Excerpted from:

No Hair Shirts: Money and Politics in the Fight Against Global Warming (forthcoming)

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Introduction

This is a brief excerpt from a larger work *No Hair Shirts: Money and Politics in the Fight Against Global Warming*. It is pretty well known that a great many opportunities for efficiency are overlooked, opportunities that can pay for themselves in an extremely short time. The following begins with some short examples of such technologies, then moves on to structural economic and political causes for missing such opportuntities.

Technical Examples

Industrial Efficiency

Most industrial goods exist to provide service to humans – we care about such services rather than the exact nature of goods that provide them. We care that our refrigerators keep foot cold, not the exact cooler design, that our homes be roomy, comfortable, useful and beautiful rather than made of specific material. Give us the same functional results, and most of us would not object to taking significantly different routes to get there.

For example, Super-Adobe construction uses high tech plastic sandbags, filled with wet earth, courses bound with barbed wire to construct low rise buildings[i]. Because the "sandbags" in this form of construction are a single continuous tube, the earth can be pumped from a cement mixer rather than moved by hand - requiring no more labor than conventional stick built construction. The barbed wire provides tensional and shear strength to make Super-Adobe earthquake resistant. So the result is both stronger and less expensive than conventional construction. Reducing use of lumber, concrete and steel saves energy before we improve efficiency in one steel plant, lumber mill, or cement factory.

As an example of direct savings, with help from the DOE, Alex-Tronix Controls in Fresno California developed a control system that reduces energy consumption in irrigation systems by up to 99%[ii]. Automatic sprinkler systems normally hook to a grid supply, and draw power 24 hours a day, even though they only run for minutes. (The A.C. motors that run them also waste energy even in use.) Storage based systems would be more efficient in terms of power use, but batteries would have to be changed too often in inconvenient locations, and don't hold up well in wet conditions. The Alex-Tronix system seals the battery and control system behind a latching solenoid. So the system draws 60% less power per minute, minutes per day instead of 24 hours. The sealed system gives the battery a ten year life span, and can operate under water if necessary.

Transportation

One key example of a technology with massive potential to save transportation energy is Cybertran[iii]. This ultra-light rail uses small cars carrying from 6 to 20 passengers. To keep manufacturing costs low, the cars are the same size; differing passenger capacity is based upon different seat arrangements.

Small light cars run on cheaper tracks. The total capital cost of a Cybertran urban system (including rail and guideways) is about a tenth or less of the per seat cost of conventional light rail. The same light cars also mean energy costs per passenger mile are better than conventional light rail - around 683 passenger mpg[iv] equivalent if powered by renewable electricty). Cybertran is an automated driverless system; so while fixed routes would be used during rush hour, (a series of CT cars following one another would mimic a conventional multi-car train) at all other times it would be an on demand system. Regardless, you would never have to wait more than five minutes or so for a car - usually less. In-system transfers should take even less time, because when you bought a ticket, the system would know you needed to transfer and when. And because of the high degree of computerization (each car would have an on-board computer, plus the system would have a bank of central computers as well) routing would be optimized. Transfers would be avoided when possible; when transfers were needed the routes would still be direct enough you would never go around Robin Hood's barn to get to your destination.

Given the small numbers of passengers per car, travel would be optimized to minimize the number of stops a given car made. That is passengers would be sorted onto cars by destination. During off-peak hours this would result in virtual expresses with few stops between a passenger and her destination. Rush hour might or might not allow this; but at minimum the number of stops made would be reduced; you never have to stop at every, or almost every, station.

And there will be a lot of stations available. Stops are offline from main guideways - one Cybertran car stopping does not delay others. Cybertran stations can be as frequent as bus stops. Because of automation you can afford more surplus cars, since unused capacity is parked, not rolling, not consuming labor or energy. And you can also afford not to have to fill the cars. So in most cases you will have a stop within easy walking distance of both ends of your journey. In addition, even major stops don't have to be major multi-acre lots like the BART Park n' Rides in San Francisco; Park n' Rides can consist of many small parking lots; not giant branches of the night auto supply. If you live in a nightmarish suburban development, with acre after acre of housing and no shops or suitable areas for a transit stop within walking distance, you will still find a (comparatively) small, pleasant Cybertran stop with parking a short drive from your home. In other words even in ultra-suburban towns where nothing is close to anything else, where you have to drive miles between the grocery store and the dry-cleaners, you still could put in a Cybertran at a lower cost than a bus system.

Also Cybertran is not designed for people to stand in the aisles. The cost, as mentioned, is about 10% that of conventional rails and most of that is in guideways, not the cars. So it won't need to be overloaded during peak hours to pay for off-peak travel. You are guaranteed a seat. You only stand if you want to stretch your legs - an option you don't have while driving an auto.

To summarize, you have about the same journey time as a car; you have close to door to door service; and you can read the paper on your commute.

As a second example, a four passenger electric sedan (running at the equivalent of above 200 mpg if the electricity had come from wind or other renewable sources) was demonstrated in 1997 that had a range of 250 miles at normal highway speeds before needing recharging and could have retailed for as little as $20,000[v]. That is a lot of money; but it was also at the mid, rather than high end for a new car –even in 1997. There are people for whom that mile range would not be enough; but there are also plenty who would never drive more than 250 miles in a single day, not even on vacation.

Residences

Climate control in new homes can easily be reduced from the average U.S. standard through high levels of insulation without thermal bridges, tight seals, high-quality single pass ventilation, and high efficiency windows. In Germany, Jürgen Schnieders conducted a study of various "Passivhuas" (passive house) buildings[vi] in Germany, documenting that they saved 90% of heating and cooling costs compared to U.S. averages, while adding about 10% to construction costs. That is easily recovered (with interest) over the course of a 15 year mortgage or by slightly higher rents that will still save tenants money in lower utility bills. U.K. buildings do not have the U.S. level of inefficiency, but still could benefit from this technology at a profit.

Commercial Buildings

A commercial example is the Sukkertoppen office building, owned by Employees Capital Pension Fund; it was retrofitted, and rented commercially to small computer companies and educational organizations[vii]. Insulation, super-efficient windows, daylighting via these same windows, and via skylights to reduce the use of commercial lights, more efficient commercial lighting where needed, and more efficient appliances reduced total consumption by 74% compared to U.S. commercial averages per square foot. Again U.K. savings would not be quite as great, but still substantial.

Why aren't we doing it now?

Why do we keep missing opportunities to save or make money through energy efficiency and renewables? Why, for instance, aren't the passive techniques described in the previous section, saving a high percentage of climate control costs, in all new homes?

Many economists would answer that we pay less than the full social cost of our energy. Fossil fuels have effects – air pollution, global warming, mining and drilling. As long as the costs of those effects are not included in fossil fuel prices we will use more than we should; we tend overuse anything we get even partially for free. If fossil fuels were more expensive, we would use them more efficiently, and alternatives would be more attractive.

But that is not the full story. Passive homes are only around 10% more expensive to construct than conventional homes; energy savings provide a fifteen year payback or less - even with a 6.5% interest payment. Ultra-light rail is less expensive than transit buses; super-adobe costs less than stick built construction. A small increment of wind electricity (10%-20% of total grid supply) costs less than the fossil fuel power plant it replaces. Solar energy can provide between 40% and 65% of space and water heating at a lower price than natural gas.

We overlook huge savings (of energy and money both) available at current market prices, and have done so since at least the mid seventies. Neither Japan, nor Finland, nor Germany takes advantage of all the savings they have available at U.S. prices, let alone the potential at the higher price levels there. Lack of social pricing is not sufficient explanation.

Economists have a name for what is going on; they say energy exhibits low demand elasticity in response to price increases. That means that while people use less energy when it grows more expensive, that use changes very slowly.

In the short run, this is easily explained. Short term reductions in energy past a certain point are very expensive – requiring immediate capital investments, or compromising survival. Getting to work is not like buying jelly beans. If energy prices rise, people may find some marginal things to cut, but past that they will give up other things to pay for energy rather than giving it up. Prices must rise high enough to compete with other necessities before they cut demand past that point; among the elderly poor, this is known as the heat/eat dilemma.

