# Markets, Democracy & Survival:

## How to Be Prosperous Without Being Self-Destructive

Roy Morrison

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# Markets, Democracy & Survival: How to Be Prosperous Without Being Self-Destructive

by

Roy Morrison

*for Luanne*
*who believes*

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## Who Am I?

I'm a writer and energy consultant living in Warner New Hampshire. My books include *Eco Civilization 2140*; *Tax Pollution, Not Income*; *Ecological Democracy*; *Ecological Investigations*; *We Build the Road as We Travel: Mondragon A Cooperative Social System*. (See www.amazon.com & www.essentialbooks.com)

As Director of the Office of Sustainability at Southern New Hampshire University, I'm helping pioneer the development of wind hedges. These are long-term financial agreements between energy users and wind developers that benefit both parties and help build the renewable power infrastructure. (www.rmaenergy.net)

For many years, I was a safe energy and anti-nuclear activist working with the Clamshell Alliance and other groups committed to non-violent direct action. My activist experience led me to consider how we could build the kind of ecological civilization we advocated. My writing and my energy work are an outgrowth of that search for a safe energy future.

I've studied and written about cooperative entrepreneurship as exemplified by the Mondragon Cooperatives in Spain, the world's leading cooperative system in a market economy. I have become convinced of the potentially healing and transformative power of democratic markets.

## Why *Markets' Democracy & Survival?*

Today, our central challenge is for economic growth to mean ecological improvement, not ecological destruction. This is possible if we can craft new market rules that send proper price signals. What's polluting, depleting, or ecological damaging must cost more. What's sustainable must cost less.

The crucial means I have considered for us to get the prices right is to phase out all taxes on income and phase in a smart sales tax, an ecological value added tax on all goods and services. The more polluting, depleting, or ecologically damaging, the higher the tax rate, and therefore, the higher the price. Buy cheap, save the planet. Prices, not just regulations, are the key to a prosperous and sustainable future. Making prices send signals for sustainability is not all that needs to be done. But it is a vital step for our democracy to take in order to help guide the global market system.

Democracy and markets in the 21st century will have their way. We can build a sustainable and prosperous future. The time to act is now.

Roy Morrison, Back House Studio, Warner, NH

# I. Democracy's Market & Tax Solutions

## 1. The 21st Century Challenge

Sustainability as an essential practice for prosperity and growth and a guide to action. Making economic growth mean ecological improvement, not ecological destruction. Market prices, not regulation, are the key. Crucial is ending all taxes on income and instead taxing pollution, depletion, ecological damage with a smart sales tax, an ecological value added tax or E-VAT, averaging 18% on all consumption. This is supported by a Negative Income Tax (NIT) that can end welfare and poverty, and a National Trust to invest in sustainability. The Plan is outlined on pages 8 to 9.

### How Can We Be Prosperous Without Being Self-Destructive?

Our hearts tell us what we should do. Market prices tell us what we will do. The challenge of the 21st century is to make prices reflect what we know is right.

By finding a way for democracies to help markets make what's polluting more expensive, we can help answer some of the fundamental questions posed by the 21st century: How can we be prosperous without being self-destructive? How can we meet the global warming and sustainability challenge?

And the answers will contribute to resolving a third conundrum: How can we build an international order based on peace, freedom, and justice?

In *Markets, Democracy & Survival*, we will examine an ecological consumption tax, specifically an ecological value added tax, or E-VAT for short, as a practical path to long-term prosperity and ecological survival. It's strong medicine: replacing income taxation with ecological consumption taxes. Ecological taxation is a way of using the market to help cure fundamental problems of the market.

Our future depends on the application of smart medicine. In broad compass, the transformation represents a healing and countervailing response to industrial excess.

We can replace all income taxation with an 18% E-VAT on all U.S. consumption of goods and services and fully fund the federal budget at current levels (see Table 2 page 5). The E-VAT is supported by the enormous U.S. appetite for goods and services, $13.2 trillion in 2005, and still rising.

An ecological value added tax will systematically make what is sustainable cost less, and what is unsustainable cost more. For a producer, as the amount of pollution increases, the rate of profit decreases. As the amount of pollution decreases, the rate of profit increases. Ecological consumption taxes send effective price signals for us as producers and consumers to act in our self interest and do both good and well.

This will be a world, not of pollution *allowances*, but a world where polluters pay from the first gram of poison, and where market forces move us not just away from the brink but toward sustainable prosperity.

### What's a VAT?

- Unlike the conventional sales tax, a Value Added Tax or VAT is able to tax items only once as they move through the economy from raw materials to finished goods. All advanced industrial nations except the U.S. have a VAT or a near equivalent.
- For the final consumer, any kind of VAT is simple. It works just like an ordinary sales tax. If the VAT rate is 18%, you pay an 18% sales tax on the total price of any good or service you buy. But unlike a conventional sales tax, where all tax revenue is simply sent to the government, behind the scenes a VAT does something clever and the VAT avoids double taxation
- The clever way the VAT does this is called the "credit for invoices" or "credit invoice system." Producers or service providers get credit for VAT taxes paid on their invoiced purchases. This makes it easy for the E-VAT to charge different rates.
- The E-VAT is a special kind of VAT. The E-VAT will make what's sustainable cheaper and what's unsustainable more expensive by varying the tax rate. The more polluting, depleting, and ecological damaging a good or service, the higher the tax rate. This allows us to appropriately influence all economic activity.

## What in the World is Sustainability?

The World Commission on Environment and Development in *Our Common Future* (the so-called Bruntland report) in 1987 defined sustainable development as meeting "the needs of the present without compromising the ability of future generations to meet their own needs." [1]

This is the kind of bland prescriptive definition that leads immediately to more questions than to clear answers. Is sustainability an ideal or a limit, at best only

approached, like speed of light, but never reached? Or is sustainability a practical necessity acting as ongoing spur to ever evolving manifestations, much as profit drives market societies?

Our conduct is not sustainable. That much we know. The news is checkered with reports of Class 5 hurricanes, droughts, resource wars, melting permafrost, large New England lakes, like Champlain and Winnepausaukee, that no longer freeze completely. We have the growing realization in our guts and in our hearts that some things are very wrong with business as usual. The long-term consequences of our everyday acts are quickly catching up to us. When will the party be over? This seems to be the question of the moment.

Sustainability is becoming central, not peripheral. It's the missing part of the operating manual and guide for 21st century civilization. *Markets, Democracy & Survival* is meant to provide some practical answers, points of entry that are powerful, politically efficacious, and consistent with democracy and markets, Sustainability does not have the usual Left or Right pat answers. It belongs exclusively to no party—not even the ones waving a Green banner.

In many ways, we find ourselves in a situation similar to that of the American colonists become revolutionaries by necessity, attempting to both define and implement what freedom and democracy really means. That's our challenge, and our opportunity. What does sustainability mean? This is a call not only for definition, but for practical implementation.

Briefly, we can offer a few of grand abstractions about sustainability, before spending almost all our time here on practice:

- The health of living ecosystems is crucial for human wellbeing and prosperity;
- Sustainability rests on the vitality of the inextricably linked natural and social ecologies;
- The key intent of sustainability is to serve as a creative guide, not as a fetter, to human action. A sustainable world is not a recipe for stasis.

Sustainability is then more than a tool for bureaucrats, economists, and experts. In *Markets, Democracy & Survival* our democracy is urged to use ecological taxes to help inform and guide the conduct of our market society toward sustainable means and ends. This comes down to dollars and sense as the daily manifestation of lofty goals and pressing necessities.

## Can We Follow Market Means for Sustainable Ends?

Getting prices right, more than laws declaring what we can and cannot do, will unleash a global torrent of entrepreneurial energy in the cause of sustainability and challenge polluters to change or fail. Getting the prices right means phasing out all taxes on income and instead phasing in an ecological consumption tax system using an ecological value added tax or E-VAT.

After the ecological tax is phased in, there will be no more IRS and no income tax code. For consumers, there are no forms to file. You just pay the tax at the point of purchase. For businesses, there's only a simple form used to report the ecological tax collected from your sales, and to get credit for the tax you've paid to suppliers. Businesses are rewarded for filing by getting credit for the tax they have already paid to their suppliers. You simply subtract the tax paid to your suppliers from the tax you collected from your sales and send the government the remainder. That's it.

**Table 1: The E-VAT Business Tax Form: An Example**

| | |
|---|---|
| • E-VAT Collected from Sales . . . . | $ 3,260,000 |
| • E-VAT Paid to Suppliers . . . . . | $ 1,230,000 |
| Tax Due to Government: . . | $ 2,030,000 |

Businesses reduce taxes by buying sustainable supplies and selling sustainable products. There is some complexity for government in setting E-VAT rates, first by industry and then by product. But that's something we can easily handle.

The ecological value added tax is the means. The end is sustainability and prosperity, the triumph of markets and democracy in the 21st century. This is a leadership challenge. This is a legislative challenge, a market challenge, and, above all, this is a challenge to all citizens.

## Can Sustainability Rest on Democracy and Markets?

Democracy and markets are what we know best and what we do best.

We need to recognize the power of market forces and consumer choice to transform behavior far more quickly than the projections of planners and regulators. In 2005, after Katrina, gasoline prices rose 50%. In the following quarter, the sales of the best selling and gas guzzling, Ford Explorer SUV declined 50%. Ford is on the ropes, closing factories. Toyota with its hybrids and high mileage cars is ascendant, even though Toyota is still far from sustainable in its conduct.[2]

Remember, since World War II global carbon dioxide emissions have declined only in the years 1974, and 1980-1983 following OPEC oil embargoes that sent oil prices soaring. Prices did the job, not regulations, not new inventions, not laws. It was the power of the marketplace that transformed ecological outcomes.

Of course, the solution to our problems is not simply to let OPEC, a self-interested producer's cartel, run wild. We need to craft new market rules that will encourage the transformation from fossil fuels already underway.

Table 2

Calculating the 18% E-VAT to Fund The Federal Budget

| | | |
|---|---|---|
| A. | Federal Budget FY 2005 | $2.479 trillion |
| B. | Existing Non-income Based Taxes (est.) | - ($100) billion |
| C. | E-VAT Revenue Requirement | **$2.379 trillion** |
| D. | Est. 95% compliance rate with E-VAT | |
| E. | Final U.S. Sales to Domestic Purchasers 2005 | $13.194 trillion |
| F. | E-VAT rate = E-VAT Revenue Req./ Final Sales x 1/.95 (E-VAT rate = C./E. x 1/.95) | |
| G. | E-VAT rate = $2.379 trillion /$13.194 trillion x 1/.95 | |
| H. | E-VAT rate = | **18%** |

Ecological taxation puts the market in charge of our deliverance, not our destruction. What's polluting will cost more. What's sustainable will cost less. The market, not a rulebook, business success and failure, not regulators, will show us the way. Ecological consumption taxation is not all that needs to be done. But it is, I believe, the single most important step toward prosperity and sustainability.

The market will force polluters to change or put them out of business. Entrepreneurs and financiers respond with startling speed and creativity to price signals.

Hedge fund managers can earn a billion dollars a year (based on a share of the profits they make) by understanding what makes prices move up and down.

Ecological taxes will swiftly make sustainable business, good business.[3] And ecological taxes can make looking for bargains not just part of the joy of shopping, but also part of saving the planet.

## Can Economic Growth Be Sustainable?

Economic growth is essential for our prosperity and for the world's poor and aspiring. Sustainability need be understood as a tool for growth and prosperity, not an impediment. Economic growth in the 21st century can and must mean ecological improvement, not ecological destruction. It must be an expression of the sustainable. How can this be possible? This is not a seemingly insolvable riddle, or a problem awaiting dramatic, new technological marvels to save the day. In fact, only some economic activity is dramatically unsustainable. Much is not. We need to help the market recognize the difference between the two and then do its job.

There is, for example, no practical ecological or economic limit on trade in information in cyberspace. It is no accident that information is the high profit center of the 21st century. Google and Microsoft and their challengers are ascendant. GM and Ford, who tied their prosperity and futures to gas guzzling trucks and SUVs, flirt with bankruptcy.

Sustainability must serve in the 21st century as a supporting structure for freedom and democracy. Sustainability, by guiding the 21st century everyday, must become part of the calculations of economists, the setting of market prices, the determination of supply and demand. Sustainability must inform the judgement of citizens and the deliberations of politicians.

An applied sustainability strategy for non-renewable resources, for example, oil, is three-pronged. First, we can use oil much more efficiently. Second, we can replace oil with new technologies, like fuel cells, and with renewable fuels, like bio-diesel and ethanol, at a sufficient rate of speed to both meet current needs and to obviate the negative effects of pollution and ecological damage. Third, we can develop new oil-free transportation systems and supportive liveways. Getting the prices right though ecological taxation is key for the market system to send signals for sustainability and inclines us to consider, both individually and collectively, why we really want or need to consume so much fuel (whether renewable or nonrenewable).

## Why Ecological Taxation Now?

The current system is broke. Now is the time to fix it!

We must be bold. We cannot creep toward a solution while current market forces push us toward ecological disaster. But boldness need not mean military conquest or huge construction projects. Boldness can involve new market rules. Fundamental to a sustainable future is implementing the social innovation of ending taxes on income, and phasing in a new ecological consumption tax, the E-VAT.

Ending income-based taxes will not be a bitter pill to swallow for individuals, businesses, investors, and pensioners. The major drawback of consumption taxes can be turned to an advantage, potentially ending both welfare and poverty through a Negative Income Tax (NIT) explained in detail on pages 29-33.

