accelerating the Transition to a Sustainable Society

Introduction

Sustainability is a topic of great concern in our contemporary lives. Many people see the need for change, but can not imagine how this change can actually be implemented. The purpose of this chapter is to explore environmental taxation as one possible means to accelerate the transition to a more sustainable society (Figure 4-1) . When comparing the goals of sustainability and the results of environmental taxation

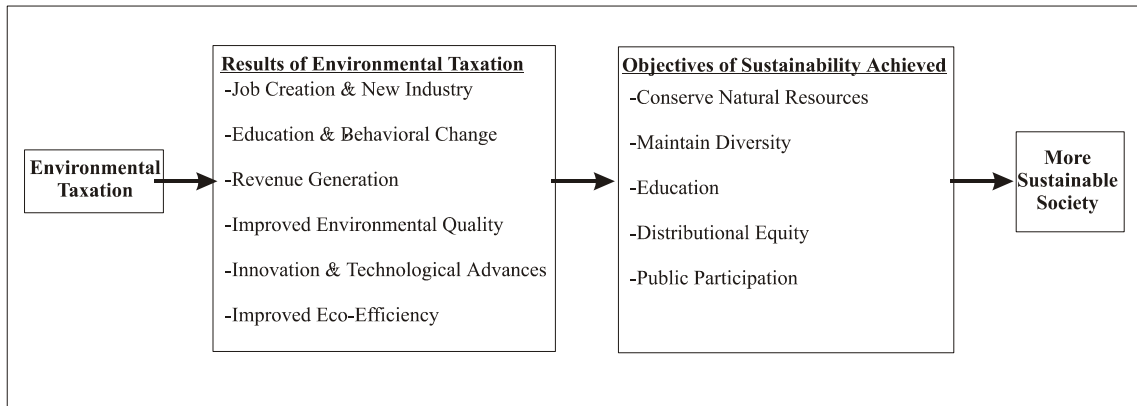


Figure 4-1. Process through which environmental taxation can achieve a more sustainable society.

many similarities become apparent (Figure 4-2). The specifics of the goals of sustainability and the results of environmental taxation will be discussed later in this chapter, but I believe that these similarities suggest that the implementation of environmental taxes could result in a society that is more educated, environmentally conscious of their activities, and more equitable among all segments of the population, all of which will lead to a more sustainable society.

Goals of Sustainability

Due to the nature of the topic of sustainability it can often be difficult to develop ideas, definitions, and objectives that successfully meet the expectations of all participants in the process. This leads to a profusion of generalities, either out of fear of upsetting certain individuals, or because it is difficult to determine what is or is not germane. For the purpose of this study the broad objectives of sustainability will be sufficient in providing the framework within which an argument can be made that environmental taxes are capable of meeting the goals of sustainability. Based on the

		Goals of Sustainability				
Results of Environmental Taxes		Conserve Natural Resources	Maintain Diversity	Distributional Equity	Public Participation	Education
	Promotes Eco-Efficiency	●	●	●		
	Improves Environmental Quality	●	●			
	Ability to Raise Revenues			●	●	●
	Education & Behavioral Change	●	●	●	●	●
	Job Creation & New Industry			●	●	●
	Innovation	●		●	●	●

Figure 4-2. Matrix comparing the results of environmental taxes to the goals of sustainability they could accomplish. For additional information on the goals of sustainability or the results of environmental taxation see chapter 2.

work of Roderick Lawrence, the United Nations, and Steve Dodds, five broad goals of sustainability have been established. They are the conservation of natural resources, the maintenance of diversity, ensuring distributional equity, promoting and allowing for public participation, and education (Dodds, 2000,; Lawrence, 2000,; Mirovitskaya, 2001). It is believed that these five goals will provide a healthier environment, better human health, better equity between the rich and poor, and a world capable of supporting quality human life for centuries longer than current behavior will allow. The question then is how do we begin the transition to this society?

Relating the Results of Environmental Taxes to the Goals of Sustainability

When examining the results of environmental taxes six main categories become evident. These are the promotion of eco-efficiency, the improvement of environmental quality, the ability to raise revenue, the ability to educate and affect behavioral change, the creation of new jobs and industry, and the promotion of innovation (EEA, *Environmental Taxes: Recent Developments in Tools for Integration*,; Jenkins, 1994; Markandya, 2002,; Mirovitskaya, 2001). Each of the results of environmental taxation can be linked directly to at least two of the goals of Sustainability, as is seen in figure 4-1.

