PIE IN THE SKY

THE BATTLE FOR ATMOSPHERIC SCARCITY RENT

By Peter Barnes and Marc Breslow

ABSTRACT: *This paper has two parts. The first part describes the emergence of scarcity rent as a consequence of the limited capacity of the atmosphere to absorb carbon dioxide. It notes competing proposals to allocate this rent to corporate carbon emitters or to citizens on a per capita basis. The second part estimates the potential size of this scarcity rent, and the net gains and losses to different population deciles if the rent is recycled to citizens. An appendix explains the calculations.*

I.

There's a trillion dollar pot of gold in the sky, and it's called *atmospheric scarcity rent.* Though hardly anyone talks about it, a battle is looming to see who gets this treasure. The outcome could shape the 21st century in surprising ways.

What on—or above—earth is atmospheric scarcity rent? Scarcity rent is what owners of highly demanded things collect from other people *just because of scarcity.* The *Mona Lisa,* for example, has a high scarcity rent because there's big demand for it and only one original. In general, the scarcer (relative to demand) things like buildable land, Mark McGwire home run balls and New York taxi medallions are, the higher their scarcity rents.

Scarcity rent is not to be confused with the rent you pay your landlord. Only part of what you pay your landlord—the part that reflects the value of land—represents scarcity rent. The rest reflects the value of the building itself, the services your landlord provides, his cost of money, and other things.

Atmospheric scarcity rent is a new phenomenon that reflects the scarcity of important services the sky provides to human users. For example, the sky "carries" electromagnetic waves that are indispensable to broadcasters and telecommunications companies. These waves are scarce because there are only a limited number of usable frequencies that don't interfere with each other. When Congress in 1997 gave broadcasters—at no cost—a large chunk of the electromagnetic spectrum to use for digital broadcasting, opponents like Senator John McCain called it a $70 billion giveaway. (Common Cause, 1997.)

The specific form of atmospheric scarcity rent that concerns us here is that which results from the limited capacity of the atmosphere to absorb carbon dioxide. Our demand for sky-borne carbon storage is, of course, the flip side of our demand for fossil fuels—the more we burn the latter, the more we require the former. Up till now, we've paid handsomely for oil dug from the ground, but nothing for air to hold its combusted wastes. That disparity, however, is about to end.

What science has shown—and governments officially recognized in the 1990s—is that Chicken Little had it *almost* right. The sky isn't falling, but it *is* filling. It can safely absorb only so much acid-brewing sulfur, ozone-eating chlorine and heat-trapping carbon dioxide— and we're now reaching those limits (if we haven't already passed them). Putting it another way, it's not *oil* that's in short supply, it's *sky*. The challenge facing us is to fix the flaw in markets that blinds them to this wild fact.

Fortunately, a fix isn't hard to design. Normally, what makes markets recognize scarcity is property laws which allow an owner of things to charge non-owners for using them. If Waste Management Inc. owned the atmosphere, they'd charge us whatever the market would bear for dumping *our* wastes into *their* sink. But there aren't any property laws for the sky, and so the sky has been subject to what Garrett Hardin called *the tragedy of the commons.*

> The rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another...But this is the conclusion reached by each and every rational herdsman sharing a commons. Therein is the tragedy…
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> In a reverse way, the tragedy of the commons reappears in problems of pollution. Here it is not a question of taking something out of the commons, but of putting something in …The rational man finds that his share of the cost of the wastes he discharges into the commons is less than the cost of purifying his wastes before releasing them. Since this is true for everyone, we are locked into a system of "fouling our own nest…" (Hardin, 1968)

What Hardin didn't foresee was the invention of "cap and trade" pollution permit systems. These systems enable market economies to prevent nest-fouling by capping pollution, while preserving freedom and efficiency by allowing polluters to trade emission rights amongst each other. (Whoever made this invention should receive a Nobel prize; strangely, we are unable to learn who it is.) Precisely this type of system was put into place nationwide by the Clean Air Act of 1990, and has been highly successful in cutting U.S. emissions of sulfur (a cause of acid rain).