Remember, income taxes did not come down from Mt. Sinai. They were first used in the United States by the Lincoln administration to pay for the Civil War, and then implemented by the 16th Constitutional Amendment in 1919, less than 100 years ago.

In the 21st century, if sustainability is our end, then the replacement of income taxes with ecological consumption taxes is our means.

### An Ecological Value Added Tax Broadsheet

- Tax Pollution, Not Income
- End All Income taxes
- Abolish the IRS
- Replace Income Taxes With an Ecological Consumption Tax on All Goods and Services
- The More Polluting, Depleting, Ecologically Damaging the Higher the Tax Rate
- Consumers File No Tax Returns
- Businesses File Only One Simple Form
- The Ecological Value Added Tax Averages 18% and Can Fully Fund the Federal Budget
- Taxes Imports, Not Exports
- Market Sends Price Signals for Sustainability

# 2. The Plan: A Summary

The plan for the 21st century has three basic and related elements: An Ecological Consumption Tax (E-VAT) on all goods and services to make the market send signals for sustainability; A Negative Income Tax to maintain tax equity after the abolition of income taxes; A National Trust to invest in sustainability to overcome institutional barriers.

## A. An Ecological Consumption Tax: Taxing Pollution, Not Income

End all income taxes and instead phase in a smart sales tax on consumption, an ecological value added tax (E-VAT) on all goods and services. The more polluting, the higher the tax rate. Phase out income taxes over ten years and phase in, dollar for dollar, an ecological consumption tax, The market will send price signals for sustainability and economic growth will mean ecological improvement, not ecological destruction. An 18% E-VAT, in addition to a small amount of non-income based taxes, will be able to fully fund the federal budget.

## B. A Negative Income Tax

The Negative Income Tax (NIT) responds to the regressive nature of the ecological consumption taxes, their major flaw. The poor spend all their income while the rich do not. Under an E-VAT, a net increase of $64.5 billion in yearly federal spending would keep total federal tax rates level for the 40% of households (44.6 million of them) with the lowest income. This $64.5 billion is spending beyond the existing Earned Income and Child Tax Credits. Total low-income tax relief under an E-VAT would be $104.3 billion (in 2003 dollars).

## C. National Trust Investment Bank

A National Trust is an investment plan to save and invest tax dollars to prime the pump for sustainability, overcome institutional barriers, and invest in needed sustainability infrastructure projects. The National Trust will be an investment bank funded through tax dollars raised by the E-VAT. Devoting 2% of the federal budget to savings for the National Trust can provide 50 billion dollars a year in new investment capital. The National Trust will be decentralized and democratically controlled. Its mission will be to invest in sustainability, jobs and community. It will be a bank run by responsible bankers, not a charity. The National Trust will help overcome barriers to market entry and remedy market failures that will unnecessarily retard an ecological transformation.

## Strength of the Plan

The ecological value added tax when combined with the Negative Income Tax and National Trust passes four basic tests:

It will have a positive long-term effect on the economy, ecology, and society.

It is comprehensive and is fair.

It can raise sufficient revenue.

It is political feasible.

### Why is the E-VAT and Negative Income Tax Combination Politically Smart?

The E-VAT and the NIT combination will appeal to more than economists and ecologists. It is politically efficacious as well. This dog can hunt.

Attempts at eco taxes, a gas tax, for example, despite their occasional good sense have gone nowhere. The common interest has wilted before the very special interests of the oil and automotive industries and their unions. Their focused self-interest is assisted by the lukewarm enthusiasm of American motorists to pay yet another tax and still more at the pump despite the gas tax's allegedly good long-term effects.

The E-VAT-NIT combination changes the game. By abolishing *all* income taxes for everyone, an ecological tax regime enlists the combination of self- and common interest in the cause of ecological sustainability.

Information age companies, by their nature comparatively low polluting, and of almost all individuals with high incomes who will benefit from an end to income taxation now have a dog in the fight with the relatively small number of mega-polluters unwilling or uninterested in changing their ways. And the Negative Income Tax enlists those concerned with poverty and social justice.

Politically, from both right and left, it's a win-win remedy and an enormous political opportunity for the person and the party that seizes the E-VAT-NIT initiative.

## The E-VAT and Responding to Objections

Two major objections are raised to replacing income taxes with ecological taxes—it's not fair and eco taxes won't work in time. A Negative Income Tax and A National Trust, introduced here, are effective solutions to the issues of fairness and efficacy of ecological consumption taxation. They are not the only ways to accomplish these ends. Phasing out income taxes and phasing in ecological consumption taxes must not be held hostage to political disagreements on the nature of a Negative Income Tax and National Trust.

## Report from the Year 2020

For a moment, imagine a better future with me. Let's visit an America where there are no more income taxes. April 15 is just another day in the early baseball season. Not only are there no personal income taxes (which include capital gains taxes, interest and dividend taxes) but corporate taxes, and even the regressive Social Security tax has disappeared.

The federal government fully funds its budget and meets all Social Security obligations. We still pay taxes. But the taxes we pay are levied at the point of sale on all the goods and services we consume. Consumption taxes have replaced all income taxes over a ten-year period. As income taxes were phased out, a new ecological consumption tax system was phased in dollar for dollar. The economy is booming. Pollution is declining faster then anyone thought possible. We're meeting the carbon challenge the president announces.

Individuals file no tax returns. And businesses file a single page form each year, reporting the tax collected from sales and the amount of credit they get from the tax they paid their suppliers. The ecological value added tax, or E-VAT, averages about 18% on everything we buy. We pay the E-VAT at the store, the gas station, the health club, when we buy insurance, purchase our house, buy a car. But we don't pay taxes on the money we earn, no matter how we earn it.

The E-VAT is smart in two ways. First, it taxes items based on how much value was added in each stage of production or use to avoid double taxation. Second, the rate of the E-VAT changes depending on how polluting, depleting, or ecologically damaging the service or item is. The more polluting, depleting, ecologically damaging the higher the E-VAT rate. The more benign, the lower the E-VAT rate.

While the E-VAT averages 18%, the tax on items sometimes varies dramatically.

Buy a 60-mpg hybrid, for example, and pay 9% E-VAT (one-half the average 18% E-VAT rate). Buy the biggest and baddest Hummer and you'll pay 54% (triple the average rate). And traditional gasoline for your vehicle is taxed at 72% (quadruple the average), while mustard seed biodiesel is taxed at 4.5% (one-quarter the average). *Continued on page 12.*

The E-VAT rate has become part of the ubiquitous product barcodes and computer chips. It's color coded on packaging to make things easy for consumer. Buy green, save money.

And contrary to fears that setting the E-VAT rates would be an impossible boggle, it began easily by using industry-wide averages for pollution and depletion by Standard Industrial Classification (SIC) code. And now the E-VAT rate is re-calculated for items that claim to do better than industry averages. Manufacturers and service providers are rewarded for their initiative.

The Negative Income Tax or NIT ameliorates the impact of the E-VAT on the poor and lower income people, who spend almost all their income, while the rich do not. People receive NIT benefits that were phased in initially to make them no worse off in terms of tax burden than under the late, unlamented income tax regime.

The E-VAT has also served to fund the National Trust that has helped jump-start the ecological transformation. The National Trust helped finance the major transmission lines to bring east and west the thousands of megawatts of electricity from the new plethora of wind farms stretching from the Dakotas to Texas and from the new desert solar installations. The National Trust has also participated in helping groups start wind farm and biodiesel cooperatives that support the new renaissance in America's rural and farming communities, and the solar workshops of the city.

# 3. Smart, Not Painful Medicine

The ecological value added tax (E-VAT) rests on a $13.2 trillion tax base, sufficient to fund the federal budget. The E-VAT is positively reinforcing, progressively forcing out polluting, depleting, and ecologically damaging items in order to maintain revenue. Varying E-VAT rates are developed over time, starting by using an industry's average ecological performance by SIC code (Standard Industrial Classification) and then refining the ratings to reflect performance varying from the industrial average The E-VAT is good for business and largely self-enforcing due to the credit-invoice system.

The basics of the ecological tax shift are simple. First, over ten years phase out all taxes on income, and phase in, dollar for dollar, the new ecological consumption tax on all goods and services.

We will no longer be shifting costs of poison to others down wind, or down stream, or to future generations. Polluters will have to charge a price in the market an amount much closer to the true costs of their goods and services.

Economists across the political spectrum agree that to make markets work truly efficiently you must internalize the cost of externalities. This means, in English, that the market system works best for everyone if you include ("internalize") in the market price all the costs of pollution, depletion, and ecological damage. Today these are not fully charged to customers and instead are shifted ("externalized") to people effected by the pollution and to future generations.

The invisible hand of the market will work in our self-interest only if prices reflect true costs. Otherwise we will continue to subsidize costs for pollution, depletion and ecological damage to our collective, and likely catastrophic detriment.

### E-VAT: A Destination-Based, Gross Product VAT

The E-VAT we are considering is a so-called destination based, gross product VAT.

Destination-based means that imports are taxed as they enter the country. Exports are not taxed. This both encourages domestic production and allows the E-VAT, through huge amounts of U.S. imports, to influence foreign behavior.

A Gross Product VAT is the largest tax base available, and is measured by final sales to domestic purchasers. It is equal to the GDP minus exports of goods and services, plus imports of goods and services. Using final sales to domestic purchasers gives the E-VAT the largest tax base in order to do its job most effectively at the lowest average rate. In 2005, final sales to domestic purchasers were $13.194 trillion.

## Why Consumption Taxes?

This ecological tax shift is consistent with World Trade Organization (WTO) rules. It is levied on imports to the U.S. and not on exports. Since the U.S. is the largest market, if we lead, other industrialized and industrializing nations are likely to follow. There will be positive consequences from comprehensive U.S. ecological taxation on the conduct of foreign investment in developing nations.

We will be encouraging a transformation already begun. European nations currently have many ecological taxes. Germany, for example, pays a portion of its social insurance costs through a fuel tax.[4] Netherlands is a model for sustainability planning and creative mechanisms.[5] China has sharply increased the tax on low gas mileage cars and introduced ecological taxes on disposable chopsticks to help save tropical forests.[6]

Consumption taxes, if properly applied, by affecting the trillions of market decisions for goods and services will shape entire supply chains and quickly move the economy toward sustainability. What's polluting, depleting, or ecologically damaging must become more expensive. Cost-cutting business and smart-shopping consumers will be pursuing ecologically sustainable paths. Otherwise we will continue to try to roll the stone of sustainability uphill against powerful market forces.

An ecological tax shift means as income taxes are reduced, consumption taxes are phased in. An equal amount of tax money will be raised by the E-VAT as was raised by income taxes. This is a fiscally neutral plan.

People will quickly understand that paying attention to higher or lower E-VAT rates will save them money—a fact that advertisers and packagers will most

assuredly bring to their attention.

Few will cry tears at the abolition of income taxes and the imposition of consumption taxation in the form of an ecological value added tax levied on all goods and services throughout our economy.

## How Does an Ecological Value Added Tax Work?

Remember, the system is simple for individuals. No forms. We pay tax at the point of sale. And businesses have to file only a single form reporting the tax they collected and getting credit for the tax they have paid their suppliers. (See Table 1 on page 4.)

Determining the average E-VAT tax rate is easy for the whole economy. It's high school math, not rocket science, as Table 2 on page 5 makes clear.

What's new is calculating product E-VAT rates. All products are ranked by the government on the basis of how polluting, depleting, or ecologically damaging using objective criteria. The rank is then used to calculate the effective E-VAT rates for each good or service. Appendix -1 provides a model E-VAT calculation method.

For convenience, early E-VAT ranking could be based on industry-wide averages for pollution, depletion and ecological damage calculated on the basis of available data based on existing Commerce Department Standard Industrial Classification (SIC) codes. This average rate setting will be extended to smaller SIC subsections. Ultimately, each product or service would have a specific E-VAT rating. Manufacturers and service providers would apply for reductions in the E-VAT rate on the basis of improving their products above industrial averages, which would be updated periodically.

The ability to reduce E-VAT rates for sellers will represent a major incentive and competitive advantage for low and non-polluting processes. The E-VAT will be an ongoing goad to develop innovative ecological ways of doing business. The goal is a market pushed toward sustainability by its own prices. Thus, both purchasers and sellers are moved in an ecologically sound (and profitable) direction by self-interest as well as by the national interest.

A consumer product E-VAT rating would become part of product color-coded labels (green is good and cheaper) and of the product barcode and resident computer chips to facilitate easy cash register calculation. Over time, every product or service would be given an E-VAT ranking or score based on how polluting, deplet-

ing, or ecologically damaging.

The key is that E-VAT rates would vary widely. For example, non-polluting, sustainable goods might pay a 4.5% E-VAT (25% of the average 18% E-VAT). Polluting goods might pay (as their E-VAT score worsened) a 36% E-VAT (200% of average), or 54% E-VAT (300% of average), or 108% E-VAT (600% of average).

Ecological consumption taxes work on both broad and targeted scales. The Netherlands has sharply reduced toxic chemical emissions and air pollution through a sustainability strategy using ecological consumption taxes and regulatory means in the context of a booming, export led economy.[7] Ireland, in 2002, placed a fifteen-cent tax on disposable plastic shopping bags at the point of sale. The bags had become a ubiquitous nuisance across Ireland, as well as part of the global petrochemical pollution and disposal chain. In just three months, use of these bags dropped more than 90%, as shoppers chose reusable bags and paper products.[8]

## Why Is the Ecological VAT is Self-Enforcing?

Another of the clear advantages of consumption taxes over income taxes is that the credit invoice system used for E-VAT reporting and calculation tends to make the E-VAT self-enforcing and assure that goods and services are taxed only once.

