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Bound to Burn

Humanity will keep spewing carbon into the atmosphere, but good policy can help sink it back into the earth.

Spring 2009

Like medieval priests, today's carbon brokers will sell you an indulgence that forgives your carbon sins. It will run you about \$500 for 5 tons of forgiveness—about how much the typical American needs every year. Or about \$2,000 a year for a typical four-person household. Your broker will spend the money on such things as reducing methane emissions from hog farms in Brazil.

But if you really want to make a difference, you must send a check large enough to forgive the carbon emitted by four poor Brazilian households, too—because they're not going to do it themselves. To cover all five households, then, send \$4,000. And you probably forgot to send in a check last year, and you might forget again in the future, so you'd best make it an even \$40,000, to take care of a decade right now. If you decline to write your own check while insisting that to save the world we must ditch the carbon, you are just burdening your already sooty soul with another ton of self-righteous hypocrisy. And you can't possibly afford what it will cost to forgive that.

If making carbon this personal seems rude, then think globally instead. During the presidential race, Barack Obama was heard to remark that he would bankrupt the coal industry. No one can doubt Washington's power to bankrupt almost anything—in the United States. But China is adding 100 gigawatts of coal-fired electrical capacity a year. That's another whole United States' worth of coal consumption added every three years, with no stopping point in sight. Much of the rest of the developing world is on a similar path.

Cut to the chase. We rich people can't stop the world's 5 billion poor people from burning the couple of trillion tons of cheap carbon that they have within easy reach. We can't even make any durable dent in global emissions—because emissions from the developing world are growing too fast, because the other 80 percent of humanity desperately needs cheap energy, and because we and they are now part of the same global economy. What we can do, if we're foolish enough, is let carbon worries send our jobs and industries to their shores, making them grow even faster, and their carbon emissions faster still.

We don't control the global supply of carbon.

Ten countries ruled by nasty people control 80 percent of the planet's oil reserves—about 1 trillion barrels, currently worth about \$40 trillion. If \$40 trillion worth of gold were located where most of the oil is, one could only scoff at any suggestion that we might somehow persuade the nasty people to leave the wealth buried. They can lift most of their oil at a cost well under \$10 a barrel. They will drill. They will pump. And they will find buyers. Oil is all they've got.

Poor countries all around the planet are sitting on a second, even bigger source of carbon—almost a trillion tons of cheap, easily accessible coal. They also control most of the planet's third great carbon reservoir—the rain forests and soil. They will keep squeezing the carbon out of cheap coal, and cheap forest, and cheap soil, because that's all they've got. Unless they can find something even cheaper. But they won't—not any time in the foreseeable future.

We no longer control the demand for carbon, either. The 5 billion poor—the other 80 percent—are already the main problem, not us. Collectively, they emit 20 percent more greenhouse gas than we do. We burn a lot more carbon individually, but they have a lot more children. Their fecundity has eclipsed our gluttony, and the gap is now widening fast. China, not the United States, is now the planet's largest emitter. Brazil, India, Indonesia, South Africa, and others are in hot pursuit. And these countries have all made it clear that they aren't interested in spending what money they have on low-carb diets. It is idle to argue, as some have done, that global warming can be solved—decades hence—at a cost of 1 to 2 percent of the global economy. Eighty percent of the global population hasn't signed on to pay more than 0 percent.

Accepting this last, self-evident fact, the Kyoto Protocol divides the world into two groups. The roughly 1.2 billion citizens of

industrialized countries are expected to reduce their emissions. The other 5 billion—including both China and India, each of which is about as populous as the entire Organisation for Economic Co-operation and Development—aren't. These numbers alone guarantee that humanity isn't going to reduce global emissions at any point in the foreseeable future—unless it does it the old-fashioned way, by getting poorer. But the current recession won't last forever, and the long-term trend is clear. Their populations and per-capita emissions are rising far faster than ours could fall under any remotely plausible carbon-reduction scheme.

Might we simply buy their cooperation? Various plans have circulated for having the rich pay the poor to stop burning down rain forests and to lower greenhouse-gas emissions from primitive agricultural practices. But taking control of what belongs to someone else ultimately means buying it. Over the long term, we would in effect have to buy up a large fraction of all the world's forests, soil, coal, and oil—and then post guards to make sure that poor people didn't sneak in and grab all the carbon anyway. Buying off people just doesn't fly when they outnumber you four to one.

