

# Up in the Air

## Carbon Policies Weigh Environmental and Economic Risks

BY BETTY JOYCE NASH

Carbon controls are on the congressional drawing board for political, economic, scientific, and public opinion reasons. The Intergovernmental Panel on Climate Change's 2007 report turned some heads with its findings, key congressional committees have seized the issue, and public interest is growing after a dramatic 2005 storm season and volatile oil prices. Last, but not least, the Supreme Court ruled that the Environmental Protection Agency can regulate greenhouse gases under the Clean Air Act.

But by how much, how soon, and at what cost? It's easier said than done. Emissions targets may or may not ensure appropriate atmospheric concentrations or sufficiently limit long-term damage because climate response is loaded with uncertainty. Hypothetical scenarios would either stabilize emissions at 2008 levels by 2050 or cut them to half of 1990 levels by that time, at a cost that ranges from below 0.5 percent to 1 percent annually of gross domestic product.

Solutions hinge on the idea that all people and businesses need an incentive, a price on energy-intensive goods, says Ian Parry, an economist at Resources for the Future. "Whereas any other policy, one that's just focused on the power or transportation sector, won't exploit all the opportunities for emissions reductions and is therefore more costly."

That could be accomplished through a per-ton tax on carbon or emissions limits (a cap) coupled with "emissions allowances" that participants may buy, sell, or trade among themselves. Risks abound with each policy: It's risky to do nothing, a tax risks uneven environmental outcomes because it doesn't limit emissions, and "cap-and-trade" plans can cause firms to face uncertainty because the price of carbon would fluctuate according to the market.

While experts and policymakers weigh alternatives, at least economic incentives have influenced the big ideas on the table this go around.

### States Cut Carbs

Cap-and-trade policies already have a track record in cleaning up pollution. Best remembered is the ongoing U.S. acid rain program, which has reduced sulfur dioxide (SO<sub>2</sub>) emissions 22 percent below mandated levels at a cost of about \$1 billion a year, well under estimates of an annual \$3 billion to \$25 billion. The ongoing nitrous oxide (NO<sub>x</sub>) trading plan covers 19 states, the District of Columbia, and portions of two other states.

A group of 10 states from Maryland to Maine auctioned in September the first set (about 12.6 million) of carbon

allowances in advance of a 2009 annual cap on power plant emissions. Known as the Regional Greenhouse Gas Initiative, (RGGI) the plan limits carbon emissions at 188 million tons until 2015, when the cap will be reduced by 2.5 percent per year until 2019. The first RGGI allowances sold for \$3.07 apiece at auction in September. Its second auction was in December.

Latest data — 2006 emissions of 164.5 million tons during a mild winter — suggest it may be a piece of cake for some utilities to meet this goal. The initiative, which Maryland joined in 2007, covers 233 coal, oil, and gas-fired power plants located in the RGGI region. That includes Dominion, based in Richmond, Va., the biggest power producer in New England. (Dominion participated in the auction, but spokesman Jim Norvelle says they prefer a national cap-and-trade plan over regional approaches.)

Critics have faulted the RGGI cap for not being aggressive enough. However, greenhouse gas buildup is a long-term problem, and allowances can be adjusted if necessary.

You have to start somewhere, according to Matthias Ruth, director of the Center for Integrative Environmental Research at the University of Maryland. He's studied effects of climate change on Maryland, Boston, and New Zealand, too. "It's so new everyone was worried," he says. "The last thing you want to do is have an overly ambitious and un-doable target."

As to the distribution of allowances, RGGI's plan requires at least a quarter be auctioned; most states, including Maryland, plan to auction 100 percent. In a cap-and-trade program, an auction reveals emissions prices through bidding and can raise money that could offset less efficient taxes such as those on capital or payrolls.

In most cap-and-trade programs, allowances have been given away, except in 2004 and 2005 when Virginia auctioned nitrogen allowances, and netted \$10.5 million. The RGGI auction raised \$38.6 million, some of which will pay for energy conservation and alternatives. That may not be the most efficient use of the money, Parry notes, because "the government is picking winners, saying this is a better way to reduce emissions; we know better than the market." It would be more equitable and efficient if the money were used to, say, lower personal income taxes in those states.

The RGGI states might be the first, but may not be the last to cap greenhouse gas emissions and trade allowances regionally in the absence of a national plan. Seven Western states, including California, plus four Canadian provinces have formed the Western States Initiative, which will create a regional cap-and-trade system similar to RGGI's.

