

**Addressing the Risks of Climate Change:  
The Environmental Effectiveness and Economic Efficiency of  
Emissions Caps and Tradable Permits,  
Compared to Carbon Taxes**

**Robert J. Shapiro**

**With a Foreword by Ambassador Nancy Soderberg**

**February 2007**

## *Foreword*

**By Ambassador Nancy Soderberg**

Today, there is consensus among scientists – and increasingly among the world’s population – that temperatures are rising due to human burning of fossil fuels. No responsible leader can argue the trends are cyclical or due to natural occurrences. It is beyond dispute that the coal, gas, and oil we burn and our clearing of forests put too much carbon dioxide and other gases into the earth’s atmosphere. Those gases are becoming trapped there and putting our planet – and us -- at risk.

Yet, today, there is little consensus on how best to meet this threat. The current approach has failed to get even the United States on board, much less the developing world. It is time to revive the debate and build a new consensus on meeting this real and present danger. That is why Robert J. Shapiro and I have come together on this project. An eminent national economist and former Undersecretary of Commerce, Dr. Shapiro brings a refreshing and insightful perspective to the debate. This report evaluates the current approach to a global warming regime and concludes there is a better way. As a former diplomat, I see the need to challenge the current stalemate with a fresh approach that could serve as a catalyst to revive the moribund debate over how to stem this danger. Unless there is a new global pact to meet this challenge, we are all at risk.

It is time to rethink Kyoto. After years of arduous negotiations, kick-started at the Rio Earth Summit in 1992 by President George H. W. Bush, an agreement was reached in 1997 on the Kyoto accords. The pact called for the United States and other industrial nations to reduce carbon dioxide and other heat-trapping pollutants to below 1990 levels, setting the first binding limits on emissions of carbon dioxide and other heat-trapping gases that scientists say are contributing to global warming and threaten disastrous climate change.

Yet, America has rejected Kyoto, arguing it places an unfair burden on the United States. The developing world too refuses to participate, arguing it did not cause the current crisis. With America, China, India and other developing nations opting out, Kyoto addresses only one third of the world’s polluters. Without the leadership of the United States and participation by all significant greenhouse gas producers, we cannot meet the risks and challenges of climate change.

Evaluating the current system agreed to in Kyoto, Dr. Shapiro examines a variety of problems that have developed. Called “Cap-and-Trade,” the mechanism Kyoto set up involves a quantitative target for emission reductions and a timetable for achieving them. The system allows countries and companies to buy and sell “rights” to produce the targeted emissions. While this system provides a level of certainty regarding the quantity of emissions, it also involves much more volatility in energy and energy-related prices, as well as significant additional costs to energy-intensive products. Serious administrative problems and prospects of blatant corruption are added costs to the cap-and-trade system.

Dr. Shapiro urges us to consider another approach, a global system of carbon-based taxes. This approach offers a more effective way to reduce greenhouse gas emissions and provides more powerful incentives for the development of new, climate-friendly technologies. While the poorest nations could still be exempt, it would bring many of the developing countries into the project. Such a system would avoid the price volatility and administrative problems associated with cap-and-trade, as well as improve economic efficiency. In raising the price of carbon-intensive products, carbon taxes would make alternative energy sources more competitive. The world's citizens – and planet earth – would benefit.

The challenge is to America's political leaders to think anew and do what is best for this nation. The current consensus among scientists is that climate change is real and poses a threat to our society and ecosystems that requires action. A workable global climate change regime that emphasizes real reductions in emissions is essential to that task. Dr. Shapiro's analysis provides important insights into a better way forward. It is now up to America's leaders to take up the challenge.

# **Addressing the Risks of Climate Change: The Environmental Effectiveness and Economic Efficiency of Carbon Taxes, Compared to Emissions Caps and Tradable Permits<sup>1</sup>**

**Robert J. Shapiro**

## **I. Introduction**

A solid and unambiguous consensus has emerged among scientists and most public officials around the world: Emissions of greenhouse gases from burning fossil fuels, especially carbon dioxide (CO<sub>2</sub>), contribute significantly to climate changes which if unaddressed for much longer could have very serious adverse effects on everyone. These greenhouse gases disperse widely through the upper atmosphere and remain there for many years, so wherever they happen to originate, they affect everyone on the planet. Since every nation with an industrialized economy produces these emissions, they all will have to be part of the global effort to control them. The need is clear, therefore, to identify the most effective and economically efficient ways to reduce these emissions, so we can slow and eventually reverse the climate changes associated with them.