But energy demand shows the same behavior over the long run too. Even when people make capital investments they seem to buy less energy efficiency than would provide an optimum return for their investment. (In fact most of the examples mentioned are of this type. Passive homes in new construction, wind generators as an alternative to natural gas, ultra-light rail instead of buses all more than pay for them selves compared to the alternatives.) In short, energy efficiency is a classic public good – one where underinvestment will occur if left to market forces.

Look at the U.S. – where automobile efficiency more than doubled from ~14 mpg to ~25 mpg when CAFÉ standards were imposed – then stopped rising when trade decisions, congressional actions, and light truck loopholes stalled standards.

Again look at home insulation in most U.S. states; generally average levels of attic insulation hover around the minimum state regulations require; a few people may get more, a few are grandfathered in at less; but within a few percentage points, regulatory minimums are a fair predictor of actual insulation.

In European Union nations, you will find that regulation and public spending (especially on rail) are better predictors of carbon efficiency than price policies. Again, this is not to say that raising the price of energy does not reduce use; merely that regulation and public works does so more quickly, more efficiently and with fewer unintended consequences.

This is quite counter-intuitive. What would cause individual expenditures - insulation, windows, cars, industrial machinery and so forth - to act like public goods such as health care and education?

We will need to examine some fundamentals about the way markets work. Rewards in a market are based on bargaining power. What you get depends on how much leverage you have. People work harder, more efficiently, take risks, pretty much as ways to gain more bargaining power in markets. Unfortunately other factors influence bargaining power as much or more than all these wonderful things markets supposedly promote.

When it comes to bargaining between corporations and the people who work for them, corporations often find the most productive choices do not give them the most bargaining power. Michael Perelman has documented case after case where, given multiple technological alternatives, companies chose methods that increased measurability and control of labor over similarly priced ones that would increase worker productivity (narrowly measured) by greater amounts[viii]. Corporations assumed - probably correctly - that more control would let them extract more labor from labor power than merely increasing the ability of employees to produce more during an hour of work - if they chose.

One of the cruelest examples of this is the case of short-handled hoe in agriculture. The book "Fight in the Fields" describe the fight against what was sometimes called "The Devil's Hoe"[ix].

> *El Cortito, "the short one," was a hoe that was only twenty-four inches long, forcing the farmworkers who used it to bend and stoop all day long—a position that often led to lifelong, debilitating back injuries. The pool-room meeting with a handful of its victims led Jourdane to try working in nearby fields for two days. Within weeks of experiencing firsthand the pain el cortito caused, he and other CRLA attorneys began a seven-year battle to outlaw the most insidious tool ever used by California agriculture.*
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> …
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> *In the late 1960s and 1970s, el cortito was the most potent symbol of all that was wrong with farmwork in California: The tool was unnecessary, and farmers in most other states had long switched to longer hoes. Growers argued that without the control the short hoe offered, thinning and weeding would be mishandled, crop losses would mount, and some farmers would go bankrupt.*

What was the actual result? "The head of Bud Antle, then one of the California's largest lettuce growers and a critic of the ban of the short-handled hoe later admitted that his crews had adjusted quickly to long-handled hoes, gained stamina, and raised productivity by 5% to 10% on the very first day they eliminated short-handled hoes"[x].

How does this affect energy and material efficiency?

Given equal savings possible in material and direct labor, an owner has a strong tendency to save the labor cost. Material suppliers generally have multiple customers. Most of us work for only one or two employers at a time. An owner's ability to do without a particular worker provides more leverage than the ability to do without a particular supplier. The employee would have to find a whole new job; the supplier would still have income from other customers. So a reduction in labor costs results in a much greater increase in owner leverage than an equal reduction in material costs. In good times this might (but need not) take the form of an increased absolute, but decreased relative, share. In bad times it provides more power to let the owner lower absolute wages, layoff a larger number of workers, or both. (The way a friend of mine put it is that materials don't go on strike.)

This is not some sort of iron law. But the tendency of businesses to favor increased leverage against labor over other types of investment is extremely strong. It was already well under way when Adam Smith wrote about the division of labor in a pin factory back in the mid-18th century. By now it is rooted in the culture and institutions of businesses as well as the material interests.

Another structural problem is uneven access to capital between firms, and between consumers and investors. Firms have different investment time frames; policies affect one another's deployment of capital.

For example, utilities recover the costs of generating power over a period of twenty years or more. Grid investments are often recovered over an even longer time. I don't know what the maximum is; when I lived in Houston during the mid-nineties, Houston Lighting and Power was still depreciating grid investment from rural electrification completed well before 1945.

Gas pipelines and the coal and petroleum infrastructure costs in general are recovered over periods of at least twenty years. Oil and gas well costs are recovered over a shorter period, but that is because so much exploration is required before holes can be drilled, and so many dry holes are struck. When all costs are taken into consideration, exploration, analysis, dry holes, and holes that produce but never recover their costs, net investment in drilling is recovered over at least 11 years. [Note; the preceding sentence was written when oil prices were around $40 per barrel. It is historically, if not currently correct.] So most energy investments are recovered over twenty years or longer, a minority over eleven years.

But most industries amortize their costs over much shorter periods. Savings in electricity or in coal use also saves generating capacity and grid improvements or coal industry infrastructure that would be recovered over a minimum of twenty year. But the firms saving the electricity cannot credit it over that long a period. Their own investment outlooks are shorter. Similarly a savings in natural gas or petroleum derivatives will save capital investment that would be recovered over the course of eleven to twenty years (or more in some pipeline cases). Again, legitimately, most firms cannot afford that long a recovery period for that type of investment.

Passive new homes of the sort mentioned at the beginning of this chapter (with a fifteen year payback) are examples of uneven access to capital. Most homeowners may not be able to afford to tie up capital or ability to borrow that long in an illiquid asset.

This occurs even within firms; most companies require investments in operational savings to pay for themselves in 18 months. Many require they pay for themselves in 4 months. Some forward thinking companies allow payback in 4 years; but these are mostly in industries with very long term outlooks, with a decade or more for recovery on investment. There are very few companies who will allow investment in operational savings the same payback period they would accept in normal investments - that is an investment that would produce a saving in labor or an increase in revenue. Bear in mind that investment to increase sales is usually much more speculative, much higher risk than energy or materials savings.

A bias towards leverage over labor is not the only structural obstacle to managing flows properly. Owners have a problem in hiring. They buy labor power, but need to extract actual labor. That is, owners don't want workers to spend the day reading novels, or surfing the Internet, or socializing, or arm-wrestling. They want work done, work that will make them a profit. Part of the solution, since there are too few owners to see to this themselves, is to hire managers to ensure that work gets done[1]. But another part of it is to organize the work to be as predictable and measurable as possible. Ideally, from an owner perspective, every step of every work process would be known in detail, and measured as completed. But, even after hiring managers, this is not possible. The most advanced computers cannot yet measure everything a worker has to do. So the next best thing is to treat workers as black boxes. You don't measure their entire work process; you know what inputs they need for their job; you know what outputs they produce; you know various timeframes so you can predict how much output you can expect from them in a given time period.

[1] Yes, I know. That is only part of what managers do.

A while back there was a fad called TQM. Supposedly it stood for *Total Quality Management*, rather than *Time-wasting Quirky Meetings*. It was very popular among owners and top managers because it reflected a very fundamental underpinning of the way business is done. Each worker or manager in a firm was to look at any other worker or manager as a customer to whom they supplied output. At the same time, they were to look upon themselves as customers for others who provided needed inputs. In short, everyone was to look upon everyone (including herself) simply as a black box that received and provided inputs and outputs. It was an attempt to get workers and managers to see everything from an owner's point of view.

And it is not just owners that benefits from people being black boxes; in any market system bargaining power can be obtained in a variety of ways. A significant ownership right in the company is one. Possession of a skill is another. There is an advantage not just to owners but to workers and managers in being "black boxes". What goes on inside the black box can be your bargaining chip; the inputs and outputs may be obvious, but not just anyone has the skill to take those inputs and turn them into those outputs. What is more, quite often the processes developed may be firm specific or even workplace specific. At that point, a worker or manager may have a limited sort of local monopoly - be the only one able to perform their particular task without a steep learning curve. High level managers, bureaucrats and technical workers may be in an especially good position to gain this type of leverage, and be as resistant as to whole systems thinking as any owner. So maintenance of bargaining power provides incentives to resist systems thinking for owners, managers and employees to varying extents within a market system.

Now the problem with this shows up when it comes to things like energy and material efficiency.