The standard E-VAT method is called credit invoice system. Sellers get credit for all E-VAT charges paid by them on invoices to produce their products or perform their services. (See Appendix 2 for an example of the E-VAT credit invoice system in action.)

In order to receive this credit, it is in the seller's interests to accurately report their invoice expenditures and E-VAT collection. Unlike income taxes, where a taxpayer has an interest in not reporting income, the E-VAT gives sellers a strong motivation to file tax returns to receive a credit for taxes already paid through purchases.

## Does the E-VAT Really Mean Ending All Taxes on Income?

Abolition of all income based taxes is necessary both as part of the political carrot needed to shift to enlist broad and powerful political support to shift taxes to polluters, and of sufficient and comprehensive impact in the economy to help move us swiftly toward sustainable conduct.

The E-VAT will replace all taxes on income, not just the individual income taxes, (which includes the capital gains tax and the interest and dividend tax). The E-VAT will also replace the two other major income taxes: the corporate income tax, and

the Social Security tax. Funds that used to be raised by these income taxes will be raised instead by the ecological VAT.

Abolishing the highly regressive Social Security tax and instead raising funds for Social Security through the E-VAT will benefit working people. The current Social Security tax only applies to the first $90,000 in income. In contrast, there is no cap on how much spending is taxed under the E-VAT to fund Social Security.

E-VAT revenue for Social Security should be set by statute at amounts necessary to fund benefits. Individual benefit levels can be determined, as now, on the basis of work and income history, which will reflect past payments and the future payment of consumption taxes. These future payments will be broadly proportional to income, particularly at income levels currently subject to Social Security taxation (up to $90,000) which are almost entirely spent.

Ecological taxation has the ability to maintain the Social Security status quo. Whether funds for Social Security need be increased, or benefit levels changed, or the program dramatically altered to become a Basic Income Grant to all is an entirely different question. Ecological taxation is *not* a backdoor means for dismantling Social Security. In fact, the E-VAT ensures adequate Social Security funding.

## Why Are Consumption Taxes Good For Business?

Currently, corporate income is subject to double taxation: first, through corporate income taxes, and second, through individual income taxes. Value added consumption taxes like the E-VAT are better for business than income taxes. The E-VAT will tax corporate income only once.

Harry Gubert and T. Scott Newlon of the Treasury Department in their article, "The International Implications of Consumption Tax Proposals," show that for companies earn higher rates of return for capital investment under a consumption tax system. For example, given an equal 20% corporate income and consumption tax rate, there was a 10% rate of return for capital investment under a VAT, compared to just with 7.5% or 25% less, under the income tax regime. [9]

Gubert and Newlon conclude, "In fact, switching to a consumption tax likely would result in a greater preference by MNCs [multi-national corporations] for investment in the Unites States, even as compared with investment in low-tax countries in many cases."[10]

Consumption taxes are fairer and simpler for businesses and for society. The current corporate tax regime is larded with exemptions and special provisions, includ-

ing rules on investment tax credits, foreign income and taxes. Many profitable corporations avoid taxes entirely.

Under an E-VAT the playing field is leveled. All corporations get to immediately expense all purchases and investments and, at the same time, get credit for the E-VAT they pay on all their purchases to be deducted from the E-VAT they collect on all their sales. Foreign taxes become irrelevant. While the rate of return for corporate investments should increase under the E-VAT, so should the total net receipt of corporate taxes.

The E-VAT will function as a way to send powerful signals for sustainable investment, discourage the need for investment in low tax countries by improving return on equity, and raise more federal tax through a consumption tax on all corporate purchases—the more economic activity the higher tax revenues, not the more baroque the tax avoidance strategies.

## How Does the E-VAT Treat Imports and Exports?

Under the E-VAT, exports by U.S. business are not taxed. Imports are taxed either by payment of a customs duty, or taxed at an earlier stage of production based on E-VAT principles. Enforcement is straightforward. A company can take credit for its import purchases under the credit for invoices rule only if it can show the tax was paid. The E-VAT placed on all domestic sales, including all imports, but not exports, is in accord with WTO rules.

In 2005, U.S. imports of goods and services amounted to $2.028 trillion that would be subject to the E-VAT. Exports were $1.301 trillion, which would not be taxed.

Thus, under the E-VAT, huge U.S. imports would help fund the federal budget. For example, an average 18% E-VAT would raise $365 billion. But since a substantial amount of these imports are non-sustainable products such as oil, the average tax on imports, and thus the amount of revenue raised, would be substantially higher at the start.

## Could Ecological Taxation Make Adam Smith Smile?

In our imagined future, consumers and business people caught on very quickly that buying and selling low polluting, sustainable items is a way to save and to make money.

And, unlike a simple pollution tax or an excise tax on cigarettes, the E-VAT neither destroys the revenue source, killing the goose that lays the golden egg, nor makes us dependent upon poison for our revenue.

On the contrary, the E-VAT is positively reinforcing. Through an effect on markets that would make Adam Smith smile, over time, the E-VAT will move inexorably toward a flat tax of around 18% on most now sustainable items.

Here's the market magic and why the E-VAT is good for all of us. Under the impact of the E-VAT, the higher taxed polluting and depleting stuff losses market share. Polluters must change or else. But that's not all that happens. To maintain tax revenue, what was the moderately polluting, depleting, and ecologically damaging goods and services are now, on average, high polluting, and therefore subject to a higher tax rate.

Thus, over time, the E-VAT will push polluting items out of the market. Most goods and services eventually will be in the near to sustainability band and have nearly identical tax rates. And the remaining polluting outliers will be taxed most severely.

### Consumption Taxes and Social Justice

Remember that sustainability cannot be separated from social justice. In practice, social justice means that each of us has the real opportunity to live a good live with existential security. It is not based on punishing the wealthy.

If consumption taxes by not taxing income offend your sense of social justice, let's work to assure that a Negative Income Tax (NIT) or Basic Income Grant (BIG) is adopted in conjunction with an ecological consumption tax plan and is sufficient to aid all Americans. And also support an increase in the estate tax on the biggest estates in the name of intergenerational equity.

Since income will not be taxed directly by consumption taxes, an enhanced estate tax on estates above five or ten million dollars can be levied on untaxed and sometimes unearned wealth. Untaxed, the inherited wealth of billionaires will become, through the power of compound interest, trillions gifted to a class of infant plutocrats. This should give us pause in a democracy.

## Price As Road Sign to Sustainability?

An interesting idea, ending income taxes, you may say. But wasn't modern industrial society was built on the income tax? Many people argue that income taxes are something we cannot do without. Progressive income taxation—the more you

make, the higher the tax rate you pay—maintains a balance between rich and poor, and raises the money we need to fund everything the government does. Is there really a better way that will build a sustainable prosperity and also be fair and raise enough money?

Prices regulate conduct. After Katrina disrupted Gulf Coast refineries and distribution networks, gas prices soared. And drivers bought less gas. In the short run, there was enough gas if you could pay the price. Driving less helped bring prices down. And high prices also led consumers to buy more fuel efficient cars. If we put a cap on market driven prices, consumption wouldn't drop and soon there'd rationing, gas lines, and a black market.

It was foolish in 2006 to talk about sending each American a $100 check in the wake of rising gas prices. It's good social policy, in the short run, to provide the poor with subsidy coupons to help buy gas to get to work or bring their children to the doctor. Gas coupons could be paid for by a windfall profits tax on oil, a tax that companies could moderate by taking advantage of an investment tax credit for renewable development. It's better social policy, of course, to have affordable mass transit, non-polluting automobiles, and full employment at fair wages.

Markets certainly have problems. Market societies are still afflicted with poverty, pollution, and injustice. The question is how can these problems be rectified, not how can they be ignored? The Negative Income Tax (NIT) is meant to accompany the E-VAT to remedy its regressive nature, and can take a proactive stance in helping end both welfare and poverty.

If you have a problem with democratic markets of any kind I suggest you witness what can happen without them.

In the mid 1960s, I worked on the S.S. Brasil, a passenger liner that docked at the working class port city of Gydnia, Poland. There was literally no food in the stores. People in patched clothing stood waiting in lines for trucks to deliver food. Fat men in grey uniforms carrying submachine guns walked through the streets.

Some miles away, there was a fashionable beach resort favored by foreign tourists and local elites doing well under the regime. People enjoyed themselves. And anything was available, of course, if you had dollars to exchange for zlotys. These are the conditions that gave rise to Solidarity and the Communist collapse once Mikhail Gorbachev loosened the reigns of empire.

## Are Prices by Themselves Enough?

If we don't have to pay the true costs of what we buy, polluters get a free ride. Their poison products are artificially cheaper, while what's sustainable appear to be "too expensive." Too expensive, that is, until the real bill comes due.

But prices by themselves are not enough. If we clear-cut forests, devastate fisheries with factory trawlers, destroy habitat and drive species to extinction, if we poison the air, water and soil there may be nothing available at any price. Prices by themselves are not enough to enforce sustainable limits, recreate species, and restore vanished habitat. Prices are excellent tools. But sometimes, limits, bans, prohibitions, and reserves need to be established by democracies.

And sometimes, it also makes sense to use regulation or allowances or lotteries or rationing instead of just prices as means to fairly allocate use of things, for example, the opportunity to use National Park campgrounds or drive into a central city if road access is limited. The rich should not be able to buy anything, while all sacrifices are made by people with lower incomes.

And high prices, while encouraging future production of food, do not feed a starving child who needs to eat today. Democracy, fairness and justice mean that each of us has a right to a fair share in exchange for meeting our responsibilities. This is not a simple function of the price system. Sustainability can not be built upon a foundation of injustice. It won't happen. And will we suffer the fate of previously vanished civilizations. Ecological consumption taxes are crucial for resolving the current crisis of industrial civilization. But they are not by themselves enough. We need to use our democracy; our hearts and our heads are crucial for building a just and sustainable future.

# 4. Phasing In and Using the E-VAT

As income taxes are phased out over a ten-year period, ecological consumption taxes are phased in. This gives a reasonable amount of time for the tax transition and provides businesses with fair warning to clean up their acts and remain competitive. The ecological tax regime is meant to be transformative, not punitive.

A ten-year transition period provides sufficient time to gradually reduce income tax rates and while gradually introducing the E-VAT. For simplicity, at first, the E-VAT rate would be flat like a conventional VAT. Gradually, varying E-VAT rates would be introduced. By the end of a decade, income taxes would have vanished and the full ecological value added tax would be in place with varying tax rates based on the degree of pollution, depletion, and ecological damage.

For example, in the first two years of implementation, income taxes rates could be reduced 10% a year and a simple E-VAT tax introduced with one tax rate, for example, 2.5% in year one and 5.0% in year two to maintain net federal revenue.

In year three, the varying E-VAT rates would be gradually introduced. By year ten, income taxes and the IRS will have disappeared and the E-VAT ecological consumption tax system would be fully operational.

## How Does the E-VAT Score and Rate Pollution, Depletion, Ecological Damage?

The E-VAT scoring and rating system should also be phased in during the transition from income taxes to ecological taxes. When fully in place, for each good or service the total E-VAT rank or score would combine the item's separate scores for pollution, depletion, and ecological damage. The higher the total E-VAT score, the higher the tax rate.

The total score could range from 3 for sustainable, to 12 for the most polluting, depleting, and ecologically damaging. (See Appendix 1 for E-VAT rate setting example.)

To gain competitive advantage, manufacturers and service providers would take the initiative and apply for E-VAT reductions if their product was better than average.

## Pollution

Pollution is the logical place to begin with varying E-VAT rates as the basis for helping the market send accurate price signals. Pollution from many sources, for

example, from energy and industrial use, chemical processes, and sewage outflows is often already carefully monitored. The EPA has data on the emitters of toxic chemicals. Emissions from power plants, automobiles, factories, homes and offices are well understood. We know how much nitrogen dioxide (NOX), sulfur dioxide (SOX), carbon dioxide, particulates, carbon monoxide, mercury, and dioxin, et. al. are released from various combustion processes.

In 2006, the European Union is debating a new tax structure for ethanol producers. Taxes will vary on the basis of how much their whole processes, from seed to fuels, actually reduces the net amount of carbon dioxide released into the air. Sweden is now giving tax brakes to users of Brazilian produced sugar cane ethanol.

Brazilian sugar cane is 90% climate neutral. That is, a gallon of sugar cane ethanol will result in a 90% reduction in carbon dioxide emissions compared to burning a gallon of conventional gasoline.

U.S. corn based ethanol using existing processes, in contrast, is only 30% climate neutral. A gallon of conventional corn based ethanol will only reduce carbon dioxide emissions 30% compared to burning a gallon of gasoline. [11]

The E-VAT is meant to reflect these kinds of differences in the tax rate. This will enable the market to clearly distinguish not just between gasoline and ethanol, but between the considerably different consequences of different ethanol production processes and reward the more sustainable fuel.

## Sustainability

Sustainability cannot be reduced to any single metric. Accounting for carbon and reducing its release, for example, is a necessary, but not sufficient task for the E-VAT to help accomplish in the market by sending clear price signs. We need to deal with other types of pollution and we also need to be able to send relevant market signals to account for depletion and ecological damage.