Here, we examine the two most prominent and important strategies for reducing greenhouse gases: A global system of national caps on greenhouse-gas emissions and tradable permits, based on the emissions targets and timetables created by the Kyoto Protocol (cap-and-trade); and global, harmonized, net carbon-based taxes (carbon taxes). Based on recent economic analyses and evidence, it is clear that carbon taxes are the more effective and efficient strategy for addressing climate change, and provide stronger incentives to develop alternative fuels and more energy-efficient technologies.<sup>2</sup>

Since the causes and effects of climate change are global, a serious response will require an international consensus and on-going international collaboration. Climate change is not unique in this regard – no single nation or even many nations acting individually can successfully address such global threats as nuclear proliferation, pandemic disease, transnational terrorism or global financial instability. Since no nation can be forced to participate in any international effort, some will choose to be “free riders” who can enjoy the benefits of stable global capital markets or, someday, a world without transnational terrorism or the threat of climate change, without bearing the costs.

Climate change will be very challenging in this respect, because the benefits will be felt decades from now while the costs have to begin as soon as possible. Moreover,

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<sup>1</sup> We want to acknowledge the American Consumer Institute for its support for this study.

<sup>2</sup> This conclusion is shared by Yale University economist William Nordhaus in a comprehensive review of the economics literature on climate change, from which this report draws extensively. William D. Nordhaus, “Life After Kyoto: Alternative Approaches to Global Warming Policies,” National Bureau of Economic Research, Working Paper 11889, December 2005. Harvard University economist Richard Cooper has also written extensively on the economic advantages of carbon taxes, in “Toward a Real Treaty on Global Warming,” *Foreign Affairs*, Volume 77, No. 2, 1998; and “Alternatives to Kyoto: The Case for a Carbon Tax, 2005, <http://www.economics.harvard.edu/faculty/cooper/papers.html>.

those costs will be significant: A serious program to reduce greenhouse emissions will mean that most people in the world will pay considerably more for carbon-based fuels, especially coal-fired electricity, oil for home and office heating, and gasoline for transportation.<sup>3</sup> As we will see with the Kyoto agreement, this prospect creates the temptation in many countries to be free riders. Yet, there are no alternatives to everyone addressing climate change in serious ways and bearing substantial costs. A new analysis from the McKinsey Global Institute, for example, found that more than half of potential reductions in emissions that would cost less than \$50 per-ton of CO<sub>2</sub> would occur in developing countries.<sup>4</sup>

As a general proposition, there are three policy approaches to reduce the CO<sub>2</sub> emissions that drive climate changes:

- Command and Control Regulation: Mandate quantitative limits on the emissions of each nation or each company and plant;
- Global Caps and Tradable Permits, or “Cap-and-Trade:” Set quantitative targets for emission reductions and timetables to achieve them, and let nations and companies buy and sell “rights” to produce the targeted emissions. Each country would issue and distribute permits to produce emissions up to a capped level, and permits representing any difference between a target or cap and a country or company’s actual emissions can be traded or transferred.
- Carbon Taxes: Raise the cost and price of products and activities that result in CO<sub>2</sub> emissions by taxing the fossil fuels that produce them, either nationally or in a global version through international agreement on a harmonized tax on carbon-based fuels, net of each country’s existing energy taxes and subsidies.

Other policies also affect climate change, especially support for new technologies that can reduce emissions or their adverse effects on the climate, and measures to protect and replant tropical forests. Reforestation and scientific advances will play important roles in serious climate change efforts. Forestry measures are one of the most cost-effective responses available, especially for Latin America and Africa.<sup>5</sup> Moreover, both a strict cap-and-trade program and carbon taxes impose substantial new costs on emissions and the energy that produce them, creating incentives to reduce those costs by developing and using cleaner fuels and more energy-efficient technologies. As a political matter, the higher energy prices required to make meaningful progress will be difficult to sustain without the prospect of technological advances that eventually can stabilize or even bring down those prices. However, depending on future scientific developments alone to solve climate change would be risky.

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<sup>3</sup> Cattle and rice production also will be affected, because they are major sources of methane, the second most damaging greenhouse gas. Richard Cooper, “The Kyoto Protocol: A Flawed Concept,” Fondazione Eni Enrico Mattei Series, Working Paper 52-2001, July 2001.