Might we instead manage to give the world something cheaper than carbon? The moon-shot law of economics says yes, of course we can. If we just put our minds to it, it will happen. Atom bomb, moon landing, ultracheap energy—all it takes is a triumph of political will.

Really? For the very poorest, this would mean beating the price of the free rain forest that they burn down to clear land to plant a subsistence crop. For the slightly less poor, it would mean beating the price of coal used to generate electricity at under 3 cents per kilowatt-hour.

And with one important exception, which we will return to shortly, no carbon-free fuel or technology comes remotely close to being able to do that. Fossil fuels are extremely cheap because geological forces happen to have created large deposits of these dense forms of energy in accessible places. Find a mountain of coal, and you can just shovel gargantuan amounts of energy into the boxcars.

Shoveling wind and sun is much, much harder. Windmills are now 50-story skyscrapers. Yet one windmill generates a piddling 2 to 3 megawatts. A jumbo jet needs 100 megawatts to get off the ground; Google is building 100-megawatt server farms. Meeting New York City's total energy demand would require 13,000 of those skyscrapers spinning at top speed, which would require scattering about 50,000 of them across the state, to make sure that you always hit enough windy spots. To answer the howls of green protest that inevitably greet realistic engineering estimates like these, note that real-world systems must be able to meet peak, not average, demand; that reserve margins are essential; and that converting electric power into liquid or gaseous fuels to power the existing transportation and heating systems would entail substantial losses. What was Mayor Bloomberg thinking when he suggested that he might just tuck windmills into Manhattan? Such thoughts betray a deep ignorance about how difficult it is to get a lot of energy out of sources as thin and dilute as wind and sun.

It's often suggested that technology improvements and mass production will sharply lower the cost of wind and solar. But engineers have pursued these technologies for decades, and while costs of some components have fallen, there is no serious prospect of costs plummeting and performance soaring as they have in our laptops and cell phones. When you replace conventional with renewable energy, everything gets bigger, not smaller—and bigger costs more, not less. Even if solar cells themselves were free, solar power would remain very expensive because of the huge structures and support systems required to extract large amounts of electricity from a source so weak that it takes hours to deliver a tan.

This is why the (few) greens ready to accept engineering and economic reality have suddenly emerged as avid proponents of nuclear power. In the aftermath of the Three Mile Island accident—which didn't harm anyone, and wouldn't even have damaged the reactor core if the operators had simply kept their hands off the switches and let the automatic safety systems do their job—ostensibly green antinuclear activists unwittingly boosted U.S. coal consumption by about 400 million tons per year. The United States would be in compliance with the Kyoto Protocol today if we could simply undo their handiwork and conjure back into existence the nuclear plants that were in the pipeline in nuclear power's heyday. Nuclear power is fantastically compact, and—as America's nuclear navy, several commercial U.S. operators, France, Japan, and a handful of other countries have convincingly established—it's both safe and cheap wherever engineers are allowed to get on with it.

But getting on with it briskly is essential, because costs hinge on the huge, up-front capital investment in the power plant. Years of delay between the capital investment and when it starts earning a return are ruinous. Most of the developed world has made nuclear power unaffordable by surrounding it with a regulatory process so sluggish and unpredictable that no one will pour a

couple of billion dollars into a new plant, for the good reason that no one knows when (or even if) the investment will be allowed to start making money.

And countries that don't trust nuclear power on their own soil must hesitate to share the technology with countries where you never know who will be in charge next year, or what he might decide to do with his nuclear toys. So much for the possibility that cheap nuclear power might replace carbon-spewing sources of energy in the developing world. Moreover, even India and China, which have mastered nuclear technologies, are deploying far more new coal capacity.

Remember, finally, that most of the cost of carbon-based energy resides not in the fuels but in the gigantic infrastructure of furnaces, turbines, and engines. Those costs are sunk, which means that carbon-free alternatives—with their own huge, attendant, front-end capital costs—must be cheap enough to beat carbon fuels that already have their infrastructure in place. That won't happen in our lifetimes.

Another argument commonly advanced is that getting over carbon will, nevertheless, be comparatively cheap, because it will get us over oil, too—which will impoverish our enemies and save us a bundle at the Pentagon and the Department of Homeland Security. But uranium aside, the most economical substitute for oil is, in fact, electricity generated with coal. Cheap coal-fired electricity has been, is, and will continue to be a substitute for oil, or a substitute for natural gas, which can in turn substitute for oil. By sharply boosting the cost of coal electricity, the war on carbon will make us more dependent on oil, not less.