Wood, for example, is a renewable resource. Cutting a single tree can be the source of fuel, building material, and improved habitat for many species. But deforestation is a major and ongoing contributor to habitat destruction, flooding, soil erosion, impoverishment, and ecological devastation. Jared Diamond in his book *Collapse* reviews the evidence and it's catastrophic consequences in the past from a denuded Easter Island to today's denuded Haiti compared to neighboring and still forested Dominican Republic.[12]

The E-VAT will employ relevant measures for depletion and ecological damage. For example, sustainable forestry should be taxed at quite a different rate than clear cutting leading to maximum habitat destruction. There are measures of total material requirements (TMR) that provide a reasonable proxy measure for overall ecological impacts.[13]

E-VAT ranking and rate setting can be accomplished by a competent group of economists, ecologists, engineers, and material scientists working with objective criteria. (There's some back-office complexity, but, up front, the E-VAT requires no forms for consumers, and a single form for businesses.) Certainly there will be attempts by self-interested industries to influence the process. This is true of any tax system. Remember, the E-VAT has a greater chance to resist the power of polluters since the E-VAT is applied to all goods and services, and not just to selected polluting items where revolving door relationships tend to emerge between government officials and the industries they once regulated.

## How Do We Set E-VAT Rates?

Determining the E-VAT rate and the amount of tax is a two step process.

First, we calculate the E-VAT *rank* or *score* based on how polluting, depleting, and ecologically damaging a product or service. This score could range, for example, from 3 for a sustainable product, to 12 for a very damaging product. This should be done with the best available data using objective criteria.

Second, using the basic equation in Appendix 1 we can easily calculate the E-VAT percentage *rate* compared to the average for all goods or services in the economy, as well as the amount of tax due given the price. (See Appendixes 1 and 2.)

But what happens if the E-VAT rate is not sufficient to lead to needed change in market behavior, or conversely, is too high and unnecessarily economically dislocating in the short run? What then? The purpose of the E-VAT system is not simply to generate revenue, but to send robust enough price signals in the market to lead to sustainable conduct and to offer the effected polluter the opportunity to adopt new processes and procedures or be forced from the market. Depression level unemployment will slash pollution, but that's not what we want.

We can adjust the effective E-VAT tax rate to make sure it sends effective market price signals in the case of crucially important ecological threats such as coal combustion.

## What About E-VAT Rates and Price Elasticity?

Setting an effective E-VAT percentage rate relies on estimates of price elasticity—how much increases in price diminishes sales directly and encourages the growth of competitive replacements. There is not necessarily a correspondence between how polluting, depleting, and ecologically damaging a product or service and how high an E-VAT tax rate is required to lead to sustainable conduct.

It may be necessary to have the option to use a multiplier to increase or decrease the effective E-VAT rate for the most ecologically critical items. The E-VAT rate could be doubled, or tripled or quadrupled if necessary. For example, if the tax rate on the most polluting items was 36% or double the average 18%, but an E-VAT of around 100% was required to send effective market signals, then the use of a multiplier of nearly 6 should be employed here in setting the effective E-VAT rate.

Some harmful processes continue operation because they hold just a slight cost advantage over more ecologically sound and well developed competitors, for example, chlorine bleaching process in paper making, or coal fired power plants "grandfathered" under the Clean Air Act. In both cases, small cost advantages permits some existing plants to continue operation. A moderate E-VAT rate would likely quickly prove decisive.

In other cases, for example, gasoline, replacements may not be fully commercialized, or available in sufficient quantity, or have uncertain future costs as their sales volume increases. The effect of taxes will not just be the development of alternative fuels or propulsion systems, but the use of much higher efficiency cars and trucks and reduce the aggregate consumption of gasoline trough greater efficiency. Pollution taxes may also discourage driving, or encourage the use and/or development of alternative transportation means, and the related elaboration of legal structures such as zoning that encourage less ecologically damaging transportation systems.

It's important to understand that the purpose of the E-VAT is to potentiate the transformation and not just the elimination of technological systems. Industrial engineering in the 21st century will become the applied practice of ecological engineering in an aspiring zero pollution, zero waste economy where all the outputs of one process become inputs to others.

Concern with coal power plants, for example, does not begin and end with carbon emissions. The E-VAT would effect the whole coal fuel cycle from mining to slag reuse and move it toward sustainable practices. For the power plant part of

the fuel cycle, the tax on coal used for power generation without scrubbers and carbon dioxide capture and use needs to be set high enough to effectively reduce emissions to sustainable levels.

A coal power plant, for example, could employ extensive algae ponds for biodiesel production using waste heat and the carbon dioxide and dramatically reduce its net carbon release per ton of coal.

We need to think of total efficiency of technological systems, and not just the optimization of individual parts of an inherently wasteful system. For example, conventional power generation (roughly 30% efficient) results in enormous systemic wastes, by dumping huge amounts of power plant "waste" heat into rivers, the air, and the oceans, instead of employing it to heat our homes and for industrial processes. System efficiency can rise from 30% to 90% through co-generation. The E-VAT inclines the market to send proper signals to assist in this process of ecological engineering.

# II. Balancing and Supporting Ecological Taxation: The Negative Income Tax and National Trust

A Negative Income Tax and A National Trust for investment in sustainability are effective responses to two basic criticisms of ecological consumption taxes—they are regressive and they won't work quickly enough. A Negative Income Tax, by spending an additional $64.5 billion per year, would keep total federal tax burden constant for the 40% of U.S. households with the lowest average annual income. A National Trust capitalized using 2% of federal budget, or about $50 billion annually, can effectively help overcome institutional roadblocks to sustainability and help fund programs such as the Negative Income Tax.

## 1. Overview

Two major objections can be raised to replacing income taxes with ecological taxes—they're not fair and they won't work in time.

First, it's argued that consumption taxes are too kind to the rich. By their nature, consumption taxes are regressive—at least in the short run. The poor spend almost all their money. The rich can more easily choose to save. While the E-VAT also functions as a tax on wealth, it is undeniably true that for low-income people, an 18% average E-VAT would represent an increase in federal tax burden.

Sustainability cannot be paid for on the backs of the poor and lower income groups. Without justice, there cannot be a sustainable and prosperous democratic society. The good news is that the amount of money needed to assure a fair tax burden for lower income people under the E-VAT is quite reasonable.

The Negative Income Tax, or NIT, is one good means to target such aid. Keeping the total federal tax burden flat for the 40% of households with the lowest income (44.6 million households) would mean $64.5 billion in new federal spending. This is in addition to the $39.8 billion now spent on the Earned Income Credit and Child Tax Credit. A total of $104.3 billion is a very reasonable price to pay for an end for all income taxes and the establishment of an ecological consumption tax regime. This is not all that should be done to alleviate economic need. But it is the minimum that must be done to establish a workable ecological tax system.

Second, it's held that the price system alone cannot overcome quickly enough institutional and market barriers to sustainable investment even under the influ-

ence of ecological price signals. In theory, supply and demand should come into balance and all competitive markets should clear. In the real world, markets by themselves sometimes fail. There is persistent unemployment. There are institutional barriers to investment and market entry. There is racial and ethnic discrimination. There is ecological damage.

A National Trust system is one means to use federal savings and investment to help overcome institutional barriers and market failures. This is not the government picking winners and losers. This is the government acting strategically in the interest of sustainability and prosperity in making investments in sustainability, jobs, and communities.

The E-VAT must and should come first in the movement toward sustainability, and, as it is being phased in, a Negative Income Tax or other measure needed to maintain fairness should also be introduced, to be followed by an investment plan or fiscal policy needed to overcome potential market failures.

Table 3: Income Tax Payments by Income

| Type of tax computation by size of adjusted gross income | Tax Year 2003 (regular tax computation) Number of returns | Income Tax $ (Thousands) |
|---|---|---|
| Returns with regular tax computation only Total Number: | 82,147,340 | $381,631,905 |
| Under $5,000 | 498,096 | 23,963 |
| $5,000 under $10,000 | 4,485,904 | 773,686 |
| $10,000 under $15,000 | 6,566,178 | 2,924,231 |
| $15,000 under $20,000 | 8,136,494 | 6,136,555 |
| $20,000 under $25,000 | 8,249,208 | 9,897,334 |
| $25,000 under $30,000 | 7,484,672 | 12,745,380 |
| Total Under $5,000 to $30,000: | 35,420,552 | $32,501,149 |

### Existing Federal Tax System: Mixing Progressive and Regressive

The current federal tax system combines a progressive personal income tax with a regressive Social Security tax. In fact, today 80% Americans taxpayers on average pay more taxes for Social Security and Medicaid than they do in income taxes.

In 2003 (latest available data) the 35 million tax returns of people with adjusted gross incomes of $30,000 or under, subject to what the IRS calls "regular tax calculation" (no capital gains Schedule D or alternative minimum tax) paid only $32.5 billion in income taxes. This is an average tax of less than $1,000 per return. (See Table 3, page 30.)

On the other hand, U.S. social insurance taxes are particularly regressive. All income over $90,000 is not taxed. The rich get a free ride. Up to $90,000 in adjusted gross income, people pay about a 9% average social insurance tax. For lower income filers, the popular Earned Income Credit reimburses a portion of social insurance taxes. But the top 1% of households pay only an effective 2.5% average social insurance tax, while the highest income taxpayers pay social insurance taxes at a miniscule .1% rate of total income.

## 2. The Negative Income Tax: Themes and Variations

A Negative Income Tax (NIT), basically an expansion of the current Earned Income Credit, was originally outlined by Milton Friedman and proposed by Richard Nixon in the 1970s. A Negative Income Tax can potentially eliminate both welfare and poverty. An NIT of sufficient size is necessary to make adoption of ecological consumption taxation, and the essential benefits it brings to all, politically possible. A 21st century NIT, at the minimum, needs to reduce the federal tax burden of an E-VAT on low-income earners to no more than current levels.

The principle behind the NIT and related proposals stretches back to Thomas Paine who proposed a cash grant be given to all property poor citizens in recognition of varying economic advantages and opportunities given to us at birth.[14]

An NIT could be funded by E-VAT taxes, and by income generated from a National Trust sustainable investment strategy. Over time, an NIT could become less a prod for *mor*e than a reflection of *enough* in a sustainable, ecological world where economic growth means ecological improvement, not ecological destruction.

Currently there are proposals from the left and from the right for various forms of Negative Income Tax, refundable tax credits or Basic Income Grant.[15] The common themes include recognition that each of us is entitled to some form of a fair share and the self-managing opportunities for further advancement it brings combined with a distaste for intrusive and stigmatizing and costly welfare bureaucracies.

Free market conservative Charles Murray has proposed an ambitious plan in his book *In Our Hands: A Plan to Replace the Welfare State*. He provides all adults over 21 with a $10,000 annual stipend ($3,000 would be used for health insurance) plus a $1,000 per child benefit. The stipend would be phased out for incomes above $50,000 per year. Murray's plan would eliminate a very wide range of benefit programs including Social Security, Medicare, Medicaid, Earned Income Tax Credit, Child Tax Credit, School Lunches, Pell Grants, TANF, *et. al.*[16]

On the left, Representative Robert Filner (Democrat, California) introduced a less ambitious "Tax Cut for the Rest of Us Act of 2006" as House Resolution 5257. This would provide a $2,000 refundable tax credit per adult and a $1,000 tax credit per child.

An average 18% E-VAT in exchange for abolition of income and Social Security taxes and the institution of a Negative Income Tax is a fair deal. As we'll see below, the Filner plan is roughly equal in scope for that required for a minimum NIT to keep federal tax burden flat on the 40% of households with lowest income. Murray's plan is more ambitious.

## Making the E-VAT Fair: The Minimum

To hold the 40% of households (44.6 million households) with the lowest income harmless from the transition to an 18% E-VAT that would replace all income taxes (including Social Security taxes) would require a modest NIT. The NIT would range from an average of about $2,000 for the poorest 20% of households, to almost $2,800 per household for the next 20% of households in income. (See Tables 4 to 6 Page 33.)

It is certainly reasonable to hold harmless the 40% of us with the lowest income from the affects of instituting an E-VAT. Whether the NIT should be larger or treated as a Basic Income Grant or annual stipend is certainly an open question.

**Table 4: Effective 2003 Tax Rates (Congressional Budget Office)**:

- Lowest Income Quintile
  23.0 million households
  $14,800 average income pretax; $14,100 after tax
  **4.8% rate for all federal taxes:**
  (Effective income tax rate (-5.9)%; Social Insurance 8.1%; Misc. 2.6%)
- Second Income Quintile
  21.6 million households
  $34,100 average income pretax; $30,800 after tax
  **9.8% rate for all federal taxes:**
  (Income taxes (-1.1)%; social Insurance 9.1%; 1.8% Misc.)

**Table 5: NIT for Equal Federal Tax Burden with 18% E-VAT**

- Lowest Income Quintile
  23.0 million households
  $14,800 average income pretax
  13.2% average N.I.T per Household
  **$1,954 average NIT per household**
  $44.9 billion total to keep tax rate flat
- Second Income Quintile
  21.6 million households
  $34,100 average income pretax;
  8.2% average N.I.T per Household
  **$2,796 average NIT per household**
  $60.3 billion total to keep tax rate flat

**Table 6: Federal Budget Impact of Break-even NIT for 18% E-VAT**

$104.3 billion total projected NIT for Lowest and Second Income Quintiles
-$39.8 billion 2003 Existing Earned Income and Child Tax Credit subsidy[17]
**$64.5 Billion Additional NIT Spending (2003 dollars)**

# 3. A National Trust

Federal government spending, saving, and investment should be used strategically to drive forward the transition to sustainability. It is long past time that we use National Savings in an entrepreneurial fashion to fund investment and to use the fruits of such investments for social good.