<sup>4</sup> Per-Anders Enkvist, Tomas Naucler and Jerker Rosander, “A cost curve for greenhouse gas reduction,” *McKinsey Quarterly*, 2007, Number 1.

<sup>5</sup> *Op.cit.*

Of the three major policy approaches, traditional command and control regulation is generally recognized to be unnecessarily inefficient: By mandating the same standard across all firms – or countries -- relatively low-cost and high-cost reductions are pursued equally, so emissions are lowered in a very cost-ineffective way. This leaves the two broad alternatives of quantity-based tradable emission rights and price-based tax mechanisms. Once again, both of these approaches will necessarily result in significantly higher prices for fossil fuels. Carbon taxes raise the price of carbon-based energy directly, imposing the greatest costs of those firms and economies that produce the most emissions. In this way, they have direct incentives to reduce their energy use or substitute cleaner forms of energy, until the cost of doing so is greater than the tax. A cap-and-trade program imposes no direct charge on emissions up to its cap, but the cap for the entire system is substantially lower than its current emissions. Companies and countries whose emissions exceed their caps have to either reduce them by cutting their energy use, substituting cleaner forms of energy, or purchasing permits to cover the gap from those whose emissions are less than their own caps. The costs of the permits or of steps taken to cut energy use or use cleaner fuels are passed on in higher prices, so once again, countries and firms with the highest carbon emissions pay higher prices.

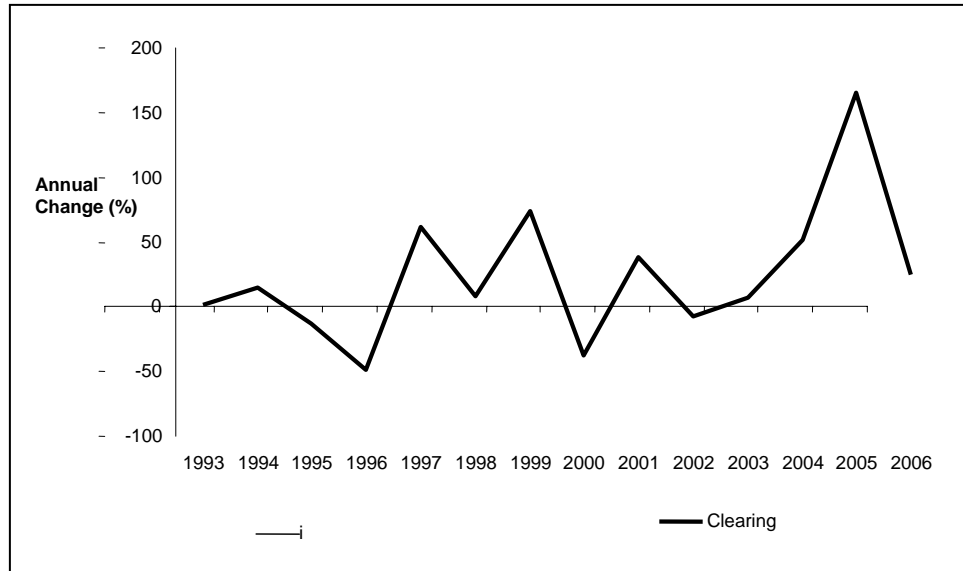
While both approaches necessarily produce higher energy prices, they are very different in three important ways. The critical economic distinction is that cap-and-trade directly controls the *quantity* of emissions, while carbon taxes directly control their *price*. The result is that cap-and-trade can produce a designated quantity of emissions but with much more volatility in energy and energy-related prices, while carbon taxes will produce more certain prices for energy and energy-intensive goods with greater uncertainty about the quantity of emissions. These two tradeoffs are not equivalent. By regulating the quantity of emissions, a strict cap-and-trade program will drive the price of its permits to whatever level is required to bring emissions under its cap. The price of permits and their underlying energy source may rise sharply when emissions happen to increase because, for example, an industry or country's growth accelerates – or the winter is especially cold. This price effect will accentuate normal energy price fluctuations but on a national rather than global basis. Under a cap-and-trade program strict enough to affect climate change, this increased volatility in all energy prices will affect business investment and consumption, especially in major CO<sub>2</sub> producing economies such as the United States, Germany, Britain, China and other major developing countries.