The success of the 1990 sulfur cap and trade program has persuaded U.S. policy makers that a similar system is the best way to reduce carbon emissions domestically. And therein lie both danger and opportunity.

The danger is that we could slide into the biggest giveaway of a public asset since the railroad land grants of the 19th century—a giveaway of our no longer spacious skies. This is what would happen if Congress were to grandfather carbon emission permits to historic polluters, as it did in 1990 with sulfur emitters. In such a scenario, all future users of fossil fuels would pay atmospheric scarcity rent to a small number of corporate "skylords."

The opportunity lies in the possibility to capture the atmospheric scarcity rent on behalf of all citizens equally. In this scenario, there'd be a cap and trade system of carbon emission permits, similar to the sulfur system, but the initial permits wouldn't be grandfathered. Instead, they'd be auctioned to fossil fuel companies for whatever the market would bear. The revenue thus generated would flow into a trust whose beneficiaries are all citizens, current and future. This trust would pay equal dividends to all citizens.

In 1997, the Corporation for Enterprise Development (CFED) proposed creation of such a "sky trust" for the United States. (One of the present authors, Peter Barnes, was the architect of that proposal. Barnes, 1998.) In 1999, four economists at Resources for the Future (RFF) proposed a similar plan, with the caveat that the initial price for carbon emissions be capped at $25 a ton (Kopp, 1999). Both proposals rely for income on "upstream" auctions of carbon emission permits (that is, companies bringing fossil fuels into the U.S. economy would be required to purchase emission permits for the carbon content of their fuels). An effort is now underway to enact these proposals into law.

As a result, a dialogue has begun about who will collect atmospheric scarcity rent for now and forever. The potential amount of money involved is substantial. As MIT economist A. Denny Ellerman has noted, "the scarcity that is implied by the Kyoto [Protocol] targets is significant, on the order of 30% of 2010 emissions….[This] raises fundamental issues of equity and the definition of rights, which are pre-eminently of the political realm. In fact…there will likely be agreement on the creation of the scarcity only as there is agreement on the allocation of the rents thereby created." (Ellerman, 1998.)

Ellerman himself is inclined to award future carbon emission rights to historical corporate emitters, as was done with sulfur emission rights in 1990.[1] Yet the cases of carbon and sulfur are sufficiently different to support a different outcome this time around. Sulfur, after all, is just an impurity in coal, not the essence of coal itself. Carbon, on the other hand, is the irreducible pith of all fossil fuels, the fire inside our cars and furnaces, the toaster of our bread, the elixir of our modern economy. We Americans blow about 1.5 *billion* tons of it into our sky every year—about 6 tons per man, woman and child. At, say, a price of $100 a ton, that's $150 billion worth of scarcity rent per year. (See Table 2 below for more elaborate estimates of this rent.) By contrast, the scarcity rent generated by the cap on sulfur emissions is less than $2 billion a year.[2]

Moreover, the utilities who were given sulfur emission permits in 1990 were, at the time, state-regulated entities, and it was argued that any windfalls they received would be passed through to ratepayers. This is not the case with the fossil fuel companies who would receive carbon emission rights. These emitters are almost all unregulated, and the rent they'd collect would flow directly to their shareholders. To the

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[1] Interestingly, Ellerman argues that "given the role of mutual funds, private retirement accounts and pension
funds in modern American society, such a distribution may not be as inequitable as it might first sound."

[2] Based on 9 million tons of sulfur allowances and allowance prices in the range of $200/ton during 1999. See http://www.epa.gov/acidrain/ats/prices.html.

extent that shareholding in energy corporations is skewed in favor of higher-income households, the result would be a regressive redistribution of income.[3]

By contrast, the sky trust proposed by CFED and RFF would have a progressive impact on income distribution. (See Table 1 below.) More than that, it would fundamentally alter the way we look at unowned natural assets such as the sky.