By saving a small fraction of the 2.5 trillion federal budget, for example, 2%, or $50 billion a year, the U.S. could fund a dynamic and democratically controlled system of National Trust banks. The Trust would function as an investment bank, with equity and debt investments in diverse communities, companies, and industries in support of sustainability. The aim of the National Trust would be to prudently help to prime the pump for sustainability and help overcome institutional barriers for sustainable development.

This is not a matter of the government picking winners and losers. It is a matter of combining government purchasing to stimulate renewable industries and government investment in important infrastructure and community projects.

The National Trust could, for example, invest broadly in the renewable power infrastructure. The Trust could help to build wind farms from North Dakota to Texas, and new Southwestern solar array fields, as well as the needed transmission infrastructure moving renewable power to cites in the east and west. These various facilities could be owned and operated by a variety of farm and rancher cooperatives, corporations, communities, and individual entrepreneurs that will generate many thousands of megawatts of renewable power.

The National Trust would be a bank making prudent investments for a return, not a social welfare program. Its income could help fund such social welfare programs like a Negative Income Tax.

## How Could A National Trust Be Structured?

The National Trust would be divided into enterprise and banking divisions. The enterprise division would promote, develop and aid business activity in support of sustainability, communities, and employment. The banking division would have the fiduciary responsibility for the bank's financial soundness in accord with its mission.

The Trust system envisioned here would be both decentralized and democratic. There should be regional boards (e.g., six) responsible for developing and imple-

menting regional sustainability plans in consultation with local communities and local stakeholders. Each Regional Trust Bank would operate in accord with broad national guidelines and policies.

The Trust's boards, regionally and nationally, should include business, labor, and community representatives, chosen by constituencies. There should be a citizen member elected at large and a Chair appointed by the President and confirmed by Congress. The Board would hire the Trust's CEO who would be responsible for recruiting professional staff.

The recent U.S. debate on the future of Social Security finance and "reform" strangely omitted the option of government investment in equities to generate income and make a positive contribution to sustainable economic development. The choices on the table deemed fit to discuss, were first, some version of cutting benefits and increasing taxes that, at most, would be used to purchase special non-tradable U.S. government debt, and second, plans for diverting tax funds into individual private investment accounts. Clearly, the choice of democratic social investment through a National Trust should be on the table in considering our future well being.

As an investment bank, the National Trust has the job of doing more than make conservative stock and bond and commercial paper purchases to generate income. A substantial fraction of a National Trust's resources should be used for investment banking. If the Trust earned a net 8% return, it would generate $4 billion yearly in surpluses for each $50 billion in reserves. These surpluses earned by the Trust could be returned to the treasury or reinvested. Clearly, $50 billion in annual tax contribution to capitalize the bank would quickly become a substantial economic force for sustainability, capable of making investments domestically and internationally. International investments by the Trust would eventually far outstrip investments by the World Bank whose activities could be more focused on development *grants* as opposed to *loans to* governments.

# III. Sustainability At Home and Abroad

Sustainability is meeting present needs without endangering future opportunities. It rests on the health and co-evolution of human and natural ecologies. Sustainability can be measured, but ultimately it is qualitative as well as quantitative. Sustainability, at bottom, is a matter for democratic action.

## Can We Weigh Sustainability?

Sustainability may be measured by, but decidedly not reduced to, the ability of the living world to perform so-called eco-system or environmental services—providing clean air, water, stable climate, detoxifying industrial toxins, and yielding sufficient food, fuels, building materials *et al.*

Sustainability may be further quantified in action through the triple bottom line of sustainable business: the economic, the ecological, and the social. It may be assessed through indexes of human and ecological well being.

Sustainability is decidedly qualitative as well as quantitative in nature. There is the straw that breaks the camel's back.

Living systems, from our local pond to our earth's eco-sphere, are conditioned and maintained within a sustainable range hospitable to our lives by complex and interactive feedback loops that brings sustainable order out of chaos. We degrade ecosystems or exceed their carrying capacity, that is, their ability to withstand insult, at our peril. One thousand SUVs are an oddity. Five hundred million gasoline powered SUVs are a plague.

Sustainability, at bottom, is a matter for everyone, not just for experts, but for democratic debate and democratic decisions as the basis for shaping our behavior, our markets, our society.

Economic growth is essential in a world where billions are desperately poor and the population is predicted to grow this century from 6.2 billion to over 9 billion. But, so far, economic growth and industrial business as usual seem to have put us on the path to ecological degradation, global climatic change, and self-destruction. How can the industrial tiger change its stripes?

## Can the E-VAT Make A Difference for Sustainability Internationally?

Ecological consumption taxes, such as the E-VAT, are consistent with World Trade Organization (WTO) rules that permits so-called indirect taxes like the E-VAT.

They can be levied on all imports—Chinese imports for instance—to level the ecological and economic playing field.[18] And if the United States, the world's biggest market, will lead, the rest of the world of exporters will likely follow or be forced from U.S. markets by high E-VAT taxes on unsustainable imports.

The E-VAT represents real leverage that can be applied to rapidly industrializing and now high polluting economies.

### Carbon Fixes

Dramatic reductions in carbon emissions are possible using existing efficiency and renewable resource technologies. We need think about energy in new ways based on total system efficiency and get more useful work out of the energy we put in. This is the road to reducing carbon emissions 75% or more. It can be done technically. Higher efficiency is economical now. But to make the market system work in a timely manner, we need to make carbon pollution more expensive. Ecological taxes can end the self-destructive subsidies to fossil fuels and other forms of poison power and help the market send accurate price signals sufficient to drive a transformation to sustainable conduct. This can be manifest, for example, by a global carbon tax regime from $160 to $ 600 per ton of carbon, proposed by William Cline[19] of the Center for global Development, or by an ecological value added tax system.

## Is Carbon the Only Major Challenge We Need to Face?

Continuing to degrade and destroy the natural world is an unsustainable act of self-destruction. Global warming is one consequence of our environmental misconduct. But it is not the only one. Carbon must be understood and dealt with as part of a broad transformation from business as usual to sustainability.

Reducing global carbon emissions quickly is a necessary, but not sufficient response by itself to the challenge of sustainability and the looming ecological crisis. We cannot reduce all questions as to whether or not we slash carbon emissions while continuing to destroy habitat and despoil the planet.

An ecological value added tax will effectively raise the price of carbon emissions. But it is more than just a carbon tax or gas tax or gas fee bate plan that returns higher gas taxes to consumers to ease the pain. Ecological taxation is the means that can help us secure our future from a full range of ecological, economic, social, and political threats.

We cannot reduce the challenges of the 21st century to questions of how much carbon we emit regardless of other consequences. For example, it is foolish and potentially fatal to ignore the spread of nuclear weapons as a result of the use of nuclear power, the paradigmatic unsustainable technology, favored by some as the major response to global warming. The Pentagon, for example, already warned in 2003 of proliferation dangers and security concerns if nuclear power is used by a desperate world as a last ditch means to respond to global warming.[20] Today, the United States supports new nuclear plants in India and China, while threatening to bomb them in Iran and Korea in response to the danger to the weapons proliferation that's been inseparable from nuclear power development for nation states seeking nuclear weapons.

Nuclear power also demands and receives enormous and on-going subsidies for its unsustainable conduct. Perhaps Tony Blair was on the right track when he "supported" the development of new British reactors in 2006, *if* investors and owners could operate without subsidies, guarantees, or bailouts.

The measure that should guide our carbon reduction strategies is the real cost per pound of carbon saved counting externalities and subsidies. The market will point us in the right direction, particularly *if* we get the prices right through the E-VAT and incorporate the value of externalities and subsidies in energy prices.

And it's important to note, unfortunately, nuclear power is *not* carbon free. A nuclear plant's fuel cycle (mining, milling, enrichment, etc.) produces about a third of the net carbon dioxide of a natural gas plant (operating at around 35% net efficiency without cogeneration).

But the world is rapidly running short of high-grade uranium ore. Low-grade ore processing can release more net carbon than it saves. The nuclear fuel source at hand when we face a shortage of high-grade uranium is reprocessing spent nuclear fuel and establishing a global trade in weapons grade plutonium.[21]

In any case, we must also keep in mind that electricity is 19% of world energy use. Nukes contribute 3%. Even doubling or tripling the number of nukes, at great expense per pound carbon saved, will only be of modest help, taking a "wedge" out of global carbon at great cost and risk.[22]

Our money is far better spent, I believe, on efficiency, renewable fuels and energy sources, cogeneration, and distributed generation instead of on nuclear or other unsustainable technologies.

There's good news. We can, in fact, slash greenhouse gas emissions while eliminating dependence on oil imports and building sustainable prosperity. This isn't pie in the sky. It's detailed in a Pentagon-funded study, *Winning the Oil Endgame* from Amory Lovins' Rocky Mountain Institute that describes how through a profit driven plan we can easily eliminate half of all oil use by 2025, using proven efficiency measures at a cost of only $12 per barrel, and then replace the remaining oil by competitive biofuels and saved natural gas. It's the law in California mandating 25% greenhouse gas cuts by 2020. It's detailed nationally by the Sustainable Energy Network in its Blueprint for Efficiency and Renewables, and in a National Renewable Energy Laboratory draft report that finds renewables could meet 99% of U.S. electricity needs by 2020.[23] (See Appendixes 3, 4, and 5.)

We can cut rampant energy waste and take advantage of efficiency measures and plentiful renewable resources. It's not heavy lifting, for example, to double auto mileage per gallon over the next decade, or to reduce oil and coal consumption 1% a year.

We will find, as the discussion of cogeneration on page 43 suggests, that if we really are concerned about global warming we would, for example, improve overall energy efficiency of electricity generation to around 90 percent with today's technologies using distributed generation and cogeneration. This would make a big dent in our heating energy needs, save money, and slash carbon emissions. We don't need to wait for fuel cells or a hydrogen economy. We have the tools today.

We can reclaim "waste" heat from micro generation in people's basements to heat our homes, or construct district heating and cooling systems to use natural gas power plant "waste" heat. Such a low carbon future optimizes cogeneration with the addition of ground and water source heat pumps and ice storage systems to take maximum advantage of heating and cooling from Carnot cycle material phase changes and "waste" heat. This is combined with smart metering and computer control that optimizes both your own energy use and the efficiency of the entire system.

As an energy consultant, I'm working on a design with my associate Pentti Aalto, for a Southern New Hampshire University dining commons. First, the system will reclaim waste heat from air conditioning chillers to produce hot water for the kitchens and store heat for spring and fall evening use. Second, a cogeneration system will produce base load electricity while reclaiming heat for space heating, hot water, and for cooling (if we can make the economics work). Third, computer-controlled emergency generators, with jacket water heat reclaim, will respond to high

electric prices and therefore help reduce system peaks by receiving 5-minute price signals from the New England power pool (ISO-New England) through a control system Pentti Aalto designed using a satellite paging network to transmit pricing data.

What we need, above all, is not new inventions, but for the price system to make the continuation of waste and business as usual a bargain we can no longer afford. We have the technological tools. We need prices that approximate real costs to help unleash the entrepreneurial energies that will build a sustainable future.

It's certainly true, as Lovins, Datta, Bustnes, and Koomey indicate in their *Winning the Oil Endgame,* that dramatic changes in efficiency and technologies are economic today. But it's also true that business as usual, its inertia and self-interested resistance to change is buttressed by the system of externalities and subsidies that make the market price of the unsustainable appear "cheap," while making the sustainable "expensive." The E-VAT is a systemic antidote to the self-destructive market malaise of externalities and subsidies that endangers both our prosperity and our futures.

## Can the E-VAT Help Resolve the Problem of China's Coal Burning?

The E-VAT is not just an abstract idea. It's a real tool that can be used to help solve some of our most intractable problems. As Al Gore's global warming call to action flickers on the screens of America's multiplexes, we must face another inconvenient truth. We need to confront the really bad climate change news behind China's economic boom built on dirty coal. We need to grasp the available market based solution from ecological consumption taxes to the global warming and sustainability crisis, one that can curb China's and our own poisonous habits.

In the last two years, China has put on line a phenomenal 90,000 megawatts of carbon dioxide belching, coal fired electric plants. That's about a 500-megawatt coal plant a week! 90,000 megawatts is also equal to the total British installed electric capacity.[24] China now burns more coal (2.73 billion tons/year) than the U.S. (2.10 billion tons/year), and by 2025, if the brakes aren't applied, Chinese coal consumption will be 40% of the world's total.[25]

The U.S. position as global carbon dioxide king will soon be threatened by Chinese dirty coal powered industrialization. The U.S. will nevertheless remain safely in the lead as oil consumer and carbon emitter to power our ever-expanding motor vehicle fleet—unless we change.

While the West talks about clean coal technologies to make low-carbon gaseous and liquid fuels, the Chinese plants are smoke and sulfur belchers using old equipment and obsolete technology. The Kyoto treaty exempted China and the rest of the developing world from greenhouse gas reductions in the name of development and pollution equity.