This price volatility is evident in the emission permits traded under the U.S. acid rain program, the major example of cap-and-trade, based on the interaction of its SO<sub>2</sub> caps and energy demand. Over the last 13 years, the clearing prices of these permits have ranged from \$66 in 1997 to \$860 in 2006, moving up or down by an average of more 43 percent a year.<sup>6</sup> Moreover, this volatility has increased in the last three years, when permit prices rose by an average of more 80 percent a year, despite a safety-valve provision allowing the Environmental Protection Agency to auction permits to temper such volatility. The following graph (below) plots the annual percentage changes in the clearing prices for these SO<sub>2</sub> permits.

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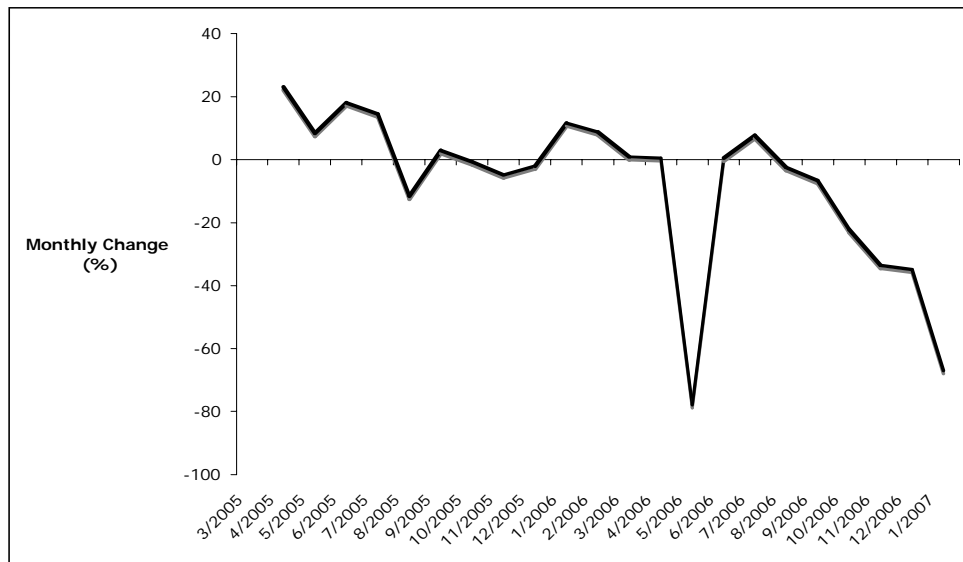
<sup>6</sup> United States Environmental Protection Agency, "Clean Air Markets – Data and Publications," <http://www.epa.gov/airmarkets/auctions/index.html>.

**Figure 1. U.S. Acid Rain Program: Annual Percentage Change in Clearing Prices for SO<sub>2</sub> Permits, 1993 – 2006<sup>7</sup>**



This price volatility has been even greater in the first 22 months of CO<sub>2</sub> permit trading under the European Emissions Trading Scheme (ETS), with price shifts averaging 17.5 percent per-month. This path of this volatility from March 2005 to January 2006:

**Figure 2. European Emissions Trading Scheme: Monthly Percentage Change in Average Prices for CO<sub>2</sub> Permits, March 2005 – January 2007<sup>8</sup>**



<sup>7</sup> *Ibid.*

<sup>8</sup> European Energy Exchange, EU Emission Allowances, 2005, 2006, 2007, [www.eex.de/get.php?f=emission\\_spot\\_historie\\_2005](http://www.eex.de/get.php?f=emission_spot_historie_2005), [www.eex.de/get.php?f=emission\\_spot\\_historie\\_2006](http://www.eex.de/get.php?f=emission_spot_historie_2006), [www.eex.de/get.php?f=emission\\_spot\\_historie\\_2007](http://www.eex.de/get.php?f=emission_spot_historie_2007).