The question of who should own the economic value of the sky is not just a debate about scarcity rent. It is also a debate with deep philosophic and religious overtones. It taps into age-old preachings of the Prophets, centuries-old traditions of the commons, and long-running political arguments of Americans—for example, do the people's rights come before the federal government's, as the 10th Amendment suggests, or vice versa?

Practically speaking, there are three possible owners of the sky: private corporations, the federal government, and citizens through a trust.

Free granting of common assets to corporations has a long, if somewhat tainted, history in America, from the enormous land grants of the 19th century to the recent gift of

electromagnetic spectrum to broadcasters. The standard argument used to justify public largesse to private coporations is that, in exchange for public assets, the receiving corporations deliver a *quid pro quo* of public value: they build railroads, extract valuable minerals, or transmit sharper television images. The citizenry thus gets something back for its generosity, making the deals at least arguably fair.

[3] According to a recent study by Edward N. Wolff, the financial wealth of the top one percent of households exceeds the combined wealth of the bottom 95 percent. (Wolff, 1998, Table 2, p. 37.)

Whether past gifts of this sort were good deals for the public is of course debatable —are sharper TV pictures worth a $70 billion public subsidy? But a future gift of carbon absorption capacity to private corporations would be in a category by itself. There is *nothing* the public would get in return, except possibly some political support for capping carbon emissions. Such *realpolitik* is in fact the only serious argument advanced for making such a grant today.

The argument for government ownership of carbon absorption capacity is certainly stronger than the case for corporate ownership. Presumably, the federal government represents the public interest, and therefore its ownership of the sky would, *ipso facto*, serve the public interest.

This presumption, however, is debatable. If we look at the historical record, it is not at all clear that the federal government has managed public assets in the public interest. Quite to the contrary, the government has all too often disposed of land, minerals, timber, water and spectrum at far below market value.

Even if the federal government *did* receive market value for carbon absorption capacity, that would solve only half the problem. While the right amount of sky rent would go *into* the U.S. Treasury, there'd be no assurance that it would come *out*—or if it did come out, who would get it. The odds that it would be equitably distributed are not high. After all, the state has its favored constituents, and they tend not to be poor.[4]

[4] The authors differ somewhat about the preceding paragraphs. Breslow is more optimistic than Barnes about the potential of the state to favor the less affluent. Barnes *hopes* Breslow is right, but is ready to use extra-statal institutions (such as the commons) when appropriate. "Don't put all your eggs—or dreams—in one basket," he believes. Of course, federal legislation is needed to assign property rights to a sky trust. But winning a one-time battle over property rights—where the issue is "one person, one share" versus "corporate welfare"—is one thing; winning repeated battles over the tax code and annual expenditures is quite another.

In the end, the argument for federal ownership of carbon absorption capacity rests mostly on habit ("we've always done things this way") and lack of imagination ("there's no other way to do it"). But as Alaska has shown, there *is* another model, and we believe it is a better one.

Under the Alaska Constitution, the natural resources of the state belong to its people. After oil began flowing from Prudhoe Bay in large quantities, Alaskans realized that they were sitting on a bonanza—but a bonanza that would not last forever. In 1976, they amended the state constitution to create a system for saving some of their oil wealth for the future. From then on, 25 percent of the state's oil revenue has been placed in an entity called the Permanent Fund.

The principal of the Permanent Fund is managed as a trust for all current and future Alaska residents, separate from the state treasury. It is invested in a diversified portfolio of stocks, bonds and real estate, and cannot be touched by the legislature.

The annual income of the Permanent Fund is divided into two roughly equal pots. About half is used for schools, highways and other public capital investments, and the rest is paid in equal dividends to all Alaskans. In 1999, the individual dividend was $1,770.[5]

A sky trust, like the Alaska Permanent Fund, would be based on the premise that citizen ownership, if properly structured, is preferable to government ownership. Why do we think this is so?

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[5] See the Alaska Permanent Fund website at http://www.apfc.org.