The first place where coal displaces oil is in the electric power plant itself. When oil prices spiked in the early 1980s, U.S. utilities quickly switched to other fuels, with coal leading the pack; the coal-fired plants now being built in China, India, and other developing countries are displacing diesel generators. More power plants burning coal to produce cheap electricity can also mean less natural gas used to generate electricity. And less used for industrial, commercial, and residential heating, welding, and chemical processing, as these users switch to electrically powered alternatives. The gas that's freed up this way can then substitute for diesel fuel in heavy trucks, delivery vehicles, and buses. And coal-fired electricity will eventually begin displacing gasoline, too, as soon as plug-in hybrid cars start recharging their batteries directly from the grid.

To top it all, using electricity generated in large part by coal to power our passenger cars would lower carbon emissions—even in Indiana, which generates 75 percent of its electricity with coal. Big power plants are so much more efficient than the gasoline engines in our cars that a plug-in hybrid car running on electricity supplied by Indiana's current grid still ends up more carbon-frugal than comparable cars burning gasoline in a conventional engine under the hood. Old-guard energy types have been saying this for decades. In a major report released last March, the World Wildlife Fund finally concluded that they were right all along.

But true carbon zealots won't settle for modest reductions in carbon emissions when fat targets beckon. They see coal-fired electricity as the dragon to slay first. Huge, stationary sources can't run or hide, and the cost of doing without them doesn't get rung up in plain view at the gas pump. California, Pennsylvania, and other greener-than-thou states have made flatlining electricity consumption the linchpin of their war on carbon. That is the one certain way to halt the displacement of foreign oil by cheap, domestic electricity.

The oil-coal economics come down to this. Per unit of energy delivered, coal costs about one-fifth as much as oil—but contains one-third more carbon. High carbon taxes (or tradable permits, or any other economic equivalent) sharply narrow the price gap between oil and the one fuel that can displace it worldwide, here and now. The oil nasties will celebrate the green war on carbon as enthusiastically as the coal industry celebrated the green war on uranium 30 years ago.

The other 5 billion are too poor to deny these economic realities. For them, the price to beat is 3-cent coal-fired electricity. China and India won't trade 3-cent coal for 15-cent wind or 30-cent solar. As for us, if we embrace those economically frivolous alternatives on our own, we will certainly end up doing more harm than good.

By pouring money into anything-but-carbon fuels, we will lower demand for carbon, making it even cheaper for the rest of the world to buy and burn. The rest will use cheaper energy to accelerate their own economic growth. Jobs will go where energy is cheap, just as they go where labor is cheap. Manufacturing and heavy industry require a great deal of energy, and in a global economy, no competitor can survive while paying substantially more for an essential input. The carbon police acknowledge the problem and talk vaguely of using tariffs and such to address it. But carbon is far too deeply embedded in the global economy,

and materials, goods, and services move and intermingle far too freely, for the customs agents to track.

Consider your next Google search. As noted in a recent article in *Harper's*, "Google . . . and its rivals now head abroad for cheaper, often dirtier power." Google itself (the "don't be evil" company) is looking to set up one of its electrically voracious server farms at a site in Lithuania, "disingenuously described as being near a hydroelectric dam." But Lithuania's grid is 0.5 percent hydroelectric and 78 percent nuclear. Perhaps the company's next huge farm will be "near" the Three Gorges Dam in China, built to generate over three times as much power as our own Grand Coulee Dam in Washington State. China will be happy to play along, while it quietly plugs another coal plant into its grid a few pylons down the line. All the while, of course, Google will maintain its low-energy headquarters in California, a state that often boasts of the wise regulatory policies—centered, one is told, on efficiency and conservation—that have made it such a frugal energy user. But in fact, sky-high prices have played the key role, curbing internal demand and propelling the flight from California of power plants, heavy industries, chip fabs, server farms, and much else (see "[California's Potemkin Environmentalism](#)," Spring 2008).

So the suggestion that we can lift ourselves out of the economic doldrums by spending lavishly on exceptionally expensive new sources of energy is absurd. "Green jobs" means Americans paying other Americans to chase carbon while the rest of the world builds new power plants and factories. And the environmental consequences of outsourcing jobs, industries, and carbon to developing countries are beyond dispute. They use energy far less efficiently than we do, and they remain almost completely oblivious to environmental impacts, just as we were in our own first century of industrialization. A massive transfer of carbon, industry, and jobs from us to them will raise carbon emissions, not lower them.