The usual way of designing an office building or a factory is to pass the design from expert to expert. Expert one pulls out a standard set of drawings, modifies and optimizes the functions that lie within her specialty for specifications given, and passes them to expert two. Expert two pulls out her standard set of drawings, optimizes within her specialty for the specs given, and the limitations imposed by the design of expert one, paper-clips them to the design of expert one, and passes the now thicker document on to expert three. Very seldom does optimizing each component in isolation like this optimize the system as a whole. Design is, and has for a very long time, been done with much the same division of labor Adam Smith observed in the pin factory. He noted that sitting there doing just one step in the pin-making process all day long tended to produce dullness among pin making workers; the same thing applies to a similar division of labor among those designing manufacturing processes or office buildings.

It is important to note that "systems thinking" can be taken too far. We, to put it mildly, depend on specialization and the division of labor. Everybody cannot know how to do everybody else's job. That is one reason we have specialties. And that means we have to look at one another's work as black boxes to some extent. But we need a balance, some counterweight to the tendency of specialization to become atomization.

Another flaw built into the structure of markets is one of information aggregation. Prices - even if the amount is the right one to reflect full social costs - tend to hide information detail needed to make good choices.

Take a simple example - buying a chair. That chair has a number of characteristics - price, appearance, sturdiness (that is ability to take structural abuse), hardiness (ability to clean up spills and such), ease of maintenance and so forth. This is by no means exhaustive, but enough for illustration. Now one point is that even if all of the costs are disclosed - sturdiness and hardiness for example by the warranty offered, ease of maintenance by boasting in the brochure, it is not an easy thing to weigh against the more obvious things like price and appearance. I wonder how many people really weigh price against probable lifespan when buying a chair. Even given the information, the calculation is not easy to do.

And in more significant cases like energy, the problem is more than just difficulty in doing the calculations. When buying a home for example, there are levels of insulation (above those required by energy regulations, though lower than "passive" houses) that pay for themselves in four months to three years - even counting only energy savings. Obviously this is a good deal when buying someplace on a 30 or 15 year mortgage. A problem arises when most homes don't offer that level of insulation. After all there are more important considerations when buying a home than energy costs. "Location, location, location" the realtors say. Is it convenient to work or schools? Is it convenient to shopping? Is it convenient to recreation? Also there are the questions of layout, and appearance. If all homebuilders were required to offer this level of insulation they could easily recover their costs and a significant profit besides at a price that would still lower overall cost of ownership to buyers. But in the absence of regulation requiring this, homebuilders may offer homes without such features. So long as most homes don't offer them, they suffer little loss in bargaining power. The odds are homes with a similar location, layout, appearance etc. won't be available with the added energy conservation features. To put it another way, they rationally believe they won't gain enough bargaining power in selling their product to make extra insulation worth adding. The house will sell or fail to sell on the basis of other characteristics. This is so even though the buyer would get a good deal by paying enough for the added energy savings feature to allow the builder a significant extra profit. Yet neither the buyer nor seller is being individually irrational.

Another problem is that of split incentives; consider the problem of insulation in rentals with a high turnover. The tenant cannot quite justify additional insulation – because installing insulation will be a gift to the landlord, one that may not pay for itself while she is in the apartment. For the landlord, additional insulation saves the tenant, not her, money. Can she recover the investment through a rent raise? Perhaps, but again you have the same information problem you have with homes; energy efficiency is not the top of criteria for choosing an apartment. The value of the savings may be lost in market noise, the insulation not increasing rents collected in a reasonable ratio to investment.

Past a certain point, even insulation in new owner occupied homes is a problem of split incentives – for example the passive homes we keep coming back to (the ones that pay back their investment over the course of 15 years). People who own their own homes don't stay in them fifteen years on average. The payback period is too long for a homeowner. So while the benefits of passive home exceed their costs, a homeowner can't be certain the benefits will go to her. Even though such an investment is sensible from a larger perspective, individually not making it is quite rational.

Split incentives occur within firms as well. In cost accounting, flows (such as energy and water) are often allocated according to budgeted rather than actual use. Variances from such budgets (whether savings or overages) are considered overheads, and allocated not to the department that created the savings or caused the expense, but in ratio to some cost driver – usually direct labor. Savings show up in the costs of whichever departments employ the most labor, often not the ones who could institute savings. Budget proposals with material or energy savings require convincing the accounting department to lower a standard ratio if a certain process change is made, and to allocate the resulting savings from one department to another. In general, justifying an investment in or energy or other flow savings will require much more work for a manager than a saving in labor - even if the dollar flow is the same. For further information on this, check out the very short appendix, **Accounting for Resource Flows**.

Aside from structural flaws, there are various industries with strong self-interest against better energy efficiency and the use of renewable resources. The fossil fuel industries want to continue to sell fossil fuels. They do not want huge drops in the total fuel consumption. Utilities similarly want to continue to sell electricity. They don't mind, and even favor efficiency where it reduces demand that would otherwise be greatly in excess of what they can supply. But they strongly don't want reductions in use below their generating capacity, leaving them with stranded costs for existing plants and grid investments. The U.S. auto industry has huge investments in existing types of cars. They don't even want the cost of incremental improvements. They especially don't want a conversion to any radically new type of car that would make their entire existing manufacturing infrastructure obsolete.

This has played out in lots of ways. The auto industry lobbies against higher CAFÉ (Car Fuel Efficiency) standards[xi]. Wind generators going up off the coast of Cape Cod find fossil fuel groups allying with organizations opposing them[xii].

Another example ties to problems pointed out earlier with the differing payback periods required by utilities for energy investment and their customers for energy efficiency. This type of gap is considered by conventional economists a perfect opportunity for arbitrage, with the utilities being ideally suited for the role of arbitrageur - selling energy efficiency at a profit and allowing customers to pay for it from savings on their energy bills. But conflict of interest prevents this. Utilities have an interest in modest efficiency - enough to prevent demand from exceeding supply, or at least exceeding it to the point of actual blackouts. Savings beyond that point leaves them with generating and grid capacities they cannot recover from sales to customers. California provides one recent example of how utility interests contrast with those of their customers (and of society as a whole). In California, the PUC recently turned down (3 to 2) a demand that those with non-utility electricity - solar cells, wind generators and such, should have to pay a per kWh fee to the utility companies for electricity they generate themselves. The utilities actually demanded compensation for NOT buying the electricity from them[xiii].

Note that non-utility arbitrage is not nearly as attractive to customers. It is one thing when your local utility offers to install energy efficient equipment in your home or office and subtract the cost from savings in your utility bill. It is quite another to be offered a complicated equipment lease by someone who used to sell aluminum siding.

And of course there are many other groups who would oppose, not so much efficiency, but some of the means needed to encourage it. For example, builders and developers don't want higher efficiency requirements imposed on new buildings. Auto manufacturers don't want massive investments in public transit or development of a Hypercar that will make their existing capital investment obsolete, or even (as pointed out) requirements for incremental improvements in auto efficiency. Industry in general doesn't want efficiency standards imposed on them. Anti-government ideologues in general don't want new or stronger regulation of any kind.

Please note that I put deliberate action by powerful interests last on my list. It is not that they are not important; they are. But the structural obstacles are worse.

As one example, a "green" Habitat for Humanity home was recently built where I lived. It did not take advantage of all the possibilities mentioned in the residential section because Habitat did not want to stick the extremely low income owner with any up front costs greater than a conventional home, no matter how quickly they would be paid back. The resulting home still will use about 75% less energy than a conventional U.S. home, and cost $400 less to build than if conventional materials had been used. (Labor for habitat homes is donated; but thanks to the use of Rastra ICF, hours to build were less than in a normal habitat home as well. So it saved almost as much energy as a super-insulated super-efficient home, and costs less to build than a conventional one.) Yet builders are not rushing to build more energy efficient, more comfortable homes for less money.

It is not the Carbon Lobby and special interests that prevent home builders from spending less to build more energy efficient homes. It is not the Carbon Lobby that causes manufacturers to ignore efficiency improvements with eight month paybacks.

What it comes down to is that just tinkering around the edges won't solve the problem. Just beating the carbon lobby won't solve the problem. Full social pricing and better information distribution are not enough. Using resources wisely will require institutional change.