The promotion of eco-efficiency can be linked to three goals of sustainability; the conservation of natural resources, maintaining diversity, and distributional equity. Improved environmental quality can be linked to the conservation of natural resources, and the maintenance of diversity. The ability of environmental taxes to raise revenue allows for the redistribution of wealth, which meets the goal of distributional equity, has the ability to decrease other more distortary taxes, which meets the goals of distributional equity, public participation, and education, and provides revenue for public education, which meets the goal of education. The ability of environmental taxes to

affect education and behavioral change may be the most important result of environmental taxation because it has the ability to meet all five of the goals of sustainability. Green taxes have the capacity to create new jobs and industries, which meet the goals of distributional equity, public participation, and education. The final result of environmental taxes, innovation, has the ability to conserve natural resources, provide distributional equity, increase public participation, and provide much needed education. This demonstrates the degree to which the results of environmental taxes and the goals of sustainability overlap. This overlap suggests that environmental taxes may be a major contributor in the movement towards a more sustainable society. In order to buttress this argument the following section will explore the four main categories of environmental taxes with regard to how they can meet the goals of a sustainable society.

How Environmental Taxes can Achieve the Goals of Sustainability

Introduction

The purpose of this section is to demonstrate that environmental taxes have the capacity to achieve all of the goals of a sustainable society. This will be accomplished by looking at the results that can be achieved by the four main categories of environmental taxation; cost covering charges, incentive taxes, fiscal environmental taxes, and environmental tax shifting, and then linking these results to the goals of sustainability. Through this analysis and comparison one possible means of accelerating the transition to a more sustainable society will be asserted.

Cost Covering Charges

Cost covering charges stipulate that those who use the environment are responsible to cover or contribute to the costs of monitoring or controlling their use. The effectiveness of these systems arises from both their revenue use and their impact on

price, exhibiting the scarcity of natural resources and sinks. There are two sub-categories associated with cost covering charges, which are user charges and earmarked charges. User charges are paid by the individual or firm that receives a specific environmental service. Whereas earmarked charges use the revenue generated from the charge to fund environmental programs that are not in the form of a specific service to the source of the charge (EEA, *Environmental Taxes: Recent Development in Tools for Implementation*, 13). Cost covering charges are capable of stimulating innovation, promoting education and behavioral change, raising revenue, and improving environmental quality, all of which contribute to overall social and environmental sustainability.

A cost covering charge is a price or fee per unit of pollution discharged. It attempts to create a price equivalent to the external costs of an activity. A profit maximizing company will lower the levels of pollution up to the point at which the price to be paid per unit of pollution equals the cost of additional pollution abatement (Markandya, 2002, 187). A company's desire to minimize the emitted levels of a taxed item will lead to innovations in the processes of production and treatment, alternative inputs that are not taxed, and substitution with other products in an attempt to produce less of the taxed product. Ways to reuse waste products from one process as the raw material for another process, mimicking natural systems, will be explored as a method of reducing tax burdens. These innovations will lead not only to a healthier environment, but also to a more efficient economy.

Cost covering charges also have the ability to affect public education and behavior. People want to know why the price of an item that they are accustomed to using suddenly increases. People who may have no opinion about the environment surely have an opinion about how they spend their money. If a portion of the revenue generated

from cost covering charges is used to provide information about the environmental effects of certain products consumers will become better educated about the consequences of their actions. Thus individuals who have never been active in environmental policy will have no choice but to participate. The increase in price will also drive consumers to search for alternative products that are not taxed. This change in consumer behavior will cause producers to look to alternative products as a means to stay competitive in their market. Overall, education and behavioral change may play the most important role in the transition to a sustainable society.

Cost covering charges serve as a means to generate revenue that can be used to invest in pollution control or reduction equipment (Markandya, 2002, 2003). Every time a factory discharges pollutants into a body of water, the air, or land, a fee is paid based on the pollutant and the concentration of the polluting material in the discharge. This money can then be spent to educate the public, finance other pollution abatement measures, provide incentives for investment in pollution control and reduction equipment, or finance the government's oversight programs. This makes sense because those who are benefiting from the production of polluting substances are required to pay for their disposal and mitigation, rather than passing these costs on to society.