Unless Chinese (and American) conduct is fundamentally changed, we likely have no chance of stabilizing atmospheric carbon dioxide levels at 500 parts per million (ppm) or less by mid century (carbon dioxide is 370 ppm today and rising).[26] And, of course, 500 ppm may already be way too high an amount of carbon for our liking . . .

Technologically, we have the means, if not the will or the proper price signals, to vastly improve energy efficiency and use renewable energy. We can cover the plains and the coasts with wind turbines, the deserts and our roofs with solar cells, drive ultra light hybrids fueled with ethanol and biodiesel, use clean coal technologies, bubble power plant carbon dioxide through enormous biodiesel algae ponds . . .

The solution is not simply to appeal to Chinese (or our own) long-term best interests to stop pollution before it's too late. As long as pollution is "free" or subsidized, the price for sustainability remains too costly.[27]

The key is to make what's polluting, depleting, and ecologically damaging more expensive than sustainable alternatives. This will translate into a high enough tax on dirty coal to transform energy use. If the industrial world led by the U.S., the biggest consumer, adopts ecological taxes, the Chinese and the other exporting Asian Tigers will be forced to follow and substantially clean up their act or be forced from our markets.

The market and ecological taxation is an available and potent means to transform our own, and Chinese conduct, from the path of ecological self-destruction to that of sustainability and prosperity. It's time.

## Cogeneration: A Home-Based Way to Slash Carbon Emissions

The good news is that we now have proven technologies that can reduce carbon emissions by over 50% when compared to new coal plant electricity generation plus conventional natural gas furnaces.

Instead of thinking about electricity and heating as separate entities, we can use cogeneration systems to produce the maximum total amount of useful energy for electricity, heating, cooling, and hot water with the smallest amount of carbon released into the atmosphere.

Improving energy efficiency means that building new central station, electric power plants of whatever kind should be a thing of the past unless they use their "waste" heat. This isn't a matter of ideology. It's engineering.

The 500-1,000 megawatt coal, oil, natural gas or nuclear behemoths at best average less than 40% net efficiency. They burn fuel to make steam that spins turbines, but waste most of their heat in cooling towers or rivers and substantial amounts of electricity in transmission and conversion losses. Even nuclear plants result in substantial carbon emissions since the nuclear fuel cycle uses huge amounts of fossil fuel energy in mining, milling, fuel fabrication, construction, decommissioning, waste storage and disposal.

Instead, we can use the existing electric grid to create smart, computer mediated high efficiency electric networks. These networks controls your electric devices based on price and help keep the electric grid in balance. They can also use 90% efficient home based cogeneration systems. These small engine cogeneration systems generate electricity while using "waste" heat for home heating and hot water. Today, we have a choice. We can heat and power millions of homes with a high efficiency natural gas fired cogeneration system, with a one-kilowatt Honda generator, currently on sale, that heats your house and produces some of the power you use.[28] Or we can build that new generation of 500 megawatt central station coal plants that will lead us to emit at least twice more total net carbon than cogeneration.

Comparing the total energy in to the useful energy out, these cogeneration units are more than twice as efficient than coal plants and conventional natural gas furnaces. This means we can slash net carbon emissions more than 50%. Choose wisely. (See Appendix 6 for calculations.)

# IV. The Gathering Storm

The end of the fossil fuel age presents profound ecological, economic, social and political challenges. Carbon and global warming is not the only challenge we must face. An ecological value added tax is an effective means for the market to respond to the full range of ecological challenges and their consequences.

The stakes are high. The time to act is now. In the 21st century we are threatened by climate change, habitat destruction, deforestation, species extinction, collapsing fisheries, soaring population and material use, toxic effluents and pollutants, soil erosion, depleted aquifers, and more. Unless we act effectively, we face a future of resource wars for oil, for water, and for food, a world of famine, epidemics, mass migration of the desperate, failed states, ecological, economic and social collapse.

The future prosperity, peace and well being of the United State does not lie in succeeding in the competition for the control of oil and natural gas with traditional OECD rivals or with the emerging Asian titans, India and China. Nor can we prosper by ever more ecological self-destructive attempts to produce another generation of fossil fuels from tar sands, arctic methane hydrates, or oil shale rock. These are the market challenges of the past. They lead nowhere but to a tragic ending. We must change the rules that shape the market price system.

But markets can offer a real solution and a path ahead. We live in a global market economy. We *can* adopt new market rules that send signals for sustainability; otherwise our civilization will die in a misguided market economy. But, by using an ecological consumption tax, there are market mechanisms at hand, that our democracy can adopt that will make all the difference in the world.

## An End and A Beginning?

Our current predicament is shaped by an epochal ending and a new beginning. How can we take advantage of the rapidly approaching end of the petroleum age and the rise of the information economy?

The end of the petroleum age does not mean the oil is running out. But the era of cheap petroleum and the ability to continue to burn it without horrendous consequences is over. The ecological clock is ticking. Ecological taxation is the path to a new beginning. It can be the crucial tool for defusing the climate bomb and meeting the sustainability imperative. We need not fear the future. As Franklin Roosevelt said, "The only thing we have to fear is fear itself." We can face the

global warming and sustainability challenge by a return to first principles—the creative and renewing practice of democracy and markets.

Markets cannot do it alone. But, I believe, given our global market economy, we cannot find the path to be prosperous without being self-destructive without a fundamental contribution from markets.

It's profoundly in our self-interest to pursue policies that move us away form the brink and toward sustainable prosperity. The program outlined in *Markets, Democracy, & Survival* will help us build an ecological future from our industrial present. This is a dynamic future based on economic growth, entrepreneurship, strong communities, and good jobs.

It is a democratic challenge. It is a leadership challenge. It is a task that, as Jefferson wrote in the Declaration of Independence, for which we come together and pledge "our lives, our fortunes, our sacred honor."

# Conclusion:

## The Time Is Now

Now is the time for us to take effect action. Unless we can make economic growth mean ecological improvement, not ecological destruction, we in all likelihood will face an unparalleled ecological catastrophe in the 21st century.

Now is the time to use our democracy and our markets to choose the path of sustainability and prosperity. Ecological consumption taxation is an essential and available means to this end. We can enlist the power of market forces and prices in the cause of ecological sustainability and long term prosperity.

The exercise of our democratic prerogatives is what's needed to help us build the kind of world we want to leave to our children and grandchildren.

We witnessed at the end of the 20th century a series of heartening and unexpected events. We watched the sudden and unforeseen collapse of the Soviet Empire, followed by the flowering of new democracies. We were astounded by the transition of an apartheid South Africa to a multiracial democracy led by a man, Nelson Mandela, who walked out of prison after 27 years to lead a nation with a commitment to justice and reconciliation.

Working together we can accomplish great things.

Ecological consumption taxation is a tool we can use to help revitalize the market system.

The time to start acting decisively for sustainability is today.

# Appendix One: Ecological VAT (E-VAT) Calculation

The heart of the E-VAT system is to use consumption taxes to make what is more polluting, depleting, and ecologically damaging more expensive, and what is sustainable less expensive. To do this, we need to find a way to compare the degree of pollution, depletion, and ecological damage that can be attributed to each good or service purchased. Each good or service would be assigned an E-Score from 3 to 12 (described below) that would indicate how polluting, depleting, or damaging it was.

We can start by assessing the performance of all businesses based on its Standard Industrial Code (S.I.C. code) by determining ratings or scores for their degree of pollution, depletion, and ecological damage. Scores can be based on categories such as:

- Amount of toxic or harmful emissions for scoring pollution;
- Rate of exhaustion of resource stocks for scoring depletion,
- Extent of habitat disruption for scoring ecological damage.

The following basic equation can be used to calculate the E-VAT for any particular good or service by comparing it to the average E-VAT for all goods and services:

$$\textbf{E-VAT} = \frac{\textbf{Product E- score}}{\textbf{Average E- score}} \textbf{ x E-VAT rate x \$ Selling Price}$$

If necessary, a further weighting factor can be added to increase the tax for high polluting items or reduce it for sustainable items.

The E-score would be based on a total of the three E-VAT tax categories ranking the amount of pollution, depletion, and ecological damage and assessing a simple numerical score for each.

Thus for pollution:

One = Sustainable

Two = Low Pollution

Three = Moderate Pollution

Four = High Pollution

If a good or service were found to be moderately polluting, depleting, and ecologically damaging it would receive an E-VAT score of 9 as the chart below demonstrates.

**Sample Product E-Score Calculation**

| **Category** | **E-Score** |
|---|---|
| Pollution | 3 (moderately polluting) |
| Depletion | 3 (moderately depleting) |
| Ecological Damage | 3 (moderately ecologically damaging.) |
| **Total E-Score:** | **9** |

The higher the E-score compared to the average E- score the higher the tax.

The lower the E -score compared to the average, the lower the tax.

This is expressed by the simple fraction in the E-VAT equation: $\frac{\text{Product E- score}}{\text{Average E- score}}$

If, as in the above example, a product had an E-VAT score of 9 and the average E-VAT for all goods and services (based on total dollar sales) was 6, the product would pay an E-VAT 1.5 times the average 18%, or 27%.

$$\text{Product E-VAT} = \frac{9 \text{ Product E-VAT score}}{6 \text{ Average E-VAT score}} \times 18\% \text{ Ave. E-VAT} = 27\%$$

By taxing all economic activity with the E-VAT, we will not fall into the trap of just taxing the "bads" and lose our revenue source and ability to influence future conduct when pollution decreased or disappeared. The E-VAT, in action, will have quite the opposite effect. As high polluting, depleting, and ecologically damaging items are forced from the market, in order to maintain revenue, taxes on moderately polluting items will increase. Thus the E-VAT over time will exert a positively reinforcing effect progressively reducing pollution et. al. until most items are sustainable and have close to a flat tax.

**Is There A Perfect E-Scoring System?**

There is no perfect or magic E-Scoring system. Essential is to use an E-scoring system that makes what's polluting more expensive than it's sustainable alternatives, and that this difference be sufficient to effect market behavior based on the degree

of price elasticity. The four category rating system presented here: sustainable, low, average, and high, and the 1,2,3,4 scoring is just one possible example that is relatively simple, but robust enough to provide substantial economic nuance. Any system of ranking raises all kinds of questions that, at bottom, are matters for informed democratic judgment.

For example, does "average" refer to the mean or the median? Is the average range plus or minus 1.0 standard deviation or 1.5 standard deviations? How are the divisions between E-score categories defined? What measures are used for the scoring? Should a "high" rating result in a score of 5 or 6 instead of 4, thus weighing the tax more heavily toward taxing the more wasteful, polluting and destructive energy resources? Should the tax attempt to be high enough to equal the cost of externalities? Should pollution be weighted more heavily than the use of non-renewable materials? Should some products be exempt because they are necessities and setting higher prices for them would hurt the poor? These are all essentially political decisions that must rely upon democracy and openness. Any tax system and any political system is subject to corruption and abuse. The E-VAT can do its job to help us build sustainable prosperity but it, like everything else in a democracy, has no inherent fail-safe mechanism, and in the end must rely upon the vigorous participation of citizens in our democracy.

# Appendix 2
# E-VAT Credit Invoice System in Action

| **E-VAT Paid to Government by a Retailer Selling a Good with 18% E-VAT Rate** | |
|---|---|
| Cost of Goods Sold | $1,000,000 |
| E-VAT Paid to Buy goods sold (ave.18%) | $ 180,000 |
| Sales | $2,000,000 |
| E-VAT collected on Sales (ave.18%) | $360,000 |
| E-VAT Paid by Retailer to Government | = $360,000-$180,000 |
| E-VAT = | $180,000 (or 18% of value added) |

Thus, in this example, a retailer purchased products for $ 1,000,000 and paid an average 18% E-VAT, or $180,000. The retailer then sold the products for $2,000,000, and collected an average 18% E-VAT, or $360,000. The retailer would get credit for $180,000 already paid on their supply invoices. Therefore the retailer would owe the government $180,000 for the $1,000,000 value added in the sale.

The final purchaser paid the retailer 18% of the total purchase price. For consumers, the E-VAT is the same as any other sales tax. If a watch cost the seller $100 and retailed for $200, the purchaser wold pay a $36 E-VAT or 18% of the total. The retailer in this case would get credit for the $18 paid to the manufacturer when the retailer purchased the watch.

# Appendix 3: Winning the Oil Endgame

**From the Rocky Mountain Institute** (See Endnote 23-a)

## FACT SHEET

**Strengthen National Security, Energy Independence, and the Economy**

- U.S. Global Competitiveness, economic stability, and national security are compromised by over-reliance on foreign oil, particularly Middle East Oil.
- The United States consumes 26 percent, produces nine percent and owns two percent of the world's oil.
- The United States imports nearly 60 percent of its oil (and rising). With Saudi Arabia the only major producer with capacity to increase supply, national security is a serious issue.
- An 18 billion annual investment over ten years—the cost of building the tools to get the United States off oil forever—is small compared to America's $120 billion/year oil import bill and U.S. security investments. For example, the United States spends $50 billion annually (in peacetime) for Persian Gulf intervention readiness.

Getting the United States off oil would decrease carbon dioxide emissions by one-fourth with no additional cost or effort.