Six Midwestern states and Florida also are studying variations on the RGGI theme. California in 2006 passed a law to return that state to 1990 emissions levels by 2020, a 25 percent cutback. Proposals to achieve that are in flux and include a light rail system, alternative energy incentives, and more.

These regional blueprints turn pollution allowances into a marketable asset. Participants meet emissions targets any way they can — with pollution-control technologies or by spending allowances — rather than using methods prescribed by government. The quantity is fixed and the price is determined by the market. To limit swings in the market, a price ceiling or floor could reduce price uncertainty — RGGI's floor was set at \$1.86 per allowance. The hope is that such tweaks will become unnecessary over time in a smooth trading market.

Economist Richard Newell of Duke University says such flexibility will “achieve some degree of cost containment while at the same time providing some certainty about emissions reductions.” Another tweak would be to inject more allowances into the system if costs get too high, he notes.

An allowance reserve would create a stash that could be released when and if prices rose above a certain level. Newell thinks it's worth exploring these options to create a flexible “hybrid” plan.

Participants also could be allowed to bank permits for the future and to use those or borrowed permits when demand pushes allowance prices up, say, during a cold winter or hot summer. Because climate change extends into the distant future and emissions contribute to the global atmosphere, it may make sense to cut deeply when it's economically feasible and let up when it's not. “But then there's the problem of whether it's credible to let firms borrow a lot of allowances in the early years of a program,” Parry says. “For political reasons, it might reduce the credibility.”

A European cap-and-trade program got a rocky start in 2005 because its administrators lacked accurate emissions data on the downstream users on which the caps were imposed. “They put the system in place and then required the accurate inventories and then, all of a sudden, when they collected the inventories, it turns out the emissions were different from what [they] were anticipating,” Parry says.

## Join the Club

In the 1920s economist Arthur Pigou identified the concept of using taxes, now called “Pigovian” taxes, to compensate for negative side effects — externalities — of actions that harm third parties. Firms use the atmosphere as a depository for carbon but don't pay for it the way trash haulers, for instance, pay to dump loads into a landfill, having already passed along that cost to customers.

That's a kind of market failure, one of two that greenhouse gases represent. There's also no incentive for firms to research and develop new technologies to improve the situation. So it's necessary to price the privilege of sending pollutants into the atmosphere, says John Whitehead, an economist at Appalachian State University and co-author of an environmental economics blog. “When they see the cost, it creates an incentive to cut back pollution,” he says. And whether it's a carbon tax or a permit generated by a cap-and-trade plan doesn't matter. “In business terms, whether they're paying in the form of a tax or paying another business to buy their permit, it doesn't matter, \$100 is \$100.”

While a carbon tax or cap-and-trade plan may have similar outcomes, under certain conditions cap-and-trade plans aren't considered “Pigovian.” The permits (either auctioned or handed out for free) are considered property in this created market. Along with the permit goes the right to buy or sell, and perhaps borrow or bank them. The theoretical framework for the cap-and-trade plans was conceived by Ronald Coase, a Nobel laureate, who suggested that if it doesn't cost parties too much to bargain, then they'll achieve an efficient distribution of ownership rights. So if a firm can make more money selling permits (“rights”) than by using them to emit pollution, it must be

because that firm can better reduce pollution on its own at a lower cost than the permit buyer can.

Ideally a carbon price would be “harmonized” across sectors and countries. Yet the dynamic, gradual, and compounding effects of climate change make it tough to quantify the total costs to society, and the range of estimates is all over the map.

Based on 100 peer-reviewed estimates, the Intergovernmental Panel on Climate Change Working Group calculates that social costs in 2005 average \$12 per ton, but costs range from -\$3 per ton to \$95 per ton. Economist William Nordhaus of Yale University has developed models that suggest carbon taxes in 2010 could vary by policy scenario from \$2 per ton of carbon to \$200 per ton. Nordhaus favors an “internationally harmonized” carbon tax to achieve reductions or a well-designed universal cap-and-trade program. A regulatory approach, such as current policies that set emissions standards for vehicles and ban light bulbs, is inefficient.