One reason is essentially religious. It stems from the belief that the sky is a gift from our common Creator. It was not given to a government, and certainly not to private corporations. We, the meek, are its inheritors and stewards. If it turns out that this gift is worth real money, well, that money belongs to us and to our heirs.

A second reason has to do with values and priorities. Federal ownership of the sky would strengthen the apparatus of the state; citizen ownership would strengthen families and children. If we believe that families and children are the bedrock of our society and our future, we should design our institutions and allocate our resources accordingly.

A third reason we favor citizen ownership has to do with equity and the proper treatment of a commons. The sky is nothing if not the ultimate commons—we all inhale oxygen from it, exhale carbon dioxide into it, and use it daily in other less obvious ways. On the theory that use implies ownership, or simply that commoners own the commons, the sky should be our common property.

But a confusion has arisen in America between the commons and the state. They are often considered to be the same thing, when in fact they are not. Historically, the English commons were owned by the commoners who used them. State property—the king's property—was something else. When the commons were enclosed, the land went not to the state or king but to the local gentry. The commoners' ownership interest was acknowledged with small cash payments.

Our intent, of course, is not to revive an agricultural system that has outlived its usefulness, but to adapt a venerable civic institution to 21st century realities. From a purely technical perspective, this is not difficult. Americans are the most ingenious creators of financial instruments the world has known. If we can invent 30-year mortgages, stock index mutual funds and pork belly futures, not to mention a veritable zoo of arcane derivatives, we can surely design ways to structure common ownership of common assets.

Compared to what's already out there, a sky trust would be a straightforward, highly transparent financial instrument. Conceptually, it's a rent recycling machine whose underlying formula is: *from* all according to their use of a commons, *to* all according to their equal ownership of that commons. Administratively, it's a no-brainer: revenue flows in from permit auctions, and dividends flow out via annual checks or electronic funds transfers. As a percentage of cash flow, on-going administrative costs would be extremely low.

Historically speaking, a sky trust would be the old commons in new clothes, a pasture transmogrified into annual dividend checks. Where the old commons was based on shared ownership and *use*, the updated commons would be based on shared ownership and *income*. (And not just that, but shared responsibility to future generations.)

A sky trust would be precedent-setting in other ways, too. It would expand the political right of one person, one *vote*, to an economic right of one person, one *share* (share of the commons, that is). In so doing, it would create a new class of property owners whose membership includes every American. It would make every future baby a trust fund baby.

This would be a major historical breakthrough. Thus, one of the great achievements of the 20th century was the invention and gradual expansion of *social insurance*—

a risk-sharing system that protects people from loss of income due to age, disability or temporary unemployment. But social insurance is only a safety net, not a ladder. Moreover, because it's based on regressive and already high payroll taxes, it is unlikely to expand much further.

A sky trust, however, would establish a new organizing principle with room to grow. This new organizing principle is the formula stated above: *from* all according to their use of a commons, *to* all according to their equal ownership. Under this formula, money passes from *over*-consumers of a commons to conservers—precisely the right direction if we want to preserve the commons. This differs significantly from the organizing principles of social insurance (*from* all according to their wages, *to* all according to their longevity and/or disability) *and* means-tested welfare (*from* all according to their tax liability, *to* all according to their need).

Moreover, it's hard to argue against the sky trust's organizing principle. That consumers should pay for what they use is among the oldest principles of markets; here it is simply extended to an asset that, foolishly, had previously been priced at zero. Similarly, that dividends should flow to property owners is a sacred tenet of capitalism; the only novel notion here is that of *equal and universal* ownership of a commons. But how else could ownership of the sky be divided? You can argue that human-made assets should be unequally distributed in order to encourage individual effort. But how can you argue that sky ownership should be unequally divided? After all, no person lifted a finger to create it. The atmosphere is a purely inherited asset, and not from anyone's parents, but from the common creation.