**Save Half U.S. Oil Through Efficiency, Competitive Biofuels, Saved Natural Gas**

- Two-thirds to three-quarters of light vehicles' fuel use is weight-related. Each unit of energy saved at the wheels saves seven to eight units of gasoline.
- In today's average car, 87 percent of fuel energy never reaches the wheels: only half the rest—about six percent of fuel energy—accelerates the car. Less than one percent actually moves the driver.
- Fully using proven technologies to wring more work from each barrel of oil can ultimately save half of projected U.S. 2025 oil. Saving each barrel of oil would cost $12 (in 2000 dollars). Compared with the government's 2025 price forecast of $26 per barrel, that means an annual savings of $133 billion by 2025.
- Once half the oil is saved be efficient energy use, the other half can be profitably replaced by competitive biofuels, such as ethanol and biodiesel, and by saved natural gas.

- Brazil has replaced one-fourth of its gasoline with cost-competitive unsubsidized ethanol made from sugarcane grown on five percent of its total cropland. Initial startup subsidies have been repaid 590 times by oil savings.
- A modern U.S. ethanol industry would be based on woody crops (switchgrass and poplar) that would not interfere with food-crop production.
- A 2025 fleet as efficient as the best hybrid cars and SUVs on the market this year would save one-sixth of all 2025 oil use or $45 billion per year, equivalent to two Persian Gulfs of oil imports.
- A $90 billion investment to revitalize transportation equipment, combined with a $90 billion investment to reinvigorate local economies would create one million new jobs.

**Embracing Innovation To Become Globally Competitive**

- U.S. automakers face stiff competition from Japan and the European Union—both already invest considerable resources in developing fuel-efficient vehicles.
- U.S. automakers market share for light vehicles is steadily declining, with SUVs making up the last profit bastion. Toyota has market capitalization grater than the "Big Three" combined.
- Boeing's fuel-efficient *7E7 Dreamliner* uses one-fifth less fuel than previous models, yet sells at the same price or less.

**Believe in Speed-of-Change**

- Major technological transformations take 12-15 years to go from 10 to 90 percent adoption based on historical examples.
- In the1920s U.S. automakers switched from 85 percent open wood bodies to 70 percent closed steel bodies in six years.
- In just six months during World War II the U.S. switched from making four million light vehicles to making tanks and planes that won the war.
- During 1977-1985, the U.S. economy grew 27 percent while oil used fell 17 percent, and oil imports from the Persian Gulf fell 87 per cent.
- Speeding entry and adoption of state-of-the-art vehicles would save American motorists $390 billion in retail fuel costs through 2025.

# Appendix 4

## "Near-Term Practical and Ultimate Technical Potential for Renewable Resources."

On January 16, 2006, the Energy Analysis Office (EAO) of the National Renewable Energy Laboratory (NREL) issued for the Office of Science a DRAFT analysis, for comment, of the technical potential for renewables. (See Endnote 23-c for information on this draft report)

The "near-term practical" potential of renewable resources as a percent of U.S. electricity generation in 2020 is estimated to be 99-124 percent, or 47-55 quads/year (electricity only).

This analysis does not consider existing economic and market barriers. These barriers and perverse economic incentives for business and pollution as usual that would, of course, be transformed by an ecological tax shift.

The text of the DRAFT paper follows:

### METHODOLOGY

Current Renewable Resource Use

Currently used renewable energy resources are drawn from a variety of sources. The current installed nameplate capacity total is a summation of verified, functioning electric-generation facilities (REPIS 2005). Delivered electricity is based on 2004 electricity production (EIA 2005a). For all the renewable electric technologies except biomass, primary energy required to produce electricity is calculated based on an average heat rate of 10,000 Btu/kWh for existing thermal power plants (EIA 2005b). For biomass, a measured heat rate for power plants, 9,000 Btu/kWh, is used (EIA 2005b). For those renewable energy forms that also contribute to heat and fuels markets, total primary energy shown is larger than the thermal energy required to produce only electricity (EIA 2005a).

### NEAR-TERM PRACTICAL POTENTIAL

The amount of electricity potentially produced by renewables is shown as a percentage of the total projected U.S. generation in 2020: 5,085 billion kWh (EIA 2005b).

## BIOMASS

Biomass is the only renewable energy form cited that can be used as either electricity or fuel. Because we cannot predict the distribution of biomass use between electricity and fuel, we make two estimates. The first assumes 100 percent of biomass is used for electricity, and the second assumes that 100 percent is use for fuel. The baseline amount of energy for these is the same, because it is limited by physical availability of biomass. Perlack (2005) estimates 1.3 billion dry tons of biomass is possible with the use of non-food cropland and forestland in the long run. To determine the near-term potential the mid-range scenarios from Perlack (2005) to identify a near-term range of 593 million to 968 million dry tons. The biomass-to-energy conversion used is an average of energy from biomass types of just more than 12 million BTUs per ton (NREL 2005c). This range yielded a potential of between 8 and 13 quads of energy in the near term. To estimate the amount of electricity that can be generated from the range, we assume a power plant heat rate of 9,000 Btu/kWh (EIA 2005b). The result is 17-28 percent of total U.S. electric generation. Biomass as a fuel potential is expressed as a percentage of projected 2020 petroleum demand: 26 million barrels per day (EIA 2005b). Using 8-13 quads of available biomass energy, and a 49 percent fuel plant conversion efficiency, biomass could contribute 9-14 percent of the national petroleum demand in 2020.

## GEOTHERMAL

Because of technology limitations, only hydrothermal energy is considered in he short term. In 1979, the United States Geological Survey (USGS) estimated that there were about 22 GW of discovered hydrothermal resources (USGS 1979). While this estimate is dated, there has been no authoritative study of the potential since that time. Using a 95 percent capacity factor (NREL 2005c), 22 GWs represents 2 quads of energy (or 4 percent of U.S. electric generation) in 2020.

## HYDROELECTRIC

Full hydroelectric potential is 140 GW (Hall et al 2003), which would provide 9.4 percent of electric generation in 2020, assuming today's national average capacity factor of 0.39 (NREL 2005c). Assuming a 10,000 Btu/kWh power plant heat rate conversion, this is equal to about 5.0 quads of primary energy.

## OCEAN

In the short term, the full potential of mechanical (wave, tidal, and current) elec-

trical generation is assumed. This resource is estimated to have a full potential of 30 GW installed nameplate capacity. Assuming constant power and a power plant conversion heat rate of 10,000 Btu/kWh, this translates to 2.3 quads of primary energy (or 4.5 percent of the electric generation) projected for 2020.

## SOLAR

For the near-term technical photovoltaic potential, it is assumed that there will be no storage for solar energy, and no PV generation will be wasted. This implies that none of the nighttime loads can be met by solar, and much of the load at dawn cannot be met (if PV capacity were sufficient to meet such loads, PV output at midday would exceed loads, wasting energy). These assumptions severely limit the impact of PV on the electric system. The PV impact would be even more limited if one also took into account the many conventional fossil and nuclear plants that must run all the time. In this case, the PV capacity would have to be even smaller to keep from wasting PV generation.

The near-term potential for concentrated solar power (CSP) is assumed to be the minimum of the projected in-state electrical load and the actual CSP resources in that state. In all cases, the projected state electrical load is the minimum. Therefore, the near-term CSP potential is the electric load of the state in which the CSP resource resides. In 2020, the projected load for states for CSP potential is expected to be 12 percent of the total U.S. generation, creating an upper bound for CSP electrical generation. Assuming a 10,000 Btu/kWh heat rate for power plants, the estimated primary energy to create this electricity is 6 quads/year.

## WIND

The short-term wind potential is limited by grid reliability/stability concerns to be 20 percent of total generation [based on Wan and Parsons (1993) estimate of between 4 percent and 50 percent]. Assuming a power plant heat rate of 10,000 Btu/kWh, the primary energy equivalent is 10 quads.

## ULTIMATE TECHNICAL POTENTIAL

Ultimate technical potential differs from the short-term potential by a set of general assumptions for each resource type and one more general assumption. The general assumption is that the electricity grid can adjust to the diverse electricity fed into it by adding storage, transmission, ancillary services, etc. Moreover, the ultimate assumptions do not limit the amount of renewable electricity as a func-

tion of total projected electricity demand. As with the short-term assumptions, economic and market constraints are not accounted for in this long-term technical potential.

## BIOMASS

Biomass is the only renewable energy form cited that can be used as either electricity or fuel. Because we cannot predict the distribution of biomass use between electricity and fuel, we make no assumption regarding the differences between the use of biomass for electricity and biomass for fuel. The baseline amount of energy for these is the same, because it is limited by physical availability of biomass. Perlack (2005) estimates 1.3 billion dry tons of biomass is possible with the use of non-food cropland and forestland. The biomass-to-energy conversion used is an average of energy from biomass types of just more than 13 million BTUs per ton (NREL 2005c). The total energy potential for biomass is 17 quads. To estimate the amount of electricity that can be generated from 17 quads, we assume a power plant heat rate of 9,000 BTU/kWh.

## GEOTHERMAL

The hydrothermal estimate includes approximately 72-127 GW of as yet-undiscovered resource (USGS 1979). The enhanced geothermal systems estimate is based on an estimate of 42 TW, which includes the entire potential heat source (Tester 1994).

## HYDROELECTRIC

The ultimate potential is assumed to be the same as the near-term potential.

## OCEAN

The ultimate potential estimate or ocean-based power expands the near-term potential to include power from ocean thermal energy of 0.11 TW (Sands 1980). The primary energy required for electricity generation, assuming a heat rate of 10,000 Btu/kWh, is 9 quads.

## SOLAR

Unlike the near-term potential, the ultimate potentials for both PV and CSP are not assumed to be constrained by grid limitations, e.g., storage is assumed, transmission is assumed available, etc. For PV, the total resource potential (NREL 2003b)

was restricted by excluding federal and sensitive lands, assuming only 30 percent of land area can be covered with PV, allowing only slopes that are less than 5 degrees, and requiring a minimum resources of 6 kwh/m2/day. This results in an ultimate technical potential of about 219 TW or 4,200 quads/year for PV systems, assuming a 22 percent capacity factor.

The CSP resource is restricted to areas with resource potential – the southwestern United States. The potential reduces that amount of land that can be used for CSP by federal and sensitive lands, land with a slope greater than a 5 percent gradient, major urban areas and features, and parcels less than 5 km2 in area. The remaining area determined the technical potential for CSP, assuming 50 MW/km2 (Price et al 2003).

## WIND

The ultimate wind potential is not limited to 20 percent for intermittency and grid stability reasons, as battery storage is assumed. Instead, wind potential is limited by appropriate land selection (exclusions for federal land, etc.) and technical feasibility. For onshore wind potential, using estimated future capacity factors (NREL 2005b), and assuming complete use of Class 3 winds and better, the result is 324 quads of primary energy from wind. For offshore wind, Class 5 and better with a distance between 5 and 200 nautical miles (nm) were assumed. Between 5-20 nautical miles, only one-third of wind energy in Class 5 and better is captured, between 20 and 50 nautical miles, two-thirds; and between 50 and 200 nautical miles, the entirety. Assuming future capacity factors, the potential for offshore wind primary energy is found to be 272 quads.

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# Appendix 5

## A Sustainable Energy Blueprint

**Materials from the Sustainable Energy Network.** (See Endnote 23c.) This is an example of a plausible strategy for a high efficiency, low carbon, sustainable energy future whose implementation would be potentiated by market forces unleashed by the adoption of an ecological tax plan. By making energy resources charge their true short and long term costs economic growth can be the path to ecological improvement, not ecological destruction.

### SUSTAINABLE ENERGY BLUEPRINT

### Objectives:

The three primary, longer-term objectives for the nation's energy policy should be:

1) reduce greenhouse gas emissions to a level consistent with a world-wide goal of global climate stabilization (assumes curbing U.S. $CO_2$ emissions by 60-80% from current levels by mid-century);
2) eliminate U.S. energy imports (i.e., oil and natural gas—now 58% and 15% respectively), while reducing overall use of oil and natural gas;
3) phase out the current generation of nuclear power while substantially curbing the production and consumption of fossil fuels, by increasing the use of energy efficiency and making a transition to sustainable, environmentally safer renewable energy sources.

### Targets:

The following targets approximate what is technically and economically feasible given the necessary policy support and leadership as well as what would likely be necessary if the above-listed objectives are to be achieved.

*By 2025*

1) reduce total energy consumption by at least one percent/year from 2005 levels, through efficiency improvements in housing, manufacturing, vehicles, airplanes, government facilities, and businesses, so that by 2025, U.S. energy use totals no more than about 80 quads.
2) increase from 2005 levels, production of renewable energy from biofuels,

biomass, geothermal, hydropower (and other water power sources), solar, and wind plus renewably-based hydrogen – in an environmentally responsible manner – by about 0.5 quads/year so that by 2025 renewables provide at least 17 quads.

3) phase out the current generation of nuclear power plants by not relicensing currently existing reactors and not building new ones.
4) reduce oil consumption by at least one percent/year below 2005 levels so that by 2025, U.S. oil imports are no more than one-third of total petroleum use.
5) reduce natural gas consumption by one percent/year below 2005 levels so that by 2025, the U.S. will no longer be importing any natural gas.
6) reduce coal consumption by at least one percent/year below 2005 levels
7) reduce carbon dioxide and other GHG emissions by at least one percent/year so that by 2025 they are at least 20% below current levels.