Policy

You will notice that almost all misallocations we are describing (as Amory Lovins put, leaving $10,000 bills on the factory floor) have power inequality as their root causes - mostly the inequality between labor and capital. Prices not reflecting full social costs mean most business have some of their costs paid by other business and individuals; and because of inequality, the owners of those business come out ahead (on average) even after bearing some of the costs of others. The accounting flaws we describe arose because business owners need maximum power over the people who work for them. The lack of whole systems thinking is exacerbated by the same causes, though it is inevitable to some extent in any society at our level of development, due to the necessary division of labor. Split incentives are often completely a function of power differentials, and always made worse by them. The particular interests opposing change are overwhelmingly the super-rich and powerful. For example in spite of the U.S. auto industry (and the UAW) opposing tougher CAFE standards, 84% of Michigan UAW members support requiring automobiles to meet 40 MPG standards [xiv].

So solutions will need to reverse this inequality or mitigate its effects. Policies that exacerbate inequality will be counterproductive..

Let's start with one thing that environmental economists often favor – green taxes so that goods and services include their full social cost – in the case of global warming a carbon and carbon equivalent tax[2].

[2]Some people object to the whole idea of "externalities" on humanitarian grounds. They argue that if an industrial process increases the cancer rate, it is not an economic cost, for which a price should be set, but a crime which should be prevented. We can all think of cases where this is true – but the fact is you can't escape this kind of cost. For example cooking food creates carcinogens – and adds noticeably to the risk of cancer. (There are in fact "raw food" advocates who oppose the use of cooking on this ground.) But cooking also kills pathogens, and lowers exposure to disease – saving a great many more people than the slight increase in carcinogens kills. In addition, cooking allows us to eat food that would not be edible raw, and makes nutrients available in cooked versions of food that are not available in raw food. There are costs to human health either way. You can't avoid tradeoffs. The raw food advocates (though in my opinion wrong) are arguing that a rational weighing of the tradeoff yields a different result than the conventional wisdom suggests. If they proved right, eating raw foods would still be a tradeoff.

Further every process, industrial or not, has these tradeoffs. Modern agriculture (and food processing) kills workers every year. In my opinion, more sustainable agriculture, and more tightly regulated or worker owned food processing plants would kill a great deal fewer workers. But the number killed would not be zero. Further if we dropped modern agriculture, and food processing altogether, aside from the question of

This runs into the problem of low demand elasticity in response to energy price increases mentioned earlier.

Suppose the price of gas suddenly went to five dollars a gallon in the U.S. Would people drive less? Sure. But there are limits to how much less they would drive. They still have to get to work, to school, to the store. Very few cities in this nation have decent train systems. U.S. city buses, as previously mentioned are less fuel efficient per passenger mile than cars and trucks for all but really long journeys. A lot of the alternatives require redirecting social spending; they are not subject to individual choice.

Carbon taxes do accomplish a certain amount. Japan, Finland and Germany pay more for energy and use much less of it than the U.S. per unit of GDP. But these countries also have efficiency regulations, and strong public spending on public transit. Further, while most of the EU uses carbon taxes, those parts of it with strict regulations and a well maintained public mass transit system get the best result. Similarly, in the 70s, the U.S. suffered a large gas price increase. While gasoline consumption fell to some extent at once, it really dropped over the course of a number of years as CAFÉ efficiency regulations went into effect. And efficiency increases slowed down and stopped, as Congress weakened those regulations, froze any increases, and refused to close loopholes, while certain aspects were invalidated under trade agreements. If CAFÉ had not been weakened, and the light truck loophole closed as soon as it became widely known, our auto fleet would average 40 mpg instead of 25.

Another problem with green taxation is that it tends to be regressive. Someone who can afford a $50,000 dollar SUV is not going to be hurt all that much by higher gas prices. Someone driving an 11 year old Ford Escort may have trouble affording a full tank at $5.00 per gallon.

Now, many economists reading along will point out, if this captures true social costs, then the social gain from discouraging driving will exceed these costs for a net progressive effect. One problem of course is that the pain is immediate, the gain long term. Also, the lack of alternatives may reduce this effect. If you tax gas at $5 per gallon, and don't provide electric trains, people cannot drive as much less as they might otherwise choose at that price. Thus, you may increase the burden on the poor MORE than the poor gain in social benefits, maybe even more than society as a whole gains.

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whether it could feed the world (it might but we would not have time to do a lot beside grow food), traditional agriculture has its own way of killing people. (I'll bet the injury level from harvesting with scythes and machetes is pretty high.) And of course food that is traditionally processed has high levels of pathogens, and kills a lot of people through diseases. Drop agriculture and return to hunter gatherer? 90% of the world population would die, and for those that remained, neither hunting nor gathering is exactly risk free.

Once you realize that tradeoffs are inevitable, part of living in a real universe that does not simply respond to mental whims, putting numbers on those risks and incorporating them into prices becomes pretty obviously a good way to weigh certain types of risk against one another.

Many progressive economists still favor green taxes, suggesting that the money be directed to some purpose that helps those most hurt by the tax. For example a gas tax might be dedicated to social security or health care or better unemployment benefits. One problem is that if the tax does what it is supposed to, discourages energy consumption then it will be a declining source of revenue; if not, it probably is not being effective. Another is that you are passing something with bad effects, and then passing something else to meliorate those effects. I think this a real political mistake. What if you only get part of what you want – the bad effects without the melioration? When coming up with a proposal you need to make sure it is not overly vulnerable to political judo – to being turned into the opposite of what you want through modest dilution. Ideally we should never advance a proposal where half a loaf is worse than none; if we must advance a proposal with bad effects, and a second to meliorate, it is important to ensure that they are organically linked in such a way that it is politically difficult to separate them – that any attempt look silly and vicious. Green taxes, with the money used to replace FICA payroll taxes (for example), does not fit this. It does not violate the spirit of the proposal in any obvious way to suggest green taxes be used to finance cuts in the capital gains tax, or to pay down the deficit.

But there is a way to do full social pricing that is fundamentally not regressive. Amory Lovins, though not the inventor of the idea, has helped popularize feebates. Charge fees (a green tax) on capital equipment that uses sources and sinks above desired levels, and return those fees as rebates to those who buy capital equipment using those same sources and sinks at below that level. (The fee or rebate is set to be roughly equivalent of the discounted social costs of the excess energy used, or the energy saved.) So a less energy efficient car would be more expensive to buy, but a more efficient car would be cheaper by the same amount. The net effect is not regressive; the subsidies for more efficient cars and appliances would provide a good way for the poor, and other working people to come out ahead – to buy goods that cost less to operate for prices comparable to what the less efficient goods would cost in the absence of subsides[3]. So you combine a minimal burden on the poor and workers, with the effects of social pricing. And you have a limit to the size of such fees and rebates – when the price equals the social cost of the goods you are taxing. For example, feebates on cars would be gradually raised until fees equaled the net present value of the social cost of the gas they would be expected to consume over their lifetime.

In addition to being less regressive, feebates are more effective. They impose social costs at the time of capital expenditure – the moment of decision that probably most influences resource efficiency.

[3] You can also tweak them to make them more progressive. Dedicate a higher percent of rebates to goods which (after rebate) sell below a price determined to be low, or moderate for the particular item.

These have their own problems. Operating decisions do affect resource use. In Europe, high gasoline taxes help subsidize transit; this provides an alternative to automobile use. But Europe had a well developed train system before the automobile became widespread, and never dismantled it the way the U.S. dismantled ours. The alternative always existed at the same time as cheap automobiles. A U.S. policy of high gas taxes, would mean high prices for years with no transit alternative available to most people. An ideal "social pricing policy" in the U.S. would probably consist of feebates initially, with a partial transition to more conventional green taxes as alternatives became available. (That is the one time you don't face demand inelasticity in face of rising energy prices; when there is a reasonably priced substitute available that does not require either huge capital investments, or immense sacrifice.) But to the extent that a less than ideal policy has to be lived with, and full social pricing will not occur, feebates give you the best response for a given amount of green tax, as well as burdening working people less. Even in an ideal situation I suspect they should always be a significant part of a social pricing policy – because of the purchase of capital (and sink and source using) goods being such a key decision point for resource use.