The cap-and-trade versus carbon tax debate has been discussed widely in economics literature, government reports, the popular press, and on the Internet. In 2006 Harvard University economist Greg Mankiw founded an informal group, the Pigou Club, composed of economists who say a carbon tax offers the most effective solution to limiting global warming effects. That's especially true if the additional money the tax generates is used efficiently by cutting taxes that depress work effort. Club members include some pretty big names in economics as well as other big names, too, like Al Gore, who has endorsed a revenue-neutral carbon tax. However if a carbon cap-and-trade program sells rather than gives allowances away, the differences all but disappear.

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Emissions were lower than expected and the cap wasn't effective, so prices collapsed. Now, however, source inventories are more accurate, and the goal is to cut greenhouse gas emissions by 20 percent by 2020. Carbon trades at between \$20 and \$40 per ton today. Ideally, the United States would impose the program on a fewer number of entities — fossil fuel suppliers — rather than downstream users because there is more accurate data on those sources.

### Path Dependence

Economist Charles Komanoff has spent years advocating an alternative: a carbon tax. He is co-director of the nonprofit Carbon Tax Center. Critics of carbon taxes say the political process is not the best way to set a carbon price. But while auctions and trades discover the price of carbon, he notes, that price would be an indirect result of the political process, too, because politics establishes the cap. Even with the trade-off between emissions and financial uncertainty, “we take the position, and economists support this, that all in all there's more certainty going forward under a carbon tax than under cap and trade.” But the quantity limits lead most environmentalists to back cap-and-trade plans — something

Komanoff refers to as a sort of “path dependence.” Taxes are unpalatable and the cap-and-trade idea may be an easier political sell. Matthias Ruth says he's even had executives tell him not to even say the word “tax” because they “stop listening.”

Not everyone feels that way. A carbon tax is transparent, and the money stream would be steady and predictable. And lawmakers could use the tax to reduce other taxes or even rebate money back to taxpayers, the way Alaska pays its citizens a dividend of oil revenues. British Columbia levied a \$10 per-ton tax on carbon in 2008. The revenue goes to cut taxes on the bottom two income tax brackets and tax credits for the poor.

But if carbon allowances get auctioned, then the difference between the two systems narrows to a split hair. Gilbert Metcalf, an economist at Tufts University, notes that even if Congress sets a hard cap, it could be changed. “If abatement costs turn out to be unexpectedly high, the resulting high permit prices will create political pressure for Congress to relax the quantity constraint.” Metcalf, in a paper, argues for a gradually rising carbon tax with revenues directed to an earned income tax credit tied to payroll tax collections.

## Can Offsets Cut Carbon Emissions?

Carbon “offsets” are being watched closely to see whether they significantly reduce additional emissions. These offsets take the form of certified credits available through a middleman who trades them on behalf of projects that destroy, displace, or sequester carbon. Governments or companies buy and sell offsets to comply with caps on carbon dioxide — or anyone could buy them for his own carbon use. (There are six primary greenhouse gases, but offsets are measured in metric tons of carbon dioxide equivalents.)

The wide range of offset opportunities includes renewable energy, forest management, or landfill-gas capture projects. Such a project in Greenville, S.C., made a list of 11 offset projects endorsed by the Environmental Defense Fund.

Enerdyne Properties developed a project that captures gases created by decomposing trash, one of which happens to be methane, also the chief constituent of natural gas. It is then turned into electricity. “If it's not collected and used and burned, it's a greenhouse gas that would otherwise go into the environment,” says William Brinker, whose father started the firm in 1993. “We're preventing the release of the methane and using it to provide reasonable electricity to consumers.” Some 6,000 metric tons of methane emissions may be prevented annually over the next 10 years, the equivalent of taking 23,000 passenger cars off the road every year, according to estimates.

While offsets have been around for years, they were codified in the Kyoto Protocol climate change agreement adopted in 1997 that became effective in 2005. The treaty binds 37 industrial nations to targets that cut greenhouse gas emissions to below 1990 levels between 2008 and 2012.

So far, 183 countries have ratified the protocol. The United States has not.

Some industrialized countries meet targets using cap-and-trade systems that cover power plants and major greenhouse-gas emitting industries. Targets may also be met with offsets called “clean development mechanisms” (CDMs). The CDMs generate certified emission reductions (CERs) that represent avoided emissions which can be bought and sold. The European Trading Scheme offers the biggest global demand for CERs. Offset contracts are also traded on the Chicago Climate Exchange.