A carbon tax produces no price volatility, because it raises the cost of energy by the constant amount (depending on its carbon content) regardless of how fast a company, industry or a nation's emissions are growing. The predictable cost of a carbon tax also simplifies government and business decisions about the investments and other steps they can take to reduce their emissions and the additional burden of the tax. Its drawback is that no one can predict how much a particular carbon tax will reduce emissions, especially since economic demand also affects its impact, and the tax may be too low to achieve the desired effect on emissions. However, this shortcoming should matter less than the price volatility of cap-and-trade, since it's correctable: the environmental costs of greenhouse gases are long-term, and governments can raise or lower their carbon taxes, year by year, to achieve the desired reduction in emissions. While some prominent proposals for a U.S. domestic CO<sub>2</sub> cap-and-trade system include provisions to auction or distribute additional permits when permit prices increase sharply, this addresses the price volatility only once it has already occurred – and in the case of the acid rain program, making more permits available by auctions has not tamed its price volatility. Depending on how sensitive the distribution of new permits is to the rising prices, it also may sacrifice much of the cap-and-trade system's environmental benefits.

The second important difference is that uniform, net carbon taxes have generally comparable effects from country to country, while a global cap-and-trade program usually does not. When slow growth or mild weather reduces the energy use and emissions of a country or an industry, it will pay less carbon taxes; but in good times or bad times, a uniform net carbon tax will impose comparable costs and provide comparable incentives from country to country to develop and adopt climate-friendly technologies and strategies. By contrast, a global cap-and-trade system creates a wide range of effects and incentives in countries, depending on the base from which it calculates the emissions targets for each country. Once a cap-and-trade agreement determines that a country's emissions should be reduced by a certain percentage relative to its current emissions or to its emissions in some previous base year, the country may be able to meet its target without taking any steps if its economy slows – or it could take serious measures to reduce emissions and still fail to meet its target because its economy grows faster than normal.

This particular drawback of cap-and-trade has cost the Kyoto program most of its potential effectiveness. The agreement includes emissions targets for 2012 averaging about 8 percent below a country's levels in 1990, the year chosen as the base. 1990 was just prior to the final collapse of communism and the closing of thousands of inefficient and high-polluting state-owned enterprises in Russia and Eastern Europe. The result is that Russia and the Eastern European countries are not subject to any real caps or incentives to reduce their emissions, because their caps are calculated from an outdated, high base. On the flip side are the United States, Australia and few other countries which experienced unusually strong growth and energy use since 1990. For them, the 1990 base year produces 2012 caps which they could not meet regardless of how much they invest in new technologies and alternative fuels, unless they pay Russia and Eastern Europe tens of billions of dollars for their excess permits. In contrast to the constant incentives of a carbon tax, the availability of excess permits under cap-and-trade weakens incentives



across the system to develop and use alternative fuels and more-energy efficient technologies.

The third important difference is that cap-and-trade programs are more difficult to administer and more vulnerable to evasion, corruption and manipulation than carbon taxes. The administration of a new carbon tax is relatively straight-forward: Each country would apply to every energy source a tax rate which, after counting the country's current energy taxes and subsidies, produces the global net carbon tax rate; and collect the receipts using the same mechanisms it relies on for existing energy or business taxes. Under cap-and-trade, each country first has to create a new system to distribute its national cap among its energy-related industries and their thousands of companies and plants, in the form of permits; and then set up a new monitoring system to track energy production at every site both before and after any permits are traded.

Cheating also poses a more serious problem for cap-and-trade than for a carbon tax. While some companies will try to evade their carbon taxes, the government on the other side of the transaction has a strong interest in discovering and stopping it. Under cap-and-trade, when a company fraudulently understates its energy production and emissions so it can sell some of them, the buyer on the other side of that transaction has no incentive to uncover or reveal the fraud. The difference helps explain why one expert has concluded that "cheating will probably be pandemic" under cap-and-trade.<sup>9</sup>

By creating tradable financial assets worth tens of billions of dollars for governments to distribute among their industries and plants and then monitor, a global cap-and-trade program also introduces powerful incentives to cheat by corrupt and radical governments. Corrupt governments will almost certainly distribute permits in ways that favor their business supporters and understate their actual energy use and emissions. By doing so – with no one to stop them -- they could potentially make billions of dollars in hard foreign currencies trading "excess" permits, and in the process undermine the program's environmental purpose. A global cap-and-trade program also has no way to prevent radical governments from using such transfers to finance whatever purpose they choose, whether that's education or domestic oppression, foreign assistance or foreign terrorism. Corrupt and radical states can use carbon-tax revenues for such purposes as well, but the resources come not from other, democratic and lawful countries but from their own economies.