A sky trust, in sum, would marry the cap and trade system for rationing use of a perishable commons with a trust for preserving common ownership. It would thereby remedy not only Hardin's *ecological* tragedy of the commons, but also an oft-forgotten *economic* tragedy: loss of the commons by the commoners (a loss that typically occurs just when a commons becomes commercially valuable). And it would do both jobs without sacrificing freedom or efficiency.

That, ultimately, is the elegance of a sky trust—it is equitable as well as ecological, efficient as well as effective. Moreover, it relies on property rights and market pricing, while it avoids taxes, means-testing and government bureaucracy. Is there any better way for a market economy to stay dynamic, while it adjusts to scarcities created by its own success?

Indeed, if a sky trust is created early in the 21^{st} century, we can envision similar trusts emerging later in the century as other scarcities arise. Fresh water, for example, and undisturbed habitats for biodiversity, are other common assets whose scarcity will soon confront us. And new technologies, such as the Internet and genetic engineering, may unveil yet unknown scarcities, just as wireless radio did in the last century.

In short, the battle for atmospheric scarcity rent, though currently obscure, may be *the* defining battle of the coming century. Its outcome will affect our economy, our society and ultimately our planet in very profound ways.

II.

The remainder of this paper addresses two technical questions surrounding the sky trust: (1) How large might the scarcity rent be, and (2) what might be a sky trust's impact on U.S. income distribution?

In addressing both questions, we assume that the price of carbon emissions will be driven entirely by markets once an emissions cap is set. We note, however, that political choices may affect the market's role. For example, the RFF proposal would place an initial ceiling on the price of carbon emissions of $25 a ton, with the ceiling then rising at 7 percent a year (in real terms) for five years. The RFF plan would also divert 25 percent of the initial revenue from emission permit auctions into a transition fund, which would be distributed to states to assist workers and communities adversely affected by the shift to a low-carbon economy. This diversion would decrease by 2.5 percent per year for ten years, at which point 100 percent of the revenue would be paid out in individual dividends. Political choices such as these would reduce (at least temporarily) the amount of scarcity rent collected, though they would not significantly alter the distributional impact.

Estimating the scarcity rent in a free but capped market for carbon emissions requires making a number of assumptions about which there is considerable uncertainty. One set of assumptions involves the "elasticity" of demand for carbon-emitting activities. If consumers are highly resistant to reducing fossil fuel use, then prices for carbon emission permits will be bid up greatly and the scarcity rent will be high. If, on the other hand, consumers are eager and able to find alternatives to fossil fuel use, prices will not rise as much and the scarcity rent will be lower. Other assumptions involve the levels and timing of emission caps, the rate at which energy technologies may change, and the degree to which permits for U.S. emissions can be acquired overseas.

Analyses of a free market for carbon emissions have been conducted by the Energy Information Administration (EIA) of the U.S. government, and by private firms including DRI/ McGraw Hill. (EIA, 1998 and 1999. Probyn and Goetz, 1996.) These analyses use a combination of econometric modeling and technical data about energy markets and technologies.

In 1998, the EIA forecasted that if emission caps begin in the year 2005, and the cap is set at the U.S. target under the Kyoto Protocol, then a carbon price of $348 per metric ton in 2010 would result (all prices in 1996 dollars). An earlier start of emission caps, beginning in 2000, would result in a lower carbon price of $316 in 2010. (EIA, July 1999, Table 1, page 10)

DRI/McGraw Hill came up with lower estimates, using somewhat different parameters. Adjusting DRI's parameters to be comparable to EIA's yields a 2010 carbon price of $224 a ton. DRI also presented an alternative case in which energy users are more responsive to price increases, which results in a carbon price only half as large. (Probyn and Goetz, 1996, 12)

EIA's 2000 start would yield an annual scarcity rent of $386 billion in 2010, while DRI's base case would yield $280 billion, and its alternative case $140 billion. Thus, there is a wide range of possibilities.