Cost covering charges can greatly improve environmental quality. By forcing the individuals responsible for polluting activity to bear the costs, an incentive to change is produced. The choice is to pay for environmentally destructive behavior, or shift to environmentally benign activities. This will result in less discharge, efficient use of resources, alternative production techniques, and the generation of revenue that can be

used to finance pollution control measures and the costs of cleaning up a damaged site. All of this will contribute to improved environmental quality at both the local, and the global scale.

If cost covering charges are capable of achieving improved environmental quality, generating revenue, increasing education and behavioral change, and promoting innovation, then based on the relationships between the results of environmental taxes and the goals of sustainability (figure 4-2) it is evident that they are also capable of achieving the five goals of sustainability. The degree to which cost covering charges can meet the goals of sustainability is not the issue, instead the purpose is to demonstrate the similarities between the goals of sustainability and the results of environmental taxes, suggesting that cost covering charges can be used to begin the movement towards sustainability.

Incentive Taxes

Incentive taxes are an environmental tax levied with the intention of changing environmental behavior. The level of an incentive tax may be set based on estimates of the cost of the environmental damage, or the price signal sufficient to achieve the environmental objectives (EEA, *Environmental Taxes: Recent Developments in Tools for Integration*, 13-14). Incentive taxes are comprised of tax incentives, deposit refund systems, grants, and subsidies (EEA, *Environmental Taxes: Recent Developments in Tools for Integration*,; Hawkins, 2000,; Jenkins, 1994). These taxes have the ability to promote innovation, affect education and behavioral change, raise revenues, improve environmental quality, and promote eco-efficiency.

Financial instruments include the use of subsidies or investments to accelerate the development of environmentally sound techniques, and innovation within a given

industry (Hawkins, 2000, 386). Attempts to minimize the levels of taxation will lead to new technologies, products, and processes that are less environmentally harmful. These taxes will lead to new policy instruments, such as the system of tradable permits, which will allow for the control of pollution levels at much lower economic costs (Hawkins, 2000, 386).

Public education and behavioral change will be much the same for incentive taxes as for cost covering charges. The most important factor is the increase in relative price of a product or service. This price increase will cause consumers to determine why a price has increased, expanding their environmental knowledge. It will also cause consumers to alter their behavior in an attempt to economize their levels of spending. This shift in consumer preference will permeate the market forcing producers to adopt change or be faced with an ever shrinking demand for their products. Programs such as deposit refund systems, based on the advance payment for the economic externality imposed with these costs being recouped as long as certain conditions or measures are met, can be used to educate the public about the need to recycle, and the individual's impact on levels of solid waste production (Hawkins, 2000, 387).

Although the primary purpose of incentive taxes is not to raise revenues, money will be generated because the taxed activity will probably not be reduced to zero. These revenues can be used to further encourage behavioral change through grants, subsidies, or tax incentives (EEA, *Environmental Taxes: Recent Developments in Tools for Integration*, 13-14). This money can also be used for public education, which will help alter consumptive behavior. Systems such as tradable permits allow for the generation of revenue first when permits, allowing a certain level of emissions, are sold or auctioned off, and later from taxes on the sale or lease of the permit from one company to another.

Through their ability to change consumer and producer behavior, incentive taxes can have a dramatic impact on environmental quality. Incentive taxes have the ability to shift consumption from non-renewable resources, such as coal and oil to inexhaustible sources such as wind, and solar power. The revenue generated from incentive taxes can be used to preserve landscapes, as well as for funding research and development of alternative processes and mitigation techniques, which will directly benefit the environment. By creating incentives to decrease levels of pollution, the impacts of human activities on the earth will be substantially lessened.

Increasing the price of scarce resources and products or services that are environmentally harmful will also serve to promote eco-efficiency. As the price of a resource increases so does its value. The more valuable a resource the more we seek to efficiently use it. In essence we seek to get the maximum product from the minimum input. This results in less waste, and more efficient use of our resources.

If incentive taxes are capable of achieving innovation, accelerating education and behavioral change, generating revenue, improving environmental quality, and promoting eco-efficiency then based on the relationships between the results of environmental taxes and the goals of sustainability (figure 4-2) it is evident that they are also capable of achieving the five goals of sustainability. This does not imply that only incentive taxes need to be implemented in order to achieve a sustainable society. Instead it suggests another front from which we can begin the implementation of a sustainable society.