Cap-and-trade programs also create a serious potential for private financial manipulation absent under a carbon tax approach. The national and international trading of billions of dollars of permits will attract large financial institutions eager to manage their trading on major security markets, create new derivatives, options, calls and other, financial instruments based on the permits, and collect commissions on both sides of every transaction. The large-scale trading of permit-based securities will create opportunities for corrupt firms to try to manipulate the private market in these permits, as they have in other commodity markets such as natural gas spot contracts and futures.

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<sup>9</sup> Nordhaus, *op. cit.*; see also, "Climate Change Monitoring: International Greenhouse Gas Emissions Trading," [www.emissierechten.nl/climate\\_change\\_moniotring\\_inter.htm](http://www.emissierechten.nl/climate_change_moniotring_inter.htm)

Perhaps the most striking example of this is that Enron, the most egregious energy-market manipulator in modern times, was a strong supporter of Kyoto and had plans to undertake clean-energy projects in developing countries in order to produce credits that Enron expected to resell as substantial profit.<sup>10</sup>

Given these numerous drawbacks, cap-and-trade's principal justification appears to its political feasibility. Many environmental activists assume that a global cap-and-trade program is more achievable politically than global carbon taxes, because most of the world agreed to Kyoto and most people resist higher taxes. On close analysis, the Kyoto agreement is too weak to signify a meaningful consensus for an effective cap-and-trade system. As we will see, numerous analyses of Kyoto have found that it would have very little effect on climate change even over a 60-year period; and the first effort to apply it in an enforceable way, the European Emissions Trading Scheme, is expected to have virtually no effect on emissions. These disappointing results reflect the political accommodations that eroded most of Kyoto's environmental potential, including:

- A complete exemption for developing countries, including major greenhouse-gas producers such as China, India and Brazil;
- An effective exemption for Russia and the Eastern European countries, and substantial leeway for many Western European countries; and
- A system of transfers that would impose such disproportionate costs on the United States that it declined to ratify the agreement.

A global carbon tax sufficiently high to affect climate change might be much less difficult to achieve than generally believed, because governments could use its revenues for other good and popular purposes, such as reducing existing payroll or corporate taxes or financing popular spending programs. If the world community intends to take serious measures to slow and ultimately reverse climate change – as it must do – a global, carbon tax would be preferable to a global cap-and-trade program on economic, environmental and political grounds.

## **II. The Drawbacks and Shortcomings of Cap-and-Trade Systems**

When the world's nations negotiated the cap-and-trade arrangements of the Kyoto agreement in the 1990s, many economists and environmental activists supported them as a politically-acceptable, market-based way to improve the global environment. By the late-1990s, however, researchers had identified a number of serious problems with the cap-and-trade approach, and many began to favor carbon taxes as a superior alternative. Yale economist William Nordhaus recently published a literature review covering recent economic research in this area, and much of the following discussion draws on that review and the research on which it was based.<sup>11</sup>

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<sup>10</sup> *The Washington Times*, April 8, 2002, p. A1.

<sup>11</sup> Nordhaus, *op.cit.*

One serious problem is the well-documented tendency of regulatory approaches that directly limit the quantity of something which people need, to experience large volatility or swings in the price of whatever is regulated. A powerful demonstration of this dynamic occurred from 1979 to 1982, when the Federal Reserve Board shifted from targeting the price of credit (interest rates) to its quantity (monetary aggregates). As demand for credit increased or waned while its quantity of credit remained strictly regulated, interest rates moved much more sharply than at any time before or after this brief period of monetarism.

The same volatility is evident in the leading instance of environmental regulation using quantity targets, the U.S. acid rain program. The program applies cap-and-trade arrangements to major emissions of SO<sub>2</sub> (sulfur dioxide) and NO<sub>x</sub> (nitrogen oxide). Recent analysis found that trading prices for SO<sub>2</sub> and NO<sub>x</sub> emission permits have ranged from \$66 per-ton to as high as \$1,700 per-ton, moving up and down by an average of 10 percent per-month and 43 percent per-year, several times the volatility seen in oil or stock-market prices.<sup>12</sup> The acid rain program is modest in scale, and there is no research on the economic effects of its price volatility. As we will see later, the EU's Emissions Trading Scheme for CO<sub>2</sub> emission permits issued under Kyoto guidelines also experienced serious price volatility in its first two years, with permit prices fluctuating up and down by as much as 80 percent over three months (see Figure 2, above).

