The Low-Carbon Diet

How the Market Can Curb Climate Change

Joel Kurtzman

The global economic crisis has battered the free market's reputation, but the market nevertheless remains a powerful tool both for allocating capital and for effecting social change. Nowhere is this truer than with the challenge of confronting and reversing climate change. Of all the market-based tools available for addressing this problem, the most potent are cap-and-trade systems for greenhouse gas emissions.

In their most basic form, cap-and-trade systems work by making it expensive to emit greenhouse gases. As a result, the owners of an emissions source are motivated to replace it with something less damaging to the environment. If they are unable to, the trading provisions allow them to purchase permits to continue emitting until they are ready to invest in new technology. Over time, as the amount of carbon allowed into the atmosphere is reduced, the price of a permit is expected to increase.

In existing cap-and-trade mechanisms, such as the European Union's Greenhouse Gas Emission Trading Scheme, governments cap the total amount of emissions allowed, and the amount of emissions permitted declines over time. Organizations such as utilities, factories, cement plants, municipalities, steel mills, and waste sites are given or sold permits that allow them to emit a certain portion of the relevant region's total greenhouse gases. If an organization emits less than its allotment, it can sell the unused permits to entities that plan on exceeding their limits. Under cap-and-trade systems, companies can trade permits with one another through brokers or in organized local or global markets.

The American Clean Energy and Security Act of 2009, the 1,201-page bill introduced by Henry Waxman (D-Calif.) and Edward Markey (D-Mass.) and passed by the U.S. House of Representatives on June 28, is an ambitious attempt by Congress to play catch-up after having failed to approve the Kyoto Protocol—which was ratified by 183 parties, including all the developed countries except the

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United States, in 1998. The bill adds further amendments to the Clean Air Act of 1970 and grants new authority to the Environmental Protection Agency (EPA), the Commodity Futures Trading Commission, and the Federal Energy Regulatory Commission, the last being the nation's main energy and electricity regulator. The bill also creates a registry of greenhouse gas emissions and systematizes what are now mostly haphazard efforts to offset emissions, such as planting trees, transforming animal waste into methane gas for energy use, and capturing methane as it escapes from landfills.

Most important, the bill seeks to reduce greenhouse gas emissions over time by creating carbon markets. The goal is to gradually reduce U.S. greenhouse gas emissions to 17 percent of 2005 levels by 2050, beginning with a modest three percent reduction by 2012. The bill would require reductions in emissions from most stationary sources of greenhouse gases, including power plants, producers and importers of industrial gas and fuel, and many other sources of carbon dioxide, such as steel mills and cement plants. It would also raise mileage standards and lower permissible emission levels for vehicles. Crucially, the bill puts its faith in the market and its ability to lower the cost of reducing emissions through the trading of permits. Although it seems revolutionary, this is not a new idea. For decades, markets have been used successfully as mechanisms for curbing different types of pollution.

ACID TEST

The conceptual framework for cap-and-trade systems was laid out in the 1960s and 1970s by two economists, Ellison Burton and William Sanjour, who worked for the U.S. National Air Pollution Control Administration, which was eventually folded into the EPA. Beginning in 1967, they sought to develop decentralized programs to limit emissions of sulfur dioxide—a pollutant emanating from the smokestacks of coal-fired power plants that caused acid rain—and to limit them in the most inexpensive and efficient way possible.

Burton and Sanjour built computer models to simulate how market forces could be used to coordinate abatement activities by using penalties and—more important—incentives and rewards. From their perspective, the penalties and incentives had to be large enough to persuade emitters of sulfur dioxide to invest in changing their practices. Burton and Sanjour realized that the complexity of the problem was beyond the ability of any command-and-control model to solve because sulfur dioxide was emitted from tens of thousand of sources operated by thousands of different utility companies doing business under dozens of regulatory jurisdictions across the United States. Their approach proved to be remarkably successful.

Then, in the 1980s, the cap-and-trade model was employed successfully to eliminate the use of leaded gasoline in cars across the United States. When lead, a performance additive for internal-combustion engines, was found to cause neurological and cognitive disabilities in children, the EPA introduced a trading program to accelerate the phasing out of leaded fuels. The system the EPA deployed in 1982 put an overall cap on the production of leaded fuels but allowed refiners to buy or sell permits among themselves to produce those fuels, as long as they did not exceed the

overall cap. At the time, the program was criticized as callous by some environmentalists, who believed it ignored the health risks to children and would allow corporations to profit even though leaded fuels were continuing to cause illness.