Fiscal Environmental Taxes

Fiscal environmental taxes are designed to raise revenues for government income (EEA, *Environmental Taxes: Recent Developments in Tools for Integration*, 14). Fiscal instruments include pollution taxes, input taxes, product taxes, export taxes, import

tariffs, tax differentiation, royalties and resource taxes, land-use taxes, investment tax credits, and accelerated depreciation subsidies (Markandya, 2002, 186). Fiscal environmental taxes have the capacity to stimulate innovation, promote education and behavioral change, raise revenue, improve environmental quality, create new jobs and industries, and promote eco-efficiency.

Fiscal environmental taxes stimulate innovation in much the same way as cost covering charges and incentive taxes. The increase in price of a certain resource, product, or service will force consumers and producers to seek new products or alternative methods of producing existing products as a way of decreasing their tax burden. Methods of reusing products or waste materials produced as a result of a production activity will also be highly sought after. Provisions that allow refunds of taxes paid on products for export must be established in order to insure competitiveness in foreign markets. While import tariffs must be established to prevent foreign industry, which may have lower environmental regulation, from undercutting local industries. Both of these measures will help in making a global transition by ensuring that all prices incorporate the environmental costs of the activity (EEA, *Environmental Taxes: Implementation and Environmental Effectiveness*, 35).

Although intended to raise revenue, fiscal environmental taxes can also change consumer and producer behavior by altering the relative prices of products. These taxes serve to increase consumer awareness of the implications to the environment of using certain products or services through the price. This system allows consumers flexibility in their reaction to the tax (Jenkins, 1994, 51). The changes in consumer and producer behavior can be attributed to an increase in the understanding of consumers and producers in the role they play in environmental change. This increased education can be

directly related to increases in the price of goods and services, much like what results from cost covering charges and incentive charges. If the price of a given commodity goes up its demand tends to go down (Rhodes, *Top 10 Reasons Why we Need a Carbon Tax*, 1). This will lead to a higher demand for those products and services which are not taxed, thus deemed environmentally acceptable, and lower demand for those products and services that are considered environmentally damaging, and thus taxed.

The main objective of fiscal environmental taxes is to generate revenue for government spending (EEA, *Environmental Taxes: Recent Developments in Tools for Integration*, 14). The benefit of using revenue generated from environmental taxation for government spending is that it can allow for decreases in other taxes, or financing for environmental expenditures (Ribeiro, *Environmental Taxes: Implementation and Environmental Effectiveness*, 2). Fiscal environmental taxes insure that those who damage the environment are directly responsible for the costs associated with environmental clean up and mitigation measures.

Fiscal environmental taxes maintain environmental quality by raising the prices of activities that are environmentally harmful above the prices of activities that are environmentally benign. This insures that resources are preserved, or used in the most efficient manner. The revenue generated from fiscal environmental taxes can be used to restore damaged environments, or provide further incentive to preserve intact ecosystems. Fiscal taxes also provide a monetary incentive to decrease environmentally harmful activities and maximize environmentally beneficial activities.

Fiscal environmental taxes have the ability to stimulate new jobs and industries. If the revenue generated from these taxes is used to offset other taxes, such as payroll taxes or income taxes, than it is cheaper for companies to higher new employees, and

individuals have more available money to invest in activities such as new businesses. The increased taxes on environmentally harmful activities also promote the establishment of new industries which can take advantage of changes in consumer behavior, such as recycling industries, or alternative energy industries.

Eco-efficiency is promoted through fiscal environmental taxes in much the same way it is promoted by both cost covering charges and incentive taxes. By increasing the price of resources and certain activities, consumers are forced to reevaluate their behavior. They will tend to use less of the taxed item, and when it is used will tend to use it in the most efficient manner possible. Once again this results in less waste, increased use of recycled products, and less dependence on virgin resources.

If fiscal environmental taxes are capable of achieving innovation, accelerating education and behavioral change, generating revenue, improving environmental quality, creating new jobs and industries, and promoting eco-efficiency then based on the relationships between the results of environmental taxes and the goals of sustainability (figure 4-2) it is evident that they are also capable of achieving the five goals of sustainability. By this point it is becoming more apparent exactly how interrelated the various forms of environmental taxes and their results are. It should also be apparent that although the various forms of environmental taxes are capable of achieving similar results each is best suited for a particular application where it can maximize the results of the tax most efficiently. It should also be apparent that no one of these tax schemes alone is sufficient to achieve the goals of a sustainable society; instead a mixture of the three forms will provide the best results.