The grand theory for how the developed world can unilaterally save the planet seems to run like this. We buy time for the planet by rapidly slashing our own emissions. We do so by developing carbon-free alternatives even cheaper than carbon. The rest of the world will then quickly adopt these alternatives, leaving most of its trillion barrels of oil and trillion tons of coal safely buried, most of the rain forests standing, and most of the planet's carbon-rich soil undisturbed. From end to end, however, this vision strains credulity.

Perhaps it's the recognition of that inconvenient truth that has made the anti-carbon rhetoric increasingly apocalyptic. Coal trains have been analogized to boxcars headed for Auschwitz. There is talk of the extinction of all humanity. But then, we have heard such things before. It is indeed quite routine, in environmental discourse, to frame choices as involving potentially infinite costs on the green side of the ledger. If they really are infinite, no reasonable person can quibble about spending mere billions, or even trillions, on the dollar side, to dodge the apocalyptic bullet.

Thirty years ago, the case against nuclear power was framed as the "Zero-Infinity Dilemma." The risks of a meltdown might be vanishingly small, but if it happened, the costs would be infinitely large, so we should forget about uranium. Computer models demonstrated that meltdowns were highly unlikely and that the costs of a meltdown, should one occur, would be manageable—but greens scoffed: huge computer models couldn't be trusted. So we ended up burning much more coal. The software shoe is on the other foot now; the machines that said nukes wouldn't melt now say that the ice caps will. Warming skeptics scoff in turn, and can quite plausibly argue that a planet is harder to model than a nuclear reactor. But that's a detail. From a rhetorical perspective, any claim that the infinite, the apocalypse, or the Almighty supports your side of the argument shuts down all further discussion.

To judge by actions rather than words, however, few people and almost no national governments actually believe in the infinite rewards of exorcising carbon from economic life. Kyoto has hurt the anti-carbon mission far more than carbon zealots seem to grasp. It has proved only that with carbon, governments will say and sign anything—and then do less than nothing. The United States should steer well clear of such treaties because they are unenforceable, routinely ignored, and therefore worthless.

If we're truly worried about carbon, we must instead approach it as if the emissions originated in an annual eruption of Mount Krakatoa. Don't try to persuade the volcano to sign a treaty promising to stop. Focus instead on what might be done to protect and promote the planet's carbon sinks—the systems that suck carbon back out of the air and bury it. Green plants currently pump 15 to 20 times as much carbon out of the atmosphere as humanity releases into it—that's the pump that put all that carbon underground in the first place, millions of years ago. At present, almost all of that plant-captured carbon is released back into the atmosphere within a year or so by animal consumers. North America, however, is currently sinking almost two-thirds of its carbon emissions back into prairies and forests that were originally leveled in the 1800s but are now recovering. For the next 50 years or so, we should focus on promoting better land use and reforestation worldwide. Beyond

that, weather and the oceans naturally sink about one-fifth of total fossil-fuel emissions. We should also investigate large-scale options for accelerating the process of ocean sequestration.

Carbon zealots despise carbon-sinking schemes because, they insist, nobody can be sure that the sunk carbon will stay sunk. Yet everything they propose hinges on the assumption that carbon already sunk by nature in what are now hugely valuable deposits of oil and coal can be kept sunk by treaty and imaginary cheaper-than-carbon alternatives. This, yet again, gets things backward. We certainly know how to improve agriculture to protect soil, and how to grow new trees, and how to maintain existing forests, and we can almost certainly learn how to mummify carbon and bury it back in the earth or the depths of the oceans, in ways that neither man nor nature will disturb. It's keeping nature's black gold sequestered from humanity that's impossible.

If we do need to do something serious about carbon, the sequestration of carbon after it's burned is the one approach that accepts the growth of carbon emissions as an inescapable fact of the twenty-first century. And it's the one approach that the rest of the world can embrace, too, here and now, because it begins with improving land use, which can lead directly and quickly to greater prosperity. If, on the other hand, we persist in building green bridges to nowhere, we will make things worse, not better. Good intentions aren't enough. Turned into ineffectual action, they can cost the earth and accelerate its ruin at the same time.

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