Note that this is not only a gas guzzler tax for automobiles; we need them on everything – homes, industrial equipment, appliances. Further not only carbon should be taxed and rebated. Even focusing on global warming, fossil fuel consumption is indirectly affected by other sources and sinks. So the best results will be achieved if these feebates are levied based on water consumed and polluted, earth disturbed, air polluted and toxics emitted ; in short feebates should be a combined energy and material intensity system, not just a greenhouse gas tax. That mountain keeps getting bigger.

But, as more than amply demonstrated, social pricing by itself - whether or not in the form of feebates – is not sufficient to produce the increase in efficiency needed Demand inelasticity means companies are leaving $10,000 bills on the floor; green taxation simply increases the number of those bills in hope more will be picked up.

A carbon tax high enough to persuade most people to make particular levels of efficiency investments will be much higher than the cost of those investments. Even including enforcement costs, mandating efficiency requirement will, on average, penalize people less than higher energy taxes. Regulation, in this case, is more efficient, and less coercive, than carbon taxes.

Envirowise, an official UK government environmental site is chock full of case studies of waste minimization, water conservation and other efficiency examples[xv]. If you look over those examples you will find that most of those with paybacks of three years or fewer were primarily implemented to meet the requirements of government regulation. In other words investments which gave much greater returns than industry normally receives were not made until regulations required them. A tax level high enough that those companies made the same investments "voluntarily" would have cost a lot more than those regulations.

If carbon taxes alone aren't sufficient, neither is taxation and regulation combined. Many of the decisions are not individual one, but social ones. Putting money into electric trains rather than better roads for automobiles is a decision we make collectively. So is the decision as to whether tax policies will favor capital investment in rail rather than roads, barges rather rail, and ground freight rather than air freight. In short a transition to fossil fuels will also require public works and social spending.

In addition regulations can be regressive in a similar way to green taxes – hitting the poor and middle class harder than the rich who can more easily afford to comply with them. Public works and social programs that help ordinary people comply with energy regulations mitigate this regressiveness in a way that reinforces the effectiveness of the regulations. Politically, that mitigation would be hard to separate from the policy it is mitigating.

So the policy we seek is threefold - a combined program of regulations and public works to help phase out fossil fuels, reinforced by green taxes (probably in the form of feebates) to avoid the need for excessive micro-management.
Let's deal with a point that I'm sure any economist reading this would raise. Obviously some people would have trouble meeting these standards. Others could exceed them for a very small incremental cost over minimal compliance. Would it not make sense to set up a compliance certificate exception where those able to save a little more could sell their surplus to those struggling to meet the new standards? After all, the average result would be what we sought, and at a lower cost than forcing everyone to comply exactly. All this is true enough, but you want to be very careful implementing it. You don't want situations such as the Kyoto treaty has produced, with the notorious toxic Bisasar dump in Durban, South Africa – kept open to continue making the local community sick as a source of "renewable methane" for carbon credits[xvi].

We need strong precautions against this sort of thing. One might be a requirement that any project generating compliance certificates (the equivalent of carbon credits) must not significantly impair general health or well being. Secondly, any project generating carbon credits must demonstrate in a full Life Cycle Impact Analysis study at least factor four reductions compared to the average for the sector and particular industry and industry niche it occupies. Thirdly, it must demonstrate specific carbon emission savings net over the full lifecycle, not just gross. So if you plant a tree farm with the intent of eventually clear cutting as an energy crop you are not sequestering carbon. Because any carbon you sequester will be released when the tree is cut down. Plus carbon locked in the soil is released too for a net carbon loss. A really carefully and sustainably managed energy farm - one that preserves the soil, can be carbon neutral, or even remove a tiny percent of annual production due to soil sequestration. That is important; it would be compliant if used as an energy source – but it would not exceed any kind of standard nor have a surplus to sell if the accounting is done right. Only decarbonization exceeding standards could be sold; merely meeting standards should never generate tradable surpluses. Last, you should not be able to sell compliance certificates for every surplus BTU you save or generate over what would be required to meet minimum standards. As a buffer to compensate for the inevitable gaming of the system any trading system would produce, you need to ensure that only a percentage of any surpluses can be used to produce tradable compliance certificates. That would make it more likely that projects that produced them made sense on their own merits and were not simply an accounting trick. Even with these precautions, any trading system should have a sunset provision much shorter than any for the regulations themselves. That way it could be modified, or simply not renewed, if it proved more a means for avoiding compliance than of flexible and efficient compliance.

The key here is not the particular proposal, but the principle. No system is perfect, not markets, not iterative planning, not regulation. It is more important to keep the regulations enforceable than to make a doomed attempt at approaching perfection. If the rules are relatively simple and transparent, then regulators can see if they are being obeyed, and the public can see if they are being enforced, and the odds are that they will actually save energy and reduce greenhouse gas emissions.

There is one more issue specific to global warming – international climate justice. We in the U.S. and Germany and Japan and France and the other rich nations can phase out fossil fuel at our own expense, and come out ahead doing it, even before the social costs are considered. (Though if the social costs did not exist, there are other means by which we could come out even further ahead.) For poor nations, the situation is not so clear. The poor nations do not want to stay poor; the easiest and cheapest way to develop is the same way we did – through extensive use of fossil fuels. A transition to a renewable economy requires lots of capital - something we (rich nations) have and the poor nations don't. So if we want them to phase out fossil fuels we will have to pay them to do it.

There are two reasons to do this, one practical, one of ordinary fairness.

The practical reason is that if every single rich nation were to phase out all use of fossil fuels, the burning of coal by the poor ones would be enough to push the world over the edge into a feedback death spiral where we might end up unable to grow crops outdoors. Remember, the issue is not whether additional warming will take place; it would even if everyone stopped tomorrow. The issue is whether we will start a process whereby it becomes unstoppable, where warming leads to release of additional greenhouse gas sources, that leads to additional warming which results in a multi-century long period of rapid climate change – basically a period where the climate is too unstable to support anything like today's agricultural production. If the poor nations stopped tomorrow and the rich nations continued, the same thing would happen – faster. The rich nations and the poor nations need each other on this; it is probably one reason more reactionary elements don't want to recognize the problem; it is an issue on which rich and poor nations must bargain on equal terms.

Beyond this is a fairness issue. Is it fair that the poor nations should be paid for helping to mitigate global warming? Absolutely, it is. The whole reason this crisis has occurred is that there is a limited amount of greenhouse gases the planet can absorb. In essence there is a limited amount of atmospheric space available. Economists, when they talk of natural resources, speak of sources and sinks. We in the rich nations have used up all the atmospheric space there is for greenhouse gases, filled up the entire global sink. The poor nations cannot (without horrible consequences) use fossil fuels for development in the same way we did. We have used up the capacity of the planet to support that particular development path. We of the rich nations ruined the plumbing, in the flat we share with poorer ones. We have to pay for repairs, not just the normal monthly lease. Since we have the money and did the damage, in all fairness, those costs are ours. The rent just came due!

How much is this going to cost the rich world, and the U.S. as a whole? We won't talk of fairness; there are no circumstances under which I would expect the rich world to pay what is fair. And since the final figure will have to be results of negotiation, there is no way to know what poor nations will settle for either. But after talking to a number of economists, here is a very rough guess. About 300 billion per year (possibly much less) would wipe out the entire debt of the poor nations[xvii]. A number of poor nations (such as China) don't owe a debt, and a number of others would want something beyond just having their debt wiped out; therefore, I would guess that a final settlement will be between 400-600 billion per year for a thirty year period. 100-300 billion of that will be above and beyond wiping out the debt owned by the poor nations.

That is a lot of money; however, it would be spread amongst a lot rich nations - the U.S., Japan, Germany, France, the U.K., Australia, New Zealand, Denmark, Sweden, Norway, Holland, Finland , Italy, Spain, Portugal, Greece, Austria, Belgium, Canada, Ireland, Luxemburg, and Iceland are obvious candidates. If the U.S. responsibility was in rough proportion to its share of total carbon emissions since ~1750, it would pay annually between 133 and 200 billion.