But the success of the program soon silenced its critics. It allowed refiners that had invested in new processes and plants for making unleaded fuel to sell their unused permits to refiners that had yet to make the change. As a result, capital flowed from leaded gasoline makers to unleaded refiners, acting as a tax on one and an incentive for the other. From a market-design perspective, the program created what economists call "strong positive feedback loops." By 1987, a mere five years after the program began, nearly all leaded gasoline had been eliminated in the United States, and other countries were copying the program. The lead-abatement program turned out to be cheaper and more efficient than anyone had predicted.

A similar approach was used to confront an even larger environmental problem: acid rain. By the 1980s, acid rain—the problem Burton and Sanjour had first studied—was causing enormous harm to the environment and seemed intractable. Sulfur dioxide and nitrogen oxide released into the atmosphere from coal-burning power plants and other factories was combining with water vapor to form acid rain, mist, and snow. This acidic precipitation fell into lakes and streams, killing fish, algae, and other forms of aquatic life. It also damaged crops, stripped the paint off cars, scarred archaeological landmarks, and was even implicated in certain types of cancer.

In 1979, the United Nations passed the Convention on Long-Range Transboundary Air Pollution, which marked the beginning of an international effort to reduce emissions of sulfur and nitrogen oxides. But it was not until the U.S. Congress passed the Clean Air Act Amendments of 1990 that the United States saw any meaningful reduction. The amendments enabled the EPA to place a national cap on emissions of sulfur and nitrogen oxides while allowing polluters to trade permits among themselves. Using 1980 emissions levels as the baseline, the program aimed to cut emissions of sulfur dioxide in half by 2010. In 2007, three years ahead of schedule, the agency's cap-and-trade program achieved its reduction targets. The cost to emitters, which the Congressional Budget Office had estimated would be $6 billion a year, came instead to about $1.1–$1.8 billion a year, largely because the program enabled emitters to choose their own solutions to the problem, rather than relying on a narrow range of mandated technologies and approaches. Thanks to this program, acid rain is no longer a first-order environmental challenge. And it can serve as an instructive model for policymakers seeking to combat climate change by creating a carbon market.

CAPPING CARBON

Although leaded fuels and acid rain were big issues in their day, they are small-scale problems compared to climate change. At its worst, acid rain harmed marine habitats and cropland, primarily in North America and Europe. But climate change affects the entire planet.

Climate change is not just an environmental problem; it is a humanitarian and health problem with multiple dimensions. Scientists warn that sea levels will rise, rainfall patterns will be altered, storm patterns will change, and the locations of

deserts, cropland, and forests will shift. As a result, famine and disease could spread, leading to increases in migration from environmentally devastated countries to Europe and the United States.

But there is another issue that makes tackling climate change more difficult than removing lead from fuels or stopping acid rain: emissions of greenhouse gases are a byproduct of economic growth. Leaded fuel was the key to only a single industry, and the processes leading to acid rain were central to just one or two sectors of the economy. Unlike these pollutants, emissions of carbon dioxide are fundamental to almost every aspect of the global economy. Leaded gasoline had a relatively cheap substitute (unleaded gas), and emissions of sulfur and nitrogen oxides have relatively straightforward technological fixes. By contrast, the fossil fuels that produce greenhouse gases are not so easy to replace.

To add to the complications, today's emerging economies—Brazil, China, India, and Russia, among others—are following the same carbon-intensive path to prosperity first taken by Europe and the United States over a century ago. Coal, oil, natural gas, and wood—all of which contribute to carbon dioxide emissions—remain the world's predominant sources of energy. Despite recent investments in alternative fuels, solar, wind, hydroelectric, geothermal, and nuclear power still only account for a small share of the world's energy supply. Moreover, trillions of dollars have been invested in finding, developing, refining, transporting, marketing, selling, and using fossil fuels. A large portion of these costs will be difficult, if not impossible, to recover if fossil fuels are phased out. For example, pipelines and storage facilities designed to transport oil and gasoline cannot be used for ethanol because of ethanol's corrosive effects; oil production facilities will not be needed at today's scale if next-generation cars are fueled by biofuels and natural gas or powered by electricity; and many coal-fired power plants will become obsolete once solar and wind energy become dominant. In short, changing the way the world produces energy in order to avoid the worst perils of climate change will be costly and complicated.