To translate the overall scarcity rent into costs and benefits for households, we relied on an analysis by Gilbert Metcalf of Tufts University (1998). Metcalf estimated the effects of a package of environmental taxes on households at different income levels, dividing all households into "deciles," or tenths of the whole population. We scaled these results up to the revenue estimates of EIA and DRI, and found that for the middle scenario—DRI's base case— the costs per household range from $1,325 to $4,913, while the dividends per household range from $1,996 to $3,385. The net result is a gain of $671 per household in the bottom decile and a loss of $1,528 for a household at the top of the income distribution. Across the income distribution, the bottom six deciles gain on average, while the top four deciles lose. Table 1 presents these results (see the Appendix for the results of all three scenarios).

TABLE 1

DRI BASE CASE, EFFECTS BY HOUSEHOLD

Decile (lowest to highest income)	Costs from higher prices	Benefits from sky trust dividend	Net effect
1	$1,325	$1,996	$671
2	1,576	2,116	540
3	2,118	2,341	223
4	2,368	2,555	187
5	2,624	2,692	68
6	2,529	2,924	395
7	3,161	3,109	-52
8	3,302	3,236	-66
9	3,773	3,335	-438
10	4,913	3,385	-1,528

Despite the uncertainty of these estimates, they support the conclusion that a system based on the principle "*from* all according to their use of the atmosphere, *to* all according to their equal ownership" would have progressive effects on income distribution in the U.S. ■

APPENDIX

To estimate the effects of atmospheric scarcity rent recycling on households at different income levels involves a number of steps. Thus, we must forecast:

1) the scarcity rent per unit of each fossil fuel that will be generated by a 2008 emission cap of seven percent below 1990 emissions (the Kyoto target for the U.S.);
2) the decline in demand for each fossil fuel, both in the short- and long-runs, due to the higher cost of emissions; and
3) the amount each person will pay in extra expenses, not only for direct purchases of the fossil fuels, but also for other goods and services, whose prices will rise in proportion to their use of fossil fuels.

1. Estimating the scarcity rent

As indicated earlier, estimating the scarcity rent requires making assumptions about the elasticity of demand for fossil fuels. Consumers of fossil fuels can reduce their use in several ways. One is to conduct less activity that uses fossil fuels. Another is to perform the activities more efficiently. Both methods have the effect of reducing the total quantity of energy consumed. A third possibility is to switch from one fuel to another. Since petroleum has about four-fifths the carbon content of coal per BTU of energy, and natural gas has three-fifths, fuel-switching away from coal can cut carbon emissions without reducing total energy consumption. The economically viable opportunities for fuel switching vary among different uses of energy, with conversion of coal-burning utilities to natural gas the most likely in the near-term.

Analysts have done a variety of studies to estimate these effects and how they will change over time. Perhaps the most authoritative analysis is that of the U.S.

Energy Information Administration (October 1998). The EIA has its own National Energy Modeling System which it uses to produce the *Annual Energy Outlook*.

To analyze the potential economic effects of the Kyoto Protocol, the EIA assumed the U.S. would meet its Kyoto commitment by issuing permits for atmospheric release of carbon, which would result in a "carbon price." The EIA first assumed the U.S. would begin this system in 2005, leaving only three years to reach its Kyoto target. Later it did a set of estimates assuming an earlier start toward Kyoto compliance (EIA, July 1999).

The EIA forecasted that if implementation begins in 2005, the carbon price in 2010 would be $348 per metric ton. This would fall to $305 by 2020 as the U.S. improved its efficiency of carbon use (all prices in 1996 dollars). A year 2000 start would result in carbon prices of $316 in 2010 and $267 in 2020. (EIA, July 1999, Table 1, page 10)

Another analysis by DRI/McGraw Hill obtained substantially lower estimates, using somewhat different parameters so that the results are not completely comparable. Assuming a policy start in the year 2000, and a reduction in all greenhouse gas emissions to 10 percent below 1990 levels by 2010 (with fossil fuels accounting for four-fifths of the warming potential of all gas emissions), DRI forecasted a carbon price of $235 in 1995 dollars, which would be about $240 in 1996 dollars—only 76 percent of EIA's "early start" figure, even though DRI was using a 3 percent greater reduction in emissions (Probyn and Goetz, 1996, 12). If we adjust DRI's 1990 minus 10 percent forecast to be comparable to EIA's, this yields an estimated carbon price of $224 billion in 1996 dollars.