For the other rich nations, Ross Gelbspan has pointed out that there is a clear source that could easily generate around 300 billion dollars per year in revenue, and help improve world economic stability besides - a Tobin tax. In 2004, international currency trading took place at an average rate of 1.9 trillion dollars per day[xviii], while international trade in goods and services for the entire years was less than 12 trillion dollars[xix]. (In other words, currency trading was nearly 58 times the volume of trade in actual goods and services.) Most of the trading is speculation – banks and hedge funds taking advantage of (and contributing to) international monetary volatility. It costs the poor nations a great deal; it provides a few of the super-rich in the wealthy nations with opportunities for great fortunes, but does nothing for ordinary people. James Tobin won the Nobel economics prize for his 1972 proposal to levy a fraction of a percent tax on currency transactions. A quarter of a percent tax per transaction would discourage currency speculation without significantly increasing the cost of international trade; if currency trading were reduced to around the volume of total trade, it would still raise around 300 billion per year.

One other important pool of potential revenue for efficiency and renewable energy are subsidies currently paid to support fossil fuels and nuclear energy. A conservative estimate would put such spending at around 235 billion dollars per year worldwide[xx], a more middle case estimate at between 250 and 300 billion dollars annually[xxi]. The majority of these subsidies are in poor nations though, and some of them in both rich and poor nations are in the form of subsidized or free fuel for the poor. The best way to phase out the portion going to the poor is to provide sufficient cash subsidies to replace them[4] – which of course will provide better economic signals than the current system and reduce fossil fuel use to some extent - but is not a revenue source. Still, even excluding the social welfare portion, this could provide at least tens of billions for efficiency and renewables, perhaps hundreds of billions.

In the book *Dead Heat: Global Justice and Global Warming*[xxii] Tom Athanasiou, and Paul Baer explain the importance of climate justice in more detail, and offer an implementation - an advanced carbon emissions trading system, Kyoto on steroids.

[4] We need to take care when doing this. Subsidies are provided in this particular form partly to benefit the industries subsidized at the same time poor people are helped. But there is tremendous pressure worldwide to reduce all types of subsidies to the poor; it would be extremely tempting for a government to take advantage of this type of switch to incorporate a major benefits cut. Also when a subsidy to an industry is replaced by grants to customers, there is a tremendous incentive to raise prices substantially more than the amount of the subsidy being removed. Depending on how the old subsidy was structured, parts of the customer's income may be "available" to the industry that was protected before in return for the subsidy. (Think of what happened much when subsidized housing in the U.S. was replaced by rent vouchers. Landlords treated the vouchers as down payments on rent – increasing net costs after vouchers to tenants.)

I agree with Baer and Athanasiou that serious climate justice work in the U.S. must include seeking U.S. ratification of Kyoto, even at this late date. There is nothing in the Kyoto treaty requiring the U.S. to buy unfairly generated carbon credits rather than cut its own emission, nor is there anything that would stop it from making cuts beyond Kyoto minimums. Ratification would signal the beginnings of U.S. sanity on this issue; further Kyoto remains the basis for serious international negotiations on the subject. It is not just a specific treaty; it is a negotiating process and a brand name. While I think Kyoto II should be drastically stronger, drastically different, and require radically more fairness to the developing world, Kyoto is still too large a base of existing work to throw away.

I do think that Baer and Athansiou are overly willing to build on the product, rather than the process. (Historically, they should remember a lot of the form Kyoto finally took was a result of trying to appease the U.S. – which then failed to ratify it anyway.) I'm not as confident as they are that creating artificial markets for public goods is really the most effective way to limit greenhouse gases. I agree with them that any system will need enforcement, and protection against gaming. I just suspect that straightforward emissions targets for each nation, with compensation for poor nations that meet those emissions targets will actually have more transparency, and be easier to enforce than complex trading schemes. I understand that such markets are an attempt to avoid certain inefficiencies and irrationalities that are inevitable with a more regulatory approach. But I suspect that artificial markets have their own imperfections and irrationalities, and are far more subject to Enron style gaming. It is not that regulations can't be gamed. But if the regulation is "your nation may emit no more than x GTC of carbon equivalent during year y", it is pretty obvious when it is not obeyed and pretty obvious when it is not enforced. I'm not saying that no trading should take place, but, as in the domestic U.S. arena, it should be secondary, with major safeguards against gaming; again much less than 100% of savings above requirements should be tradable.

There is a political point here too. The rich nations can phase out fossil fuels over 30 years, perhaps less. Imagine a treaty requiring it to do so. Now imagine there is a clause in it where we acknowledge that it is not fast enough and buy emissions rights from others as the only way to comply. We buy those rights in part for not burning fuel they were not going to burn in any case. It is easy to portray this as the rich nations being seriously cheated. Look at an alternate construction; we agree to phase out fossil fuels over the length of time we can, and we pay compensation to poor nations for having used their share of the atmospheric space. Not as a penalty (guilt really does badly in politics over a long period of time[5]) but as compensation, rent – not for what we are using currently but for what we already used. It does not feel like being cheated, and it does not feel like being penalized. We are simply paying a bill late; most people have done that on occasion. I think it is simply emotionally easier to accept.

[5]People will sometimes respond to guilt over the short terms – but guilt has a very short lifespan in politics. The Germans were "sick of hearing about the holocaust" within a few years of their defeat in WWII. Look at how difficult it is get white people to consider the completely reasonable and just case for reparations to black descendents of slaves – even many who consider themselves anti-racist. Whether it is right or not, it is an important behavior pattern to take into consideration.

Global warming concerns are also affected by the "globalization" or "free-trade" agreements – which large corporations have used, among other purposes, to weaken regulations that would control greenhouse gas emissions. The Corporate Average Fuel Efficiency (CAFE) standards that doubled average fuel economy of passenger cars by the early 1990s applied equally to all U.S. and foreign automobile manufacturers. U.S. car manufacturers complied. European manufacturers (who met CAFE standards through the early 80s) shifted to selling less fuel-efficient luxury cars to the U.S. market – deliberately violating CAFÉ regulations; Europe then won a discrimination challenge against CAFE in 1993 (filed with the WTO GATT panel). This ruling established the precedent that foreign firms may violate non-discriminatory environmental, health or safety standards which domestic firms comply with, and then claim injury under the WTO on grounds that they affect foreign and domestic firms differently[xxiii]. The U.S. and EU are now trying to use the same precedent against Japan[xxiv].

The problems with agreements such as NAFTA and WTO extend far beyond greenhouse effects. These treaties have nothing to do with globalization and very little to do with free trade (though I could argue that trade cannot truly be free between vastly unequal partners). But these agreements really provide a backdoor way for governments give corporations the special right over their citizens (such as poisoning them) while pretending they are simply signing a complicated technical trade agreement. (I deny the usual argument that governments are somehow victims of these agreements. Those who sign these things know full well what rules they are contracting their people to live by.)

Two cases under the North American Free Trade Agreement provide poisoning examples. In Ethyl v. Canada, Ethyl Corporation, an American corporation that makes MMT (banned in U.S. gasoline) won a suit against Canada under Chapter 11 of NAFTA when Canada passed a similar ban. Similarly, Metalclad, an American corporation, won a case against Mexico after it built a toxic waste facility in the Municipality of Guadalcazar, Mexico without the proper local permit[xxv].

One tricky thing about these agreements is that the people who have the most interest in defending such cases have no say. In the Ethyl case, the executive responsible for defending the law had opposed its passage. In Mexico, the toxic waste dump was banned by a town; but the court case was defended by the national government of Mexico who supported the dump; in both cases the "defense" was mounted by someone with a strong interest in losing. Because under the treaty, it is always the national government who is sued; the national government then turns around and pays any fine, invalidates any local law. The NAFTA or WTO board or whatever international body can say "we are not interfering with your local laws; we are simply ruling on a civil case against your government". The government can then turn around and say "we don't want to repeal this law or override your local decision; this darn agreement we signed forces us to do it". Octopi release clouds of ink to hide from danger; governments do the same thing to avoid responsibility.

There are other problems with this type of pseudo court, besides some of those most interested in the results being excluded. The judges are appointed by trade boards and therefore strongly biased in favor of large corporations and against health and safety laws. In general the rules say that it is not enough that laws must have a legitimate purpose to be valid; they must serve that purpose in the least restrictive way possible. Imagine if that logic was applied to laws against burglary. "Your honor, the law against breaking into someone's home and picking up their DVD player is overly restrictive. Surely, we need only prohibit actually taking valuables out of the home; we should let the poor burglar go free if we catch him still inside the door." There is also no appeal from most WTO or NAFTA decisions.