Rarely do industries—even those that pollute the most—willingly go out of business. Furthermore, until venture capitalists and other investors are certain that the economy is really transforming itself and that governments are committed to the transformation, few companies will gain access to sufficient capital to make the kind of large-scale investments necessary to change the terms of the world's energy-emissions equation. The transition from leaded to unleaded fuels cost refineries millions of dollars, and adding sulfur dioxide scrubbers to utilities' power plants cost them tens of millions, but a medium-sized solar- or wind-turbine installation could cost hundreds of millions, if not billions. And to complete the transition to new energy-production technologies, thousands of installations will be needed, along with infrastructure investments in projects such as enhancing the electricity-distribution grid. For policymakers, this presents a particular set of challenges. Weaning the global economy from carbon dependency and building an energy-efficient future will not be easy.

NO TAXATION WITHOUT MITIGATION

Cap-and-trade markets for greenhouse gases, such as the Chicago Climate Exchange (CCX), already exist in the United

States, and a number of large companies and institutions have already joined the exchange to trade the right to emit carbon. These include Safeway; the Ford Motor Company; several universities; some smaller municipalities, such as Oakland and Berkeley, California; and several state and county governments. Although membership is voluntary, each entity signs a legally binding contract that requires it to reduce its emissions. In a few cases, companies have already made money as a result of their abatement processes, whereas others have had to pay in. Those that have profited joined the exchange because they knew that organizations that exceeded their contractually bound emissions targets would have to buy credits from those emitting less than their limit; polluters have participated in order to show their green credentials and to respond to consumer demand for cleaner energy.

In Europe, where adherence to the Kyoto Protocol is mandatory, the Greenhouse Gas Emission Trading Scheme has been operating since 2005 and allows the trading of emissions from stationary sources, such as electric utilities. The program is expected to trade permits for about 3.8 billion tons of carbon in 2009, according to Point Carbon, an independent research firm. The exchange covers approximately 10,500 sites, which emit about 40 percent of the region's greenhouse gases. Australia also has a market for carbon dioxide, and others are being formed in Canada and New Zealand. California, too, is likely to adopt a cap-and-trade system as a result of its own legislation, although a federal program could eventually take its place.

In 2008, the Milken Institute helped the Chinese city of Tianjin develop a plan for a greenhouse gas trading system linked to the CCX. A Chinese system using the CCX's trading technology could form the basis of a truly global market for greenhouse gases, with standardized contracts, auditing methods, and goals. Indeed, other cities in China are also interested in developing markets for carbon, and traders there and elsewhere have shown interest in investing in those markets. If China and the United States, the world's two largest emitters of greenhouse gases, joined with Europe and the world's other major emitters to form a global market for carbon, it is conceivable that carbon could become one of the world's most traded products. Such a globally linked carbon market could transfer billions of dollars a year to quickly fund new emissions-abatement projects. Tianjin's agreement with the CCX represents an early first step and a hopeful sign that China and the United States could join forces to address the problem of climate change.

Despite these promising examples, critics of cap-and-trade systems argue that imposing taxes on fossil fuels and on emissions of greenhouse gases, such as carbon dioxide, methane, ozone, and chlorofluorocarbons, is the better policy because it is simpler to enact, more difficult to corrupt, and easier to enforce. Although it is true, for example, that raising the price of cigarettes through higher taxes has helped curb smoking, increased taxation only addresses one side of the issue—restricting one type of behavior but not promoting another.

Of course, proponents of taxes argue that by making something more expensive, taxes will force enterprising individuals or organizations to seek alternatives. Although this might be true, taxes produce change in a slow, measured, and bureaucratic way.

This occurs because taxation must be phased in and administered by the government; moreover, tax policy is always at the mercy of shifting political winds. When it comes to climate change, however, speed and certainty are important.