Both the EIA and DRI acknowledge that their estimates of carbon prices, and therefore of scarcity rent, may be too high. The EIA says, “It has been suggested that the models may be inherently pessimistic in analyzing the potential impacts of policy changes,” and acknowledges that its coal price projection for 2010 dropped greatly between its 1993 and 1998 forecasts. DRI states that it “uses econometrically estimated equations to forecast consumption in the residential, commercial and industrial sectors. The estimated elasticities in these equations are conservative. Thus, DRI’s equations require relatively high permit prices to induce the required demand response.” DRI further notes that it reviewed a survey of energy demand elasticities and found that “in many cases, the alternative elasticities were several times greater than those in the DRI model.” (Probyn and Goetz, 13)

DRI does not provide an alternative forecast for its 1990 minus 10 percent scenario, but does do so for the scenario of stabilizing greenhouse gas emissions at 1990 levels in 2010. For this scenario, it finds that with “high elasticities” the carbon price is only half that of its base case ($65 versus $125 per metric ton). (Probyn and Goetz, 12)

EIA’s 2005 start date would result in sky trust revenue (scarcity rent) of $424 billion in 2010, while its 2000 start would yield $392 billion. For DRI adjusted to 7 percent below 1990, the 2010 revenue would be $279 billion, while with “high elasticities” it would be $139 billion. Since this is a wide range of possibilities, we present in Table 2 the distributional analysis using three revenue projections: the lower EIA projection with a 2000 start date, and the two DRI projections (low and high demand elasticities), both of which also assume 2000 start dates. If we assume 2010 GDP will be roughly $10 trillion, the projected scarcity rents are in the range of 1 to 4 percent of GDP—sums well worth fighting for.

TABLE 2

CARBON PRICES AND SCARCITY RENT IN 2010
1990 minus 7% emissions ca

	EIA	**DRI-1**	**DRI-2**
	2000 start	low elasticity	high
Carbon price ($/ton)	316	224	112
Carbon emissions (mill. tons)	1,249	1,249	1,249
Revenue/scarcity rent ($ bill.)	**392**	**279**	**139**
per household ($)	3,887	2,769	1,384
per person ($)	1,460	1,040	520

2. Net benefits to consumers at different income levels, sky trust vs. carbon tax shift

The sky trust can be compared with various plans for taxing carbon and then recycling the revenue through the federal or state tax systems. Depending on how the tax recycling is done, the net effects on different segments of Americans could vary greatly, and these effects can be compared to the effects of a “one person, one share” sky trust.

For either the sky trust or a carbon tax shifting system, the net financial effects on households will be the sum of two opposite flows:

— higher prices for fossil fuels and products that use them;

— income from dividends, or lower taxes from tax cuts that offset the carbon tax. (The government could, of course, spend part or all of its carbon tax revenue.)

For the sky trust, as indicated earlier, the six lower income deciles show net gains, while the four upper deciles show net losses. This is shown below for all three scenarios.

TABLE 3

HOUSEHOLD COSTS, BENEFITS AND NET EFFECTS BY INCOME LEVEL FOR A SKY TRUST, ASSUMING 1990 –7% EMISSIONS AND A YEAR 2000 START