Comparable price fluctuations for CO<sub>2</sub> permits under a meaningful cap-and-trade program on a global scale would have serious economic costs, because the underlying source of the permits is global energy use. The largest producers of CO<sub>2</sub> emissions are electricity-generating utilities, especially those powered by high-polluting coal. Consider what would happen under a strict cap-and-trade program when a particularly cold winter or hot summer occurs, or simply when an economy grows faster than trend: CO<sub>2</sub> emissions will rise sharply with electricity consumption; and since the quantity of emission permits would be capped, their price would also rise sharply and be passed on in higher electricity prices. The same dynamic would occur in oil and gasoline prices when demand for those fuels rises.

Any strict, quantity-based approach to climate change will be a source of substantial price volatility that will differ from nation to nation, depending on its cap and shifting energy demand. This volatility would also occur in any national cap-and-trade system, and would affect prices for not only energy but all products whose production is energy- and carbon-emission intensive. If the United States were part of such a system, or if the United States adopts its own, strict cap-and-trade program, its volatility in permit and energy prices would be greater than what might be expected in Japan or Western Europe, since the U.S. economy is more energy-intensive and less energy-efficient than other advanced economies (see Table 1, below).

Price-based regulation such as a carbon tax would produce a near-mirror image of these dynamics, applying a constant increment to the price of energy while allowing volatility in the quantity of emissions as demand for energy rises or falls. Unlike the

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<sup>12</sup> EPA, "Clean Air Markets," *op. cit.*

price volatility created by a strict cap-and-trade program, volatility in the quantity of emissions has little short-term economic costs and in principle could be corrected year to year by adjusting the tax level. Unfortunately, our current state of knowledge about the extent and pace of global warming cannot provide a clear or objective basis for determining how much emissions should be reduced under either cap-and-trade or a carbon tax.

The complex trading arrangements of a serious cap-and-trade program also introduce major administrative problems that are likely to degrade its environmental results and raise the economic costs. Once negotiators determine a global cap and distribute it across the involved nations, each government distributes its nation's permits among its industries and companies. Even in the most transparent and democratic society, distributing a scarce and valuable benefit through the normal political process invites enormous pressures that produce typically special preferences for influential interests and companies. For example, the German government announced in June 2006 that it would exempt its coal industry, the country's largest greenhouse-gas producer, from its CO<sub>2</sub> caps under the European ETS. In countries without a transparent, democratic process – Russia, the Ukraine, and many others – these special-interest pressures may go unchecked, and political favoritism and corruption may largely determine how the permits are distributed.

The subsequent trading of the permits introduces additional problems. Any global cap-and-trade program will have to cover hundreds of thousands of installations in scores of countries, and trades will require accurate measurements of energy production on both sides of transaction, before and after the trade.<sup>13</sup> That may be plausible in advanced countries with elaborate, professional regulatory systems, but it's considerably less so in transitional economies such as the Czech Republic, Romania and China, and frankly implausible in places such as Russia and the Ukraine. Cap-and-trade systems may provide incentives as well as opportunities for cheating and corruption in the measurement of the energy and emissions subject to trading, because the buyer and the seller can gain by understating their actual energy production and emissions as doing so raises the seller's income and reduces the buyer's per-unit cost. Even if only the seller cheats by understating its energy production and emissions (creating or increasing the permits it can offer for sale), the buyer has no incentive to discover or reveal the fraud. Companies will try to cheat under a carbon tax system as well; but the government on the other side of that transaction has strong incentives to discover and stop it.

Cap-and-trade programs create new financial opportunities and temptations for countries as well as companies, because, as Nordhaus notes, “limiting emissions [through caps] creates a scarcity where none previously existed – in essence printing money for those in control of the permits.”<sup>14</sup> A global cap-and-trade system necessarily will include countries ruled by corrupt or radical regimes – as Kyoto does – presumably eager to trade

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<sup>13</sup> The trades may be conducted through professional institutions such as the Dutch ERUPT program or other special national agencies, the World Bank's Carbon Fund representing six governments and 17 major utility and energy companies, or even private commodity exchanges.