Cap-and-trade systems accelerate the process of emissions reduction by using incentives. Combining incentives with penalties helped rapidly remove lead from gasoline and reduce acid rain. It is doubtful that taxes alone would have been able to achieve these results, because no individual actor or organization would have received any tangible reward for changing its behavior.

Furthermore, because taxes raise prices, and because emissions of carbon touch almost all aspects of the economy, taxes would increase costs for a broad spectrum of industries, potentially slowing down the economy. With market-based mechanisms, however, capital is transferred directly from one organization to another: one part of the economy is penalized, but another is rewarded. Whereas taxes tend to act as a brake on the economy, cap-and-trade programs simply slow old sectors of the economy while jump-starting growth in new ones. As that happens, the promise of green industries and green jobs starts to become a reality.

Cap-and-trade programs function as a carrot and a stick. They add costs and difficulties to environmentally damaging processes, such as producing leaded gasoline or emitting sulfur and nitrogen oxides, and by allowing the trading of pollution permits, they transform those costs into incentives that reward emitters for changing their behavior. Fees charged for producing the wrong kind of gasoline went toward helping others produce the right kind.

Money paid by slow-to-change producers of acid rain offset some of the costs of installing sulfur dioxide scrubbers in the smokestacks of utilities willing to change. In each of these successful examples, individual operators had to decide where to invest money. No government agency determined which smokestacks were to be fitted with scrubbers, which were to be replaced, and which were to be torn down. The government ran the programs and set the rules, but individual firms made the investments.

Similarly, using cap-and-trade systems as a policy tool for addressing climate change would allow a country's tens of thousands of carbon emitters to decide for themselves how to meet their region's overall emissions goals. It would also enable the emitters themselves to select which technologies to employ to reduce pollution, freeing the government from the responsibility of choosing winners and losers.

Under the cap-and-trade system approved by the U.S. House, most of the emissions permits—about 85 percent—would be allocated freely at first, and the remainder would be auctioned off. U.S. policymakers must be careful not to repeat the errors of those in Europe, where emissions credits were initially given out too freely because regulators overestimated the region's total emissions of carbon. This caused the price of permits to collapse to near zero soon after the program went into effect, in 2005. Over time, however, the price of carbon recovered, and it now hovers around $13 per ton. As prices increased, European emissions declined. And although some of Europe's reductions were the result of the global economic slowdown, the cap-and-trade system was responsible for a substantial portion of the cuts.

For the United States, the key to making a cap-and-trade system work lies in correctly estimating the number of permits that need to be issued and then allowing emitters to trade them like any other commodity. Once this is accomplished, significant amounts of capital from private sources would likely be invested in efforts to fight climate change.

By making pollution-abatement programs profitable for investors, the system would create financial incentives for investing in clean energy. Rather than financing climate-change measures itself, the government would simply set the rules and let the market take over.

THE FOREST FOR THE TREES

Besides creating a framework for selling and trading permits, the House bill includes provisions for offsets. Offsets are activities undertaken, directly or indirectly, by an emitter to counteract the environmental damage caused by releasing greenhouse gases. The Clean Energy and Security Act recognizes that although countries have borders, the world's atmosphere does not. As a result, one ton of carbon released by an oil refinery in New Jersey, for example, could be offset by a reforestation program in the Brazilian Amazon—so long as it conformed to the rules laid out in the legislation and was subject to random audits. Offsets include programs that replace conventional energy with renewable sources, such as hydroelectric, wind, or solar power. They also include programs that turn animal waste into fuel.

Offsets are another way for companies and governments to counterbalance their emissions. One program involves emitters paying to plant trees or even entire

forests, depending on the amount of carbon that needs to be offset. Because climate change is a global issue, tree planting can take place wherever it will do the most good, such as in the tropics, where some trees can grow very quickly and remove carbon from the atmosphere at an annual rate of about one-third of a ton per tree—significantly faster than trees planted in temperate climates. Offsets must involve new projects, not projects already under way, and their impact on the environment must be verified. Most of the world's carbon exchanges—as well as some brokers and nonprofit organizations—already trade or sell offsets.