Environmental Tax Shifting

Tax shifting is a new concept based on simple economic principles which proposes that the tax burden can be reduced on working individuals, while increasing environmental protection without harming the economy (Franz, *The Environmental Tax Shift*, 1). Tax shifting involves changing the composition of taxes, but not the level of taxation. It involves reducing income taxes and offsetting this reduction with taxes on environmentally harmful activities (Brown, 2001, 236). The idea behind tax shifting is that by raising taxes on products and activities that society wants to discourage we will encourage more environmentally responsible behavior by individuals and business (Brown, 2002, 242).

Environmental tax shifting seeks to increase taxes on common property, or natural resources and services. This would mean increasing the level of taxation on seven main categories: Land sites according to land value; lands used for timber, grazing, and mining; emissions into the air, water, or soil; oceanic and freshwater sources; the electromagnetic spectrum; satellite orbit zones; and oil and minerals (Sandler, *A Green Tax Shift Policy Approach to Financing Local-to-Global Public Goods*, 1-2). These increases in taxes would then be offset by reductions in the levels of taxation of four main categories: Wages and earned income; productive and sustainable capital; sales, especially for basic necessities; and homes and other buildings (Sandler, *A Green Tax Shift Policy Approach to Financing Local-to-Global Public Goods*, 1-2). Environmental tax shifting is capable of stimulating innovation, affecting education and behavioral change, improving environmental quality, creating new jobs and industry, and promoting eco-efficiency.

Taxing activities that are deemed bad by society, such as pollution and waste, and decreasing taxes on activities we want to promote, such as work and investment, will provide an impetus for innovation. Decreased levels of taxation for income, capital investment, and sales will result in business and individuals having more money available to invest in new technologies and processes. Much of this investment will be made in an attempt to lessen the rates of environmental taxation that an individual or company is faced with. This is good for two reasons. First, the innovations that allow reductions in the amount of environmental taxes paid will directly benefit the environment through decreased emissions or consumption of a given product or material. The second benefit is that the decreased levels of taxation that now must be paid will leave the individual or firm with even more available money that can be used to further decrease their tax burden by finding alternative products and processes that are not taxed.

A tax shift will also bring about increased education and affect behavioral change. Most people want to know why they are taxed for a certain product or activity, as well as where their tax money is going. Thus a new tax is capable of stimulating the public's curiosity, leading them to determine why a tax has been implemented and what benefits it provides. An educational campaign prior to the implementation of a tax shift will allow people to see how their actions affect the environment, and how environmental taxes can be more equitable than our current tax system. Whether the government addresses the public, or the public seeks the answers from government, there is the potential for many people to learn about their impact on the environment and how they can lessen their impact, in an effort to save money. By implementing a tax shift the message will become clear, you must take responsibility for your actions. This will lead to changes in behavior

as consumers and producers attempt to minimize the quantity of taxed items they consume, and maximize the use of untaxed items. Eventually people will learn that you have to pay for what you use, which will be a major shift from current attitudes.

Environmental tax shifting would provide incentives for better environmental performance and protection (Goodman, *Environmental Tax Shifting in Massachusetts*, 2). Increasing taxes on common property decreases speculation and private profiteering and is a means to conserve and equitably share the earth's resources (Sandler, *A Green Tax Shift Policy Approach to Financing Local-to-Global Public Goods*, 1). By making it clear that activities that damage the environment will be taxed at a higher rate than activities that do not harm the environment, motivation will be provided to lessen damaging impacts in an attempt to save money. In turn those who choose not to change their behavior will be asked to pay for the damages they cause. Both lessening human impacts on the environment and generating revenue for environmental programs will serve to improve environmental quality. Tax shifting would also benefit land development and land use by providing incentive to protect open space and promote reinvestment in cities and urban areas, encouraging denser development and ensuring that alternatives to low density sprawl are available and affordable, and would help reduce dependence on the automobile (Goodman, *Environmental Tax Shifting in Massachusetts*, 16).