*By 2050*

1) continue to reduce total energy consumption by at least one percent/year below 2005 levels through efficiency improvements so that by 2050, total U.S. energy use is no more than 60 quads.
2) continue to expand use of renewable energy sources by at least 0.5 quads per year from 2005 levels so that by 2050, renewables contribute at least 30 quads to the nation's energy supply.
3) continue to reduce oil consumption by at least two percent/year below 2005 levels so that by 2050, oil imports will be eliminated and total oil use is no more than one-fifth of today's levels.
4) continue to reduce coal consumption by at least one percent/year below 2005 levels and phase out all single-cycle pulverized coal power plants, so that by 2050, coal consumption is no more than one-third of today's levels.
5) continue to reduce natural gas consumption by about one percent/year below 2005 levels so that by 2050, natural gas consumption is one-third below today's levels.
6) continue to reduce carbon dioxide emissions so that by 2050, they are no more than one-third of current levels.

## Tables:

The following tables provide an estimation of what the nation's energy mix would be if the above-listed targets are realized.

### 2005 Energy Consumption (quadrillion BTUs)

23.0 - Coal

16.5 - Oil (Domestic)

23.0 - Oil (Imports)

19.0 - Natural Gas (Domestic)

3.5 - Natural Gas (Imports)

8.0 - Nuclear

7.0 - Renewables

100.0 - Total

$CO_2$ Emissions - 6,000 million metric tons

### 2025 Energy Consumption (quadrillion BTUs)

18.0 - Coal

15.5 - Oil (Domestic)

11.5 - Oil (Imports)

18.0 - Natural Gas (Domestic)

0.0 - Natural Gas (Imports)

1.0 - Nuclear

17.0 - Renewables

81.0 - Total

$CO_2$ Emissions - <4,800 million metric tons

### 2050 Energy Consumption (quadrillion BTUs)

8.0 - Coal
8.0 - Oil (Domestic)
0.0 - Oil (Imports)
14.0 - Natural Gas (Domestic)
0.0 - Natural Gas (Imports)
0.0 - Nuclear
30.0 - Renewables
60.0 - Total

$CO_2$ Emissions - 2,000 million metric tons

### Proposed Policy Initiatives:

The following policy initiatives are not exhaustive but are illustrative of the type necessary to realize the targets and objectives outlined above.

1) By 2025, fuel economy standards for cars and trucks should be at least double what they are today, beginning with a 50% increase in fuel economy for new vehicles by the year 2015.
2) By 2025, total annual person-miles traveled by automobile and truck should be back to levels no higher than today through expansion of mass transit, better land use planning, telecommuting, etc.
3) By 2025, no less than 25 percent of the nation's liquid transportation fuels should be provided, or displaced, by renewable sources, including renewably-generated hydrogen.
4) By 2025, no less than 25 percent of the nation's electricity should be mandated to be generated by renewable energy sources and increased by at least one percent/year thereafter.
5) By 2025, state and/or federal standards should mandate that the energy efficiency of appliances, motors, and lighting should be improved by no less than 20 percent as measured on a total fuel cycle basis.
6) By 2025, state and/or federal standards should mandate that 20 percent of all new buildings must be zero energy buildings (moving towards a goal of all new buildings being zero energy by 2050), using a combination of efficient design and clean on-site energy production.

7) By 2025, energy use in the electricity sector should be reduced by at least 10 percent through the use of clean distributed generation such as combined heat & power, district energy, fuel cells, and improved energy storage and transmission technologies.
8) Energy efficiency resource standards for electric and gas utilities should be established with a target savings of at least one percent of annual sales each year, on an incremental basis, such that savings build on previous years' impacts.
9) Expansion of renewable energy, energy efficiency and clean distributed generation technologies should be promoted through national interconnection standards i.e., (net metering and transmission access reforms), production and investment tax incentives, government procurement, updated resource assessment, and state and local planning programs.
10) Annual federal funding for the research, development, and deployment of energy efficient and renewable energy technologies should be at least doubled over the next five years and expanded to no less than five times current levels by 2025.
11) Funding to support sustainable energy budget outlays and tax incentives, as well as to alleviate low-income consumer impacts, should be drawn from a mix of gradually increased dedicated taxes on carbon-based fuels, energy imports, and fossil fuel leases on federal lands.
12) Any new coal-based power plants should be required to achieve energy efficiency and environmental performance equal to, or better than, the best-available Integrated Combined Cycle Coal Gasification technology, and must include full and permanent carbon capture and sequestration.
13) Unless all of the following conditions are satisfied, licenses for existing nuclear power plants should not be renewed or extended and federal nuclear funds should be directed towards plant decommissioning and waste clean-up, storage & disposal:
    a) greenhouse gas emissions from the nuclear fuel cycle are reduced by 60 percent;
    b) designs are developed for passively-safe reactors that cannot melt down, explode, or release radioactivity, under any conditions, including direct hits from bombs, aircraft impacts, earthquakes, floods, or terrorist acts;
    c) radiation exposure standards are established that ensure no radiation exposure hazards to workers or the public;

d) waste handling and disposal technologies are developed that preclude the need for long-distance waste transport or long-term storage;

e) fuel cycle and waste handling technologies are developed that preclude any risk of nuclear weapons proliferation or theft of potentially fissionable materials; and

f) private liability per nuclear power plant under the Price-Anderson Act is increased to no less than $50 billion.

# Appendix 6

## Cogeneration system reduces total carbon 53%compared to coal plant plus conventional gas furnace.

1. Honda l kW natural gas cogeneration system overall efficiency 90%.[28]

   (21% electric efficiency + 69% heat for furnace efficiency)

- For each 100 BTU Energy in, useful energy out =90 BTU

  (100 BTU Energy In =21 BTU elec. + 69 BTU space heat energy out)

2. Coal Plant + conventional gas furnace

   (Coal plant 38% elec. efficiency + 80% gas furnace efficiency)

- For each 142 BTU energy-in obtains 90 BTU useful energy-out to equal cogeneration plant useful energy performance.

  a. Coal plant, 55.3 BTU in = 21 BTU useful electricity out

  b. Natural gas furnace 86.3 BTU in = 69 BTU useful heat out.

  c. Total energy in =142 BTU, useful energy out = 90 BTU

3. Natural gas as resource generates 44% less carbon dioxide for equal BTUs of heat. (From U.S. EIA[29])

   Natural gas = 14.47 million metric tons $CO_2$ per quadrillion BTUs.

   Coal = 25.474 million metric tons $CO_2$ per quadrillion BTUs.

4. Comparison Total Relative units of carbon released:

   a. Coal plant + gas furnace = 55.3Btu/.44 + 86.3BTU = 212 units carbon

   b. Honda cogeneration system = 100 units carbon (see 1. above)

$$\frac{\text{100 units carbon from gas cogeneration}}{\text{212 units carbon from coal electricity}} =$$

**53% reduction in net carbon with gas fired cogeneration.**

# Endnotes

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Yearly cost/thousand kg $CO_2$ avoided: wind = $ 68.90, nuclear = $132.50

b. Nuclear fuel cycle $CO_2$ production

i.Nuclear fuel cycle info & photos : http://www.energybulletin.net/15345.html

ii. *Nuclear Power - The Energy Balance* by Jan Willem Storm van Leeuwen and Philip Smith: Page 4 Chapter 1: For high quality uranium ores nuclear plants have net 18% of $CO_2$ emissions of gas burning plants if dismantling is indefinitely postponed. and 33% if not. Chapter one has detailed analysis of increasing nuclear fuel cycle $CO_2$ use as quality of uranium ore declines. Low grade uranium ores yield a net increase in carbon compared to direct natural gas combustion for energy. http://www.stormsmith.nl/report20050803/Chap_1.pdf
van Leeuwen and Smith Study Introduction from: http://www.stormsmith.nl/

"This study is a physical analysis of the nuclear system: the full technical and industrial complex, needed to generate electricity from uranium. The main issues are the potential contribution of nuclear power to the world energy supply in the future and to the mitigation of the anthropogenic climate change in the future. Safety issues and proliferation risks are not addressed, directly or indirectly.

We analyzed all energy inputs needed to operate the nuclear system and balanced these inputs with the energy output of the nuclear reactor: the amount of electricity put into the grid. Furthermore we analyzed the main parameters determining the energy balance, of which the grade of the uranium ore turned out to be the most important.

Two novel concepts are introduced: the 'energy debt' and the 'energy cliff". Beyond the energy cliff the nuclear system cannot generate net useful energy and will produce more carbon dioxide ($CO_2$) than a gas-fired station.

Nuclear power would reach the energy cliff within several decades, if the world nuclear capacity would remain at the current level, and much sooner in a nuclear renaissance scenario."

22 Electricity is 19% of World Energy Use, Nuclear is 2.5%

a. Share of electricity in final energy consumption = 19% From: *Pathways to 2050, World Business Council for Sustainable Development* http://www.leonardo-energy.org/drupal/node/306

b. Nuclear power provided 16% of world electricity production in 2005 From: Nuclear Energy Institute: http://www.nei.org/doc.asp?catnum=2&catid=106

.19 electricity x .16 nuclear = 3% world total energy

As of June, 2006, 30 countries worldwide were operating 442 nuclear reactors for electricity generation. See World Nuclear Power Plants in Operation and Nuclear Generation and Capacity. Twenty-eight new nuclear plants were under construction in 12 countries.

c. Note that statistical studies of so called primary energy done by such as BP and EIA underestimate renewables and over count tradeable fuels such as nukes and attribute 6 to 7% of global energy to nukes. BP notes on its report of 2005 primary energy consumption: "In this Review, primary energy comprises commercially traded fuels only. Fuels such as wood, peat and animal waste are excluded. Whilst they are important in many countries, they are documented unreliably in terms of consumption statistics. Also excluded are wind, geothermal and solar power generation, as well as biofuels."

http://www.bp.com/sectiongenericarticle.do?categoryId=9009516&contentId=7017962

23 For the enormous cost effective opportunities afforded by efficiency and renewables see, for example, Amory Lovins' Rocky Mountain Institute http://www.rmi.org, www.oilendgame.com, and The Sustainable Energy Coalition http://www.sustainableenergy.org/ and *A Robust Strategy for Sustainable Energy,* Brookings Papers on Economic Activity, 2:2005 www.earthinstitue.colimbia.edu.

a. *Winning the Oil End Game* see: http://www.oilendgame.com/

b. California Greenhouse Gas Reduction Plan 25% cut by 2020 http://www.worldwatch.org/node/4499

c. National Renewable Energy Laboratory (NREL) DOE

http://www.nrel.gov/ Draft report is detailed and most informative reading.

Draft NREL report is available at: http://www.nirs.org/alternatives/factoid18.htm

"Renewable Resources Could Provide 99 Percent of U.S. Electricity Generation by 2020"

The draft document had earlier been available for inspection at: <http://www.nrel.gov/analysis/tech_potential/pdfs/tech_potential_table.p df> but now appears to have been withdrawn. Comments on the draft had been requested to be sent to Elizabeth Brown in NREL's Energy Analysis Office at elizabeth_brown@nrel.gov; 303-384-7489

d. Sustainable Energy Network, 8606 Greenwood Avenue, #2, Takoma Park, MD 20912. Ken Bossong, 301-588-4741

*Sustainable Energy Blueprint: A Plausible Strategy For Achieving A No-Nuclear, Low-Carbon, Highly-Efficient And Sustainable Energy Future*

24 Chinese coal, new 90,000 megawatts, see: *Financial Times* May 30, 2006 "Special Report: Energy"

Kevin Morrison, "Coal: Reliability Fires Technology", page 3.

25 Chinese coal consumption/emissions: *New York Times,* June 11, 2006,. Keith Bradsher and David Barboza, "Clouds From Chinese Coal Cast a Long Shadow," pages 1, 14-15.

26 500 ppm carbon target: "Meeting the EU 2 Climate Target: Global and Regional Emission Implications - Group of 2" MGJ den Elzen, M Meinshausen - RIVM report, 2005 - gci.org.uk http://www.gci.org.uk/briefings/rivm.pdf

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b. "Climate change Impacts are Sensitive to the Concentration Stabilization Path - Group of 5 "BC O'Neill, M Oppenheimer - Proceedings of the National Academy of Sciences, 2004 -

pnas.org http://www.pnas.org/cgi/content/full/102/44/15728

c. John Browne, Group Chief Executive of BP plc. "Beyond Kyoto" in *Foreign Affairs,* July/August 2004 http://www.foreignaffairs.org/20040701faessay83404/john-browne/beyond-kyoto.html

Summary: "Global warming is real and needs to be addressed now. Rather than bash or mourn the defunct Kyoto Protocol, we should start taking the small steps to reduce carbon dioxide emissions today that can make a big difference down the road. The private sector already understands this, and its efforts will be crucial in improving fossil fuel efficiency and developing alternative sources of energy. To harness business potential, however, governments in the developed world must create incentives, improve scientific research, and forge international partnerships."

28 A. For Honda 1 kw system sold by Climate Energy in Massachusetts see: http://www.climate-energy.com/products.asp, and "Honda and Climate Energy Provide Innovative and Energy Efficient Heating Solution: First Micro-CHP System Residential Installation Completed", 3/3/06.
http://www.hondanews.com/catID5000?mid=2006030637467&mime=asc

29 For differential carbon emissions from coal and natural gas see U.S. Energy Information Agency carbon coefficients. Natural gas = 14.47 million metric tons $CO_2$ per quadrillion BTUs. Coal = 25.474 million metric tons $CO_2$ /quadrillion Btu. On average, natural gas thus releases 44% less carbon than coal.
http://www.eia.doe.gov/oiaf/1605/gg97rpt/appb.html