In some cases, offsets accomplish multiple goals. For example, animal waste, which is a major problem for the world's dairies, poultry farms, and cattle ranges, is often simply left on the ground or raked into uncovered lagoons. But as it decomposes, animal waste emits methane gas, which is about 20 times as damaging to the environment as carbon dioxide. Methane emissions from animal waste are a global problem, and uncovered waste is also a threat to public health. Offsets purchased by U.S. and European emitters of carbon dioxide have transferred capital to nonprofit organizations that have reduced methane emissions from animal waste in remote villages in Africa and India by using simple measures to trap the methane. Some of these programs have used captured methane to generate power and run farm equipment and are now being used on a larger scale in Europe and the United States. By cleaning up the waste, these programs have made conditions more sanitary for rural workers and farm dwellers. Some dairies in the United States and elsewhere have begun highlighting their animal-waste practices as part of their marketing. In addition, health regulations in certain countries make converting animal waste into energy more profitable than paying to dispose of it. Although some of these programs would no doubt be carried out based on their own merits, cap-and-trade systems serve as accelerators for programs that make sense but would not otherwise be top priorities.

MARKET MAGIC

Climate change comes at a time when a number of technologies, such as wind power, geothermal energy, and certain types of solar energy, have matured to the point where they can produce abundant supplies of clean energy—albeit not as cheaply as traditional energy sources, such as coal. The missing ingredient for combating climate change is access to capital—a problem that cap-and-trade systems address head-on. Until permits are traded and the price of carbon is set, price uncertainty will cloud the market. Over time, however, as the number of permits falls at regular intervals, the price of carbon will likely rise. The cost for emitters will increase in inverse proportion to that for organizations investing in abatement. As industries and investors begin to see carbon winners and carbon losers emerge, behaviors will begin to change.

Even though the government will have a role in allocating some of the capital collected from the sale of permits, market forces will allow businesses to select those technologies that work best for them. If the income received by the government from the initial sale of permits is allocated to offset programs rather than being used to subsidize specific technologies, the market can work without creating

the type of distortions that arise when policymakers attempt to choose winners and losers themselves.

Cap-and-trade systems do not need a lot of moving parts: they can be reduced to six basic elements. First, cap-and-trade systems need firmly set long-term emissions caps that place an unambiguous limit on the amount of carbon dioxide permitted to be released into the atmosphere over the long haul.

Second, permits must be allocated to emitters. Ideally, the initial permits should be free, so that the proceeds from trading go directly from major emitters to those cleaning up their acts, something that the oversight and auditing provisions of the American Clean Energy and Security Act of 2009 will ensure. The next best option is for the government to auction permits; as long as the government allocates the correct number of permits, based on the overall capped amount of emissions, the market will set a price. Because the costs of cleaning up the atmosphere and changing the way humans produce energy are so large, it is imperative that all proceeds from cap-and-trade systems be invested in programs that reduce pollution or in related offset programs. If emitters do not invest that money to curb emissions, they will find themselves penalized as carbon prices increase and their emissions costs rise accordingly.

Third, cap-and-trade programs should include offset provisions that provide emitters with alternative ways of removing carbon from the atmosphere. If a government auctions or sells permits, the revenue should be used to finance offsets, such as forestation projects, to avoid distorting the market by favoring one technology or initiative over another. Given the size of the emissions problem, there will be no shortage of offset programs from which to choose.

Fourth, emitters should be allowed to "bank" their permits so they can use them in the future. They should also be allowed to borrow permits against more expensive future allocations. Fifth, all emissions activities must be professionally audited to ensure that a ton of carbon really is a ton of carbon. Accounting firms, consultants, and nonprofit organizations can perform the audit function. They can do it through random checks, just as financial audits of large firms are conducted, or through technological means, such as by using permanently installed technology to monitor emissions. And finally, regulators and others must refrain from setting a minimum or maximum price for emissions and must allow the market to set its own.

It has been projected, based on EPA estimates of the future value of carbon, that the value of emissions permits as proposed in the House energy bill will be roughly $60 billion a year in 2012 and will increase to $113 billion in 2025. If sums this large were transferred annually from polluters to those undertaking alternative-energy, conservation, and emissions-abatement programs, these cash flows could help transform the economy into one that is more environmentally benign.

The market is a powerful force for allocating capital and creating wealth. And at a time when climate change threatens the globe, it can also be a powerful force for social change. With so much at stake for the environment, cap-and-trade legislation cannot wait.