Although it is necessary to generate revenue through taxation, the current tax system distorts the market by discouraging employment and investment. It is better to maximize labor because of the high social benefits associated with reducing unemployment (Daly, 1999, 64). By raising taxes on the things we want less of, such as pollution and waste, we can cut taxes on working men and women promoting activities

that we do want, such as employment and investment (Franz, *The Environmental Tax Shift*, 1). Shifting taxes from labor conserves resources, increases purchasing capacity, and makes hiring additional labor more attractive and will act as a stimulus to the entire economy (Milani, 2000, 195-196). A cut in payroll taxes would tend to raise average worker incomes, perhaps decreasing the number of working poor (Worldwatch Institute, *Shifting Tax Burden to Polluters Could Cut Taxes on Wages and Profits by 15 Percent*, 2). Not only will jobs be produced and incomes increased, but new industries will begin to emerge. If it becomes cheaper to hire new employees, labor intensive industries, such as recycling, will begin to be more competitive with production industries, which will face the burden of additional taxes for material extraction and processing (Brown, 2001, 236). Other industries, such as alternative fuel industries, will grow and benefit because other forms of energy production, which produce pollution, will be taxed causing the price of their good or service to increase which will result in the prices of alternatives being more comparable.

Shifting the tax base to throughput encourages greater efficiency and internalizes external costs associated with resource depletion and pollution (Daly, 1996, 90). This will result in less use of virgin resources and a shift towards the use of recycled items. This will lead to processes that attempt to be cyclical rather than linear because it is better to economize throughput due to its high external costs (Daly, 1999, 64). In essence an environmental tax shift will promote eco-efficiency because those items that we value will be more expensive and therefore consumed at a lower rate, forcing us to look to alternative products and techniques to meet our needs as well as to save money.

If environmental tax shifting is capable of achieving innovation, accelerating education and behavioral change, improving environmental quality, creating new jobs

and industries, and promoting eco-efficiency then based on the relationships between the results of environmental taxes and the goals of sustainability (figure 4-2) it is evident that they are also capable of achieving the five goals of sustainability. Although tax shifting is not a tax in itself it is an important aspect of environmental taxation. It seeks to provide a more equitable tax system by expecting the burden of taxation to be placed on the individuals who benefit from the degradation of the environment. The goal is not to produce more money for the government, but instead to tax activities that we do not want while promoting activities we do want. In effect we are asked to pay for what we consume, not what we produce.

Conclusion

By relating the results of environmental taxation to the goals of sustainability it becomes evident that environmental taxes are capable of contributing towards the achievement of the goals of sustainability. It also becomes apparent that certain forms of taxes are best suited for achieving certain goals. Thus is it important to understand the capacities of a tax and the goals one is seeking before implementing an environmental tax. Environmental taxes have the ability to improve the environment, raise money that can be spent to improve environmental quality or decrease other taxes, educate the public, affect behavioral change, create new jobs and industries, and promote eco-efficiency. All of these abilities directly relate to the objectives of sustainability, and will aid in the transition to a more sustainable society.

Chapter Five: Conclusion

The purpose of this paper was to assert that environmental economic instruments, specifically environmental taxes, can be implemented to facilitate and expedite the behavioral changes necessary in creating a sustainable civilization. The objectives of this research were to demonstrate the similarities between the results of environmental taxes and the goals of sustainability, to demonstrate that environmental taxes are capable of achieving the desired effects of sustainability, and to propose that sustainability may never occur without the behavioral changes that can be accomplished through economic incentives.

It can be concluded that environmental taxes and tax shifting are extremely useful instruments at accelerating the transition to a sustainable society. When comparing the results of environmental taxation to the goals of sustainability it becomes apparent how closely related the two are. The ability of environmental taxes to stimulate innovation, promote education and behavioral change, raise revenue, improve environmental quality, create new jobs and industries, and promote eco-efficiency can be used to achieve education, public participation, distributional equity, the maintenance of diversity, and the conservation of natural resources, which are the goals of a sustainable society.

The effectiveness of environmental taxes in achieving the goals of sustainability arise from the taxes ability to educate the public about the need for change and the means to produce this change, forcing people to make decisions with their wallets, meeting the governments demands for revenue while decreasing taxes on activities we want to promote, and the large scale of change that can be implemented through a tax, based on

its ability to affect a large segment of the population. Education may be the most important factor in the transition to a sustainable society. Change will not occur without the support of a majority of the population. By putting monetary values equal to the true costs of the products and services that the environment provides people will be forced to better understand the dimensions of their activities on the health of the planet. In an attempt to save money individuals will reassess their behavior and patterns of consumption, opting to use more of the products and services that are not taxed, thus benefiting the environment.