There are also rules that decisions must be made on the best available scientific evidence. There are two problems with this. First, it essentially says your body is someone else's property; if someone wants to put something in the air you breathe or the water your kid drinks, it is up to you to prove it unsafe. But even if that objection is waived, there is the question if a judge who essentially works for the people who are suing for access to your body is the right person to decide what the best available scientific evidence is.

The problems with such agreements are not just ones of process; for example one GATT precedent is likely to prove bad news for people concerned with labor standards, and greenhouse gas standards alike – that one can only regulate the product, and not regulate the process by which it was made if does not substantially affect the end result. The specific regulation overturned was one requiring tuna sold in the U.S. be caught in a dolphin safe way[xxvi]. But the precedent invalidates regulations against importation of goods made by slaves, or in countries that use murder and torture to settle labor disputes. In fact, at least one case has been brought on those grounds, though it was settled out of court in favor of a torturer and user of slave labor[xxvii].These same precedents could invalidate future regulations specifying the carbon emitted or energy consumed during manufacture of imported goods.

Appendixes

Accounting for Resource Flows

In recent decades business has begun to realize that so called standard accounting overlooks and misallocates costs, and costs them money. About 25% of accounting in the U.S. is now done via Activity Based Accounting; however ABC accounting is very sensitive to what drivers are used to allocate costs; energy, water and other flow costs still tend to be assigned to labor drivers – which perpetuates the problems we have covered. There are some further steps, which are still in their infancy.

One, which is not widely used, is RCA (Resource Consumption Accounting) which assigns costs to resources, not merely activities[xxviii]. I don't know if the approach as a whole provides results superior enough to ABC accounting to be worth the additional effort. However, there is one area in which it which takes a vital step; it uses the solution of simultaneous equations to allocate costs. Whole systems thinking is always iterative, always requires simultaneous solutions, because optimizing parts separately almost never optimizes the whole. Accounting (other than projections forward) has always stuck to simple arithmetic for good reason; the resources to use anything more complex on a routine basis were not there. However with computers, the use of simultaneous solutions is no more difficult than simply double entry booking. Like ABC, there is extra data entry – which is where the question of effort vs. results has to be evaluated. But if you are using a system such as ABC where the data needs to be entered in any case, then it makes no sense to avoid computer time (but not human time) it would take to allocate properly.

More widely used, at least in larger EU companies is Environmental Management Accounting. EMA is not a case of corporations suddenly caring about more than their bottom line. It is based on the recognition that some environmental mistakes can cost companies money. The International Body UK, provides a decent explanation of this[xxix]. EMA is actually an ad-hoc collection of many techniques. However it almost always includes flow accounting, a measurement of the physical flow of materials and resources through the company – with cost allocation taking place only after knowing where the material is physically and who is responsible for it. It also includes better accounting for contingent liabilities, placing a value on the risk taken both of monetary liability and loss of reputation if a company is proven responsible for severe environmental damage. Better accounting is not a fundamental solution; but it can provide some marginal improvement, and has a role to play.

A strong example of how flow costs tend to get misallocated is the issue of occupational safety. Of course the primary "misallocation" here is a misallocation of power that leads to callousness and indifference to human suffering. Here I'm making a narrower point – that many costs *to the owner*, which you would expect to be tracked out of self interest, are hidden[xxx]. The paper cited gives examples of indirect costs which are often allocated to general overhead, rather than a specific accident:

Interruption in production immediately following the accident
Morale effects on coworkers
Personnel allocated to investigating and writing up the accident
Recruitment and training costs for replacement workers
Reduced quality of recruitment pool
Damage to equipment and materials (if not identified and allocated through routine accounting procedures)
Reduction in product quality following the accident
Reduced productivity of injured workers on light duty
Overhead cost of spare capacity maintained in order to absorb the cost of accidents

Not every firm will miss every one of these costs; but most will miss some. These are real dollar and cents costs to the owner. Estimates of how many of these costs are missed vary from a bit less than half to as high as 20 to 1. In other words, almost half the cost of worker injury being missed is the *low* estimate.

Miscellaneous Grammatical Point

I try to use gender neutral language, and am familiar with the history that suggests that using "they" and "their" were once accepted as generic general neutral singular terms. But on occasion, I just can't stand the sound of it. When that happens I adapt an old fashion solution, and use "she" and "her" as generic gender neutral terms referring to human beings in general.

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[i] California Institute of Earth Art and Architecture, *Nader Khalili*. Jan 2004, California Institute of Earth Art and Architecture, 23/Aug/2005 <http://www.calearth.org/khalili.htm>.

[ii]Office of Industrial Technologies - Energy Efficiency and Renewable Energy • U.S. Department of Energy, *Irrigation Valve Solenoid Energy Saver • New Battery-Powered Controllers Save Energy in Irrigation Applications. Agriculture Success Story*, I-OT-698. Sep 2001, Office of Industrial Technologies - Energy Efficiency and Renewable Energy • U.S. Department of Energy, 5/Sep/2004 <http://www.eere.energy.gov/inventions/pdfs/alextronix.pdf>.

[iii]John A. Dearien, Struthers Richard D., and Kent D. McCarthy, *Cybertran: A Systems Analysis Solution to the High Cost and Low Passenger Appeal of Conventional Rail Transportation Systems*. Nov 2001, CyberTran International, Inc, 22/Jun/2004 <http://www.cybertran.com/ctpaper.pdf>.

[iv] John A. (Junior) Dearien, "Cybertran -Future Progress, Efficiency and Statistics.," 4/Dec 2003, 4/Dec/2003. Private e-mail from jad@cybertran.com to garlpublic@comcast.net
(Note: Private e-mail addresses were redacted, and public ones substituted.)

[v] Energy Conversion Devices, Inc., *Energy Conversion Devices, Inc. 1997 Letter to Stockholders -Commercializing Technologies That Enable the Information and Energy Industries*. Dec 1997, Energy Conversion Devices, Inc., 26/Sep/2005 <http://www.ovonic.com/PDFs/LtrstoShldrs/ecd97ltr.pdf>.p3.

[vi]Jürgen Schnieders, *CEPHEUS - Measurement Results from More Than 100 Dwelling Units in Passive Houses*. May 2003. *Passive House Institute*, 23/Dec/2003 <http://www.passiv.de/07_eng/news/CEPHEUS_ECEEE.pdf>.

(Note: he documented an 80% reduction compared to German standards. But Germans use about half the energy per capita as the U.S.

States Census Bureau, "Section 19 - Energy and Utilities," *Statistical Abstract of the United States 2002*. December 2002. *United States Census Bureau*
<http://www.census.gov/prod/2003pubs/02statab/energy.pdf>.p847
Table No. 1350. Energy Consumption and Production by Country: 1990 and 2000

So this is a 90% savings, compared to U.S. standards. Actually it is a bit more, because the 80% savings compares to tougher requirements for new German homes, not average use.

[vii]Energy Research Group - University College, *Case Study Module C - Sukkertoppen - Copenhagen DK. Mid Career Education: Solar Energy in European Office Buildings*. Nov 1997. *Energy Research Group - University College*, 22/Aug/2005 <http://erg.ucd.ie/mid_career/pdfs/case_study_C.pdf>.p15.

[viii] Michael Perelman, *Class Warfare in the Information Age* (New York: Palgrave Macmillan, 2000).

[ix] Susan Ferriss and Ricardo Sandoval, "The Death of the Short-Handled Hoe," *The Fight in the Fields: Cesar Chavez and the Farmworkers Movement*, ed. Diana Hembree. May 1997. *Harcourt*, Public Broadcasting Service, 28/Sep/2005 <http://www.pbs.org/itvs/fightfields/book1.html>.

[x] Shelley Davis, "Osha Issues Proposed Ergonomics Standard Excluding Farmworkers,". *Farmworker Justice News* 12, no. 1 Summer 2000, Farmworker Justice Fund, Inc, 26/Aug/2004 <http://www.fwjustice.org/FJNews%20Summ%202000.pdf>.p2.

[xi]Ana Aurilio, *U.S. PIRG - Statement of Anna Aurilio, Legislative Director, U.S. Public Interest Research Group on Proposal # 4, to Disclose Ford's Lobbying Expenditures*. 12/May 2005, U.S. Public Interest Research Group, 5/Jun/2005 <http://uspirg.org/uspirgnewsroom.asp?id2=17163&id3=USPIRGnewsroom&>.