	Costs from higher prices			Benefits under sky trust			Net effect by decil		
Decile	**EIA**	**DRI-1**	**DRI-2**	**EIA**	**DRI-1**	**DRI-2**	**EIA**	**DRI-1**	**DRI-2**
1	$1,860	1,325	662	$2,802	1,996	998	$942	671	336
2	2,212	1,576	788	2,971	2,116	1,058	759	540	270
3	2,973	2,118	1,059	3,287	2,341	1,171	314	223	112
4	3,325	2,368	1,184	3,588	2,555	1,278	263	187	94
5	3,684	2,624	1,312	3,779	2,692	1,346	95	68	34
6	3,551	2,529	1,265	4,104	2,924	1,462	554	395	197
7	4,438	3,161	1,581	4,365	3,109	1,555	-73	-52	-26
8	4,635	3,302	1,651	4,543	3,236	1,618	-93	-66	-33
9	5,298	3,773	1,887	4,682	3,335	1,667	-616	-438	-219

10	6,897	4,913	2,456	4,753	3,385	1,693	-2,144	-1,528	-764

The net benefits or costs to consumers from tax shifting will of course vary depending on the particular mix of new taxes and tax cuts. Numerous analysts have estimated the net results of various tax packages (Hamond 1999; Johnstone October 1998; Krupnick September 1993; Poterba 1991). Metcalf (1999) has done the most recent analysis.

Metcalf combines a carbon tax, an air pollution tax and a motor fuels excise tax, totaling 10% of federal revenue in 1994, or $126 billion. He estimates the costs to households by using input-output data to trace the quantities of fossil fuels used in other industries, and assumes that all such costs are passed along to consumers. Then, using Consumer Expenditure Survey data that shows consumption patterns for each income decile (tenth) of U.S. households, he projects the distributional impacts of his pollution tax package. He finds it would cost the poorest decile $569 a year, rising to $2,260 for the highest-income decile. (Metcalf 1999, 51).

Metcalf then constructs a package of tax reductions to match the environmental tax increases. He proposes a reduction in Social Security payroll taxes, an increased tax credit per exemption taken in the federal personal income tax, and an overall cut in the federal income tax rate. (Metcalf 1999, page 15) The gains to households range from $335 at the bottom to $2,197 at the top. The net result of the two revenue flows is that the lowest-income decile loses $234 a year per household, the second through fifth deciles lose smaller amounts, while the sixth through tenth deciles come out ahead.

(Metcalf 1999, page 51). In other words, the net effects of Metcalf's tax shift are the mirror image of the sky trust's: a sky trust is progressive, while even a good tax shift is regressive.

The reason for this is not hard to fathom. While the distribution of *costs* in both scenarios is roughly the same, the distribution of *benefits* varies markedly. Cutting taxes inevitably favors those who pay more taxes (i.e., those with higher incomes), while paying per capita dividends extends benefits to children, non-working parents and retired people with low incomes.

One unexpected insight did emerge from our analysis—namely, that average household size *rises* with income (from 1.86 persons per household for the poorest decile, to 3.16 for the highest decile). The reasons for this are not entirely clear, though it would appear that most households in the lowest deciles are without children, or single adults with one child. The implication of this variation in household size is that rebating atmospheric scarcity rent on a per *person* basis may be less progressive than rebating it on a per *household* basis.

3. Caveats

One caveat is that we are using data compiled from two different sources—the Consumer Expenditure Survey by the Bureau of Labor Statistics and the Current Population Survey by the Census Bureau (Census Bureau, 1999). While each divides households into deciles by income, the methodologies and cut-off points differ to a degree, reducing the accuracy of our computations. Surprisingly, the Census Bureau has published cut-off points for income only by quintiles, not by deciles.

Another caveat involves whether to regard incomes on an annual or lifetime basis. Many economists believe that households base current spending decisions on some expectation of their long-run, or lifetime, income. Particularly among lower income households, current spending tends to exceed current income. Therefore, economists sometimes use current expenditures as a proxy for lifetime income, and analyze distributional questions on this basis.

Metcalf presents alternative results using lifetime income (Metcalf 1999, page 51), and we also estimated the results of a sky trust on this basis. Since lifetime income shows higher spending in the bottom deciles and lower spending in the top deciles, this raises the costs to the lower deciles. The overall result, however, does not change greatly. In the DRI base case, the bottom five deciles come out ahead, while the top five deciles come out behind. ■

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