The government requires the generation of revenue to provide the services expected of it, but the source of this revenue does not matter. If environmental taxes can provide the necessary revenue then reductions in other taxes can be implemented, promoting activities that we want more of as a society, such as jobs and income. Environmental taxes have the ability to create a system that better redistributes wealth. If the revenue from environmental taxes can meet the budgetary needs of government, other taxes such as income taxes, gift taxes, and inheritance taxes can be used purely for redistribution purposes. In effect taking money from the wealthy and redistributing it to lower income families (Daly, 1996, 90). This is another important aspect of sustainability. It is hard to expect someone who has nothing to make an attempt to better the environment. Sustainability will only be successful if there is equity of wealth and resources between the northern and southern hemispheres, and between the wealthy and the poor.

Another advantage of environmental taxes in the implementation of sustainability is the ability of taxes to reach large segments of the population. Since taxes can be

implemented at the local, national, or global level they have the ability to affect the decisions of a large group of people. Since you can not legally ignore taxes individuals will be forced to take responsibility for their actions. The implementation of taxes will stimulate public discussion, which will in turn increase public education about environmental change. The revenues from certain environmental taxes can be used for educational purposes insuring that people understand a tax and the reasons for implementing it.

Environmental taxation is not the only way to achieve a sustainable society, nor can it produce the needed results all by itself. Instead it is one possible means to accelerate the transition to a sustainable society. As has been stated, environmental taxes rely on other policy measures in order to achieve the maximum results. These taxes can also serve to reinforce compliance with other forms of regulation and laws. In the end it will require a combination of regulations, policy measures (of which taxation is only one), education, and public support to achieve a sustainable society.

This study has several limitations. First of all it is a general theoretical overview of the role of taxation in the movement towards sustainability. The basic framework for how environmental taxes can promote sustainability has been covered, but it was not possible to cover every detail of the effects of environmental taxes on the environment and the economy. Furthermore, it was impossible to look at the specifics of how an environmental tax should be applied because each situation is different, requiring different forms of tax, rates of taxation, and the establishment of a tax base. Another limitation was the time available to conduct this research. It would take years to totally immerse myself in the topics of sustainability, economics, and environmental taxation.

Based on the amount of time available to conduct this study a general overview provided a basic understanding of the theories, problems, and a possible solution. However, this is not the only solution, nor is the proposed solution capable of affecting all of the necessary change. Instead it is suggested that environmental taxation is one way of accelerating the change socially, economically, and environmentally to a more sustainable society.

The research provided in this paper has made me aware of the need for future research and investigation. One area that should be addressed is the effects of environmental taxation on landscape professions, specifically landscape architecture. I feel that by increasing the value of the medium with which we work, the environment, our value as a profession may be increased. Another area of future research would be a study of the overall effects of an environmental tax on the environment, economy, and society. This would involve taking the research provided in this paper one step further and looking at the specific results of an environmental tax in terms of its effects on the environment, economy, and society. This study could provide quantitative data about the success or failure of an environmental tax in achieving the goals of sustainability. Another area of future research would be the effects of environmental taxation on the wealthy and the poor to ensure that the taxes are indeed equitable and not regressive. This study could also provide information as to what additional measures best ensure fair rates of taxation, or provide refunds or incentives to lower income families. One problem that I found when doing research is that there is little information about the long term effects of environmental taxation on the environment. This can be attributed to the difficulty is singling out the results of an environmental tax from the other policies that are part of the same package, or because there are few environmental taxes that have been

in effect long enough. However, as more green taxes are applied there will be more ability to study the long term results, and any problems that may arise from taxation. A final area of future research is on the most effective way to redistribute the revenue generated by environmental taxes. It is important to understand where the money generated goes, as well as who will benefit the most and the least from its redistribution. Sustainability is a topic that will never be fully complete. Even as we become more sustainable there will always be a need to improve. Hopefully, as more is written and understood about sustainability the ability to convince the public about the need for change and the methods of producing this change will become easier, allowing professionals to implement the changes necessary to achieve a sustainable society.

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