But offsets have been criticized for not cutting emissions in some cases. A working paper by Michael Wara and David Victor of Stanford Law School argues that many CDMs do not represent real reductions in emissions. In one example, firms made more money from selling the credits generated by capturing a toxic byproduct of a refrigerant gas than by producing the gas. This “perverse incentive” actually encouraged refrigerant production for the waste that generated the emissions credits. Payments in this case overall will cost 4.7 billion euros while estimated abatement costs are probably less than 100 million euros, according to Wara and Victor.

Still, offsets remain big business. The World Bank estimates that the global carbon market — the buying and selling of greenhouse gas emissions — reached \$64 billion in 2007, double that of 2006, largely because of high carbon prices in European Union countries. But the recession will reduce emissions and credit carbon prices as industrial output declines.

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## Hybrid Plans

While economists agree that it's a sound idea to use market approaches to solve the problem, not all such policies will perform the same — that devil still lurks in details. Newell, the Duke economist, and co-author Carolyn Fischer have found that while emissions pricing offers incentives for fossil fuel producers to cut emissions, consumers to conserve, and for renewable energy producers to expand production and invest in knowledge, an "optimal" policy portfolio will also subsidize research and development. In theory, an efficient price would encourage private firms to research and develop alternatives, since they bear the burden of reducing emissions. But in practice, a price may not work that way. High prices that risk significant cuts in economic activity aren't likely to get through the political process. Also, there could be a steep learning curve in producing and using new technology.

By their calculations, there will be lower costs and better market penetration of renewable energy sources with the subsidies to R&D — the emissions price necessary to get to a 4.8 percent reduction would fall by 36 percent, to \$4.50 per ton from \$7 per ton.

What kind of money are we talking about? The Congressional Budget Office estimates that revenue from a cap-and-trade program could range anywhere from \$50 billion to \$300 billion a year (in 2006 dollars) by 2020. Talk about uncertainty.

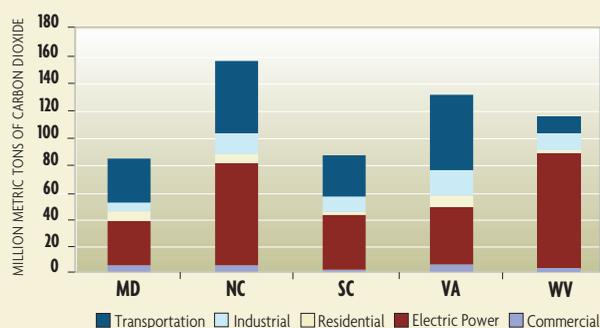
But what will happen to the money? With a big war going on and the economy dragging its feet, you have to worry about how Congress would use it, says John Whitehead, an environmental economist at Appalachian State University.

Cutting taxes on labor and capital would help the most. That could keep down the overall cost of the carbon control program, Parry says. But it won't work that way unless legislation spells out the automatic reductions in other taxes. Otherwise, the money would be up for grabs by special interests.

## So What?

China surpassed the United States in 2007 as the biggest emitter of greenhouse gases, of which carbon is the chief component. (Methane is more harmful, but represented only 8.6 percent of emissions in 2006.) But the U.S. share of

## State Emissions by Sector (2005)



NOTE: Total emissions for Washington, D.C., were roughly 4 million metric tons.  
SOURCE: Energy Information Administration

accumulated greenhouse gases is 30 percent to China's 8 percent. Electric power plants supply the biggest single U.S. source of carbon at 40 percent, and coal produces about 83 percent of that electricity. Transportation accounts for about a third of carbon emissions.

It's not out of line to ask whether a cap and trade or carbon tax plan could significantly slow global warming because it wraps the globe, not just the nation. How about the slash-and-burn forestry elsewhere that accounts for 20 percent of global carbon? How about smoggy Chinese cities, smokestacks, and the burgeoning car culture?

"The ultimate aim would be that over 10 to 15 years we'd have an emissions trading scheme over most of the large-scale emitters in the world," Parry says. And a policy, a carbon tax or cap-and-trade plan or hybrid of the two, could influence other nations' efforts to innovate and restrict greenhouse gas emissions.

The European Union carbon trading experience has been instructive for the United States, which has better data, especially on power plant fuel consumption. Although there's no shortage of projections, there are still more questions than answers that only experience can provide. What price will achieve various emissions targets? How will demand respond to the prices? How easy will it be to substitute alternate fuels? The RGGI regional laboratory, meanwhile, is aiming to find out. **RF**

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