Jeffrey Bell, "Auto Makers Juggle Substance, Style To Do Their Part For The Environment,". *Wall Street Journal* 15/May 2004*The Aluminum Association*, Dow Jones & Company, 6/Jun/2004 <http://www.aluminum.org/Template.cfm?Section=Home&template=/ContentManagement/ContentDisplay.cfm&ContentID=1444>.

[xii]Frederick Melo and Kevin Dennehy, "Windmill Opponents Added to 'Dirty' List | Toxics Action Center Joins Public Policy Fracas with Its Roster of Environmental Offenders,". *Cape Cod Times* 4/Dec 2002, Cape Cod Times, 6/Jun/2005 <http://www.capecodonline.com/special/windfarm/windmillopponents4.htm>.

[xiii] Peter Carvelli, *RenewableEnergyAccess.Com | California Victory: Solar Exit Fee Defeated*. 4/Apr 2003, Renewable Energy Access, 28/Sep/2005 <http://www.renewableenergyaccess.com/rea/news/story?id=8485>.

[xiv]Sierra Club Mackinac Chapter, *Sierra Club Mackinac Chapter - Auto State Gives Overwhelming Support for Raising Fuel-Economy Standards | 88 Percent of Michigan UAW Households Give Thumbs-Up to Higher Miles-Per-Gallon Standards*. 31/Jan 2002, Sierra Club Mackinac Chapter, 30/Aug/2004 <http://michigan.sierraclub.org/press/archive/2002-01-31.html>.

[xv]Envirowise, *Case Studies- All Industries - Envirowise*. Practical Environmental Advice for Business, a Government Programme Managed by Momenta, an Operating Division of AEA Technology Plc, and Technology Transfer and Innovation Ltd., Sep/28 2005, Momenta, 28/Sep/2005 <http://www.envirowise.gov.uk/page.aspx?o=168584>.

[xvi]Jim Vallette, Daphne Wysham, and Nadia Martínez, *A Wrong Turn From Rio: The World Bank's Road to Climate Catastrophe. Enth Session of the Conference of Parties, Climate Change Convention Buenos Aires, Argentina, December 2004*. Dec 2004. *Institute for Policy Studies;Transnational Institute*, 30/Mar/2005 <http://www.seen.org/PDFs/Wrong_turn_Rio.pdf>.

[xvii]The World Bank, *Global Development Finance (GDF) Online Sample Database*. 2003, The World Bank, 7/May/2005 < http://publications.worldbank.org/subscriptions/GDF-trial/>.<Countries: All Developing;Series: Debt service (LTDS), total long-term (US$),Disbursements, long-term + IMF (DIS, US$),Interest payments (LINT), total long-term (US$);Select years:2000,2001,2002,2003,2004>

(Note: the actual debt service for 2003 was around 380 billion. But the poor nations' debt is on much less favorable terms than the rich ones do – in extreme cases as high as 18%. Also it is pretty widely recognized that a portion must be written off in any case; there is no way all of it can ever be repaid. So if the rich nations were to assume this debt for the poor nations, they could easily demand a reduction to 300 billion per year – probably to great deal less.)

[xviii] Bank for International Settlements, *Triennial Central Bank Survey | Foreign Exchange and Derivatives Market Activity in 2004*, ISSN 1814-7356. Mar 2005, Bank for International Settlements, 16/Jun/2005 <http://www.bis.org/publ/rpfx05t.pdf ;http://www.bis.org/publ/rpfx05a.pdf>.p1.

[xix] International Monetary Fund, *Report for Selected WEO Aggregates and Subjects World Economic Outlook Database - September 2004.* Sep 2004, International Monetary Fund, 15/Jun/2005 <http://www.imf.org/external/pubs/ft/weo/2004/02/data/dbaoutm.cfm?SD=2001&ED=2005&R1=1&R2=1&CS=5&SS=2&OS=C&DD=0&OUT=1&C=001&S=BM-BX&CMP=0&x=42&y=3>.

WEO Aggregate	Subject Description	Units	Scale	2001	2002	2003	2
World (All WEO countries)	Exports of goods and services	US dollars	Billions	7567.7	7936	9200.6	1
World (All WEO countries)	Imports of goods and services	US dollars	Billions	-7597.8	-7900.8	-9132.4	-

[xx] Total annual subsidies to fossil fuel and nuclear equals 235 billion. (This is derived by taking all subsidies worldwide (244 billion), and subtracting subsidies to renewables of 9 billion.)

Jonathan Pershing and Jim Mackenzie, *Removing Subsidies: Leveling the Playing Field for Renewable Energy Technologies - Thematic Background Paper*, 'This is One of 12 Thematic Background Papers (TBP) That Have Been Prepared as Thematic Background for the.. Conference..' Mar 2004, International Conference for Renewable Energies, Bonn 2004, 11/Jun/2005 <http://www.renewables2004.de/pdf/tbp/TBP04-LevelField.pdf>.p9.

Table 3: The cost of annual energy subsidies (1995-98, $US billion)

[xxi] Global annual energy subsidies are estimated at about $250-300 billion in the mid-1990s

Richard L. Ottinger and Mindy Jayne, "Global Climate Change Kyoto Implementation: Legal Frameworks for Implementing Clean Energy Solutions,". *Pace Environmental Law Review* 18, no. 1 Winter 2000 *Temple Law School Institute for International Law and Public Policy*, Pace Law School, 11/Jun/2005 < http://www.temple.edu/iilpp/EnvironmentalRoundtableResearchDocs/Ottinger%20-%20Global%20Climate%20Change.pdf>.p9.

[xxii] Tom Athanasiou, and Paul Baer, *Dead Heat: Global Justice and Global Warming* (New York: Seven Stories Press, 2002).

[xxiii] GATT, *GATT, United States - Taxes on Automobiles (DS31/R), Report of the Panel, Oct. 11, 1994*. 11/Oct 1994. *GATT*, WorldTradeLaw.Net, 30/Sep/2005 <http://www.worldtradelaw.net/reports/gattpanels/us-autotaxes.pdf>.pp105-108.

[xxiv] Mitsutsune Yamaguchi, *Implementing the Kyoto Protocol Target and Its Impacts on Trade: Japanese Automobile Fuel Efficiency Standards*. 2003. *Keio University*, Global Environment & Trade Study, 30/Sep/2005 <http://www.gets.org/pages/harmony/Yamaguchi.doc>.

[xxv] Nell Soto, *SJR 19 Senate Joint Resolution - INTRODUCED*. 21/May 2003, California State Senate, 8/May/2005 <<http://info.sen.ca.gov/pub/03-04/bill/sen/sb_0001-0050/sjr_19_bill_20030521_introduced.html>.

[xxvi] World Trade Organization, *WTO | Understanding the WTO - The Environment: A New High Profile*. Oct 2003, World Trade Organization, 8/May/2005 <http://www.wto.org/english/thewto_e/whatis_e/tif_e/bey2_e.htm>.
Search for or scroll about half-way down to "A GATT dispute: The tuna-dolphin dispute"

[xxvii] Permanent Delegation of the European Commission to the Chairman of the Dispute Settlement Body, *United States - Measure Affecting Government Procurement: Request for Establishment of a Panel by the European Communities*, WT/DS88/3;(98-3473), (Geneva, 9/Sep/1998). Sep 2004, World Trade Organization, 30/Sep/2005 <http://trade-info.cec.eu.int/doclib/docs/2004/september/tradoc_118759.pdf>.

[xxviii] B. Douglas Clinton and David E. Keys, "Resource Consumption Accounting: The Next Generation of Cost Management Systems,". *Focus Magazine: For the Performance Management Professional* 5, no. 2002 (2002), Focused Management Inc., 2/Apr/2005 <http://www.focusmag.com/back_issues/issue_05/pages/rca.htm>.

[xxix] Shane Johnson, *Environmental Management Accounting*. 13/Jan 2004, Association of Chartered Certified Accountants, 2/Apr/2005 <http://www.acca.co.uk/publications/studentaccountant/1073480>.

[xxx] Peter Dorman, *The Economics of Safety, Health, and Well-Being at Work: An Overview. InFocus Program on SafeWork*. May 2000, International Labour Organization (ILO) of the United Nations, 2/Apr/2005 <http://www.ilo.org/public/english/protection/safework/papers/ecoanal/ecoview.pdf>.p17.