<sup>14</sup> Nordhaus, *op. cit.*

their permits and so raise billions of dollars or Euros for their own purposes. For example, under Kyoto's current terms, Russia will be able to offer permits worth tens of billions of dollars for international sale; and if the United States had ratified the agreement, much of those funds would have come from America. Under a global-cap-and-trade program, countries such as Iran, Syria and the Sudan also might be able to raise international capital by selling permits; and even under Kyoto, they can receive credits for clean-energy investments which can be traded like permits to raise funds.<sup>15</sup>

An international system of permits involving tens of billions of dollars a year also will give rise to extensive permit trading through private securities markets. Already, entrepreneurs have created private funds that invest in emissions instruments, and established the Chicago Climate Exchange (CCX) and a European subsidiary, the European Climate Exchange (ECX), to trade these instruments.<sup>16</sup> As private trading grows, it will give rise to derivatives, options, calls, short selling and more exotic financial transactions, all based on the emissions permits. These developments could produce a more efficient global allocation of the permits, but normal profit-seeking by financial institutions operating on both sides of every transaction will reduce the overall economic benefits from the system. In an era of financial deregulation, especially in commodity markets, the trading of financial instruments based on emissions permits also creates the potential for financial manipulation. As recent scandals in the United States demonstrate, even countries with very sophisticated financial markets and enforcement systems attract practitioners eager to develop ways to influence or manipulate market prices. For example, cap-and-trade requires accurate measurements of energy production, and manipulators have deliberately supplied inaccurate information to illegally influence prices in the U.S. market for natural gas futures, at a cost to consumers of billions of dollars.<sup>17</sup> None of these issues arise in a global carbon-tax program, since tax obligations and collections are not and do not give rise to tradable financial instruments.

### *Problems with Kyoto's Targets and Timetables*

The Kyoto agreement was signed and ratified by 165 nations, signed and still awaits ratification by two other nations (Croatia and Kazakhstan), and signed by two more countries that subsequently declined to ratify it (the United States and Australia). Despite its generally broad global support, Kyoto commits only 38 industrialized countries – 36 with the withdrawal of the United States and Australia -- to do anything before it expires in 2012.<sup>18</sup> These 36 countries agreed to achieve specific reductions in their CO<sub>2</sub> and other greenhouse emissions ranging from 8 percent below 1990 levels for the European Union (EU) and 6 percent below 1990 for Japan, to 10 percent above 1990

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<sup>15</sup> A recent study found that corruption of the permit trading process by dictators and dishonest administrators would be harmful to economic growth. Ragnar Torvik, "Natural Resources, Rent Seeking and Welfare," *Journal of Development Economics*, 2002, vol. 67.

<sup>16</sup> One example is Emissions Trading PLC, currently registered with the London Stock Exchange.

<sup>17</sup> Robert J. Shapiro and Nam Pham, "An Analysis of Spot and Future Prices for Natural Gas: The Roles of Economic Fundamentals, Market Structure, Speculation and Manipulation," National Legal and Policy center, August 2006.

<sup>18</sup> The agreement covers six separate emissions – CO<sub>2</sub> (carbon dioxide), CH<sub>4</sub> (methane), N<sub>2</sub>O (nitrous oxide), HFC (hexafluorocarbon), PFC (perfluorocarbon) and SF<sub>6</sub> (sulfur hexafluoride).

emissions for Iceland. The Kyoto agreement also allows countries and companies to buy and sell rights to produce emissions. Since the cost of reducing emissions differs from plant to plant, industry to industry and country to country, this trading provision creates a market for emission rights that can help ensure that emission reductions consistent with the overall targets occur where they can be achieved relatively inexpensively.

The Kyoto-based arrangements embody the general deficiencies of quantity-based regimes, plus problems specific to the terms of the agreement and the political process that produced it. The two aspects of the agreement that most seriously impair its effectiveness and efficiency are the base year from which its targeted reductions are calculated and the exclusion of developing nations from the targets. Both aspects were considered necessary to achieve a political agreement; together they profoundly weaken the entire project.

The base year always presents a problem for quantity-based programs, because it makes it difficult to deal with subsequent increases or declines in emissions unrelated to the targets or the program's efforts to control emissions. An unanticipated national economic boom or long spells of unusually cold or hot weather will increase a country's energy consumption, emissions and the consequent costs its industries and consumers will have to pay, even if they have reduced their emissions per-unit of production. Similarly, an economic setback or unusually temperate weather will lower a country's emissions for a time and ease pressures to reduce them, even if the country and its industries have made no environmental progress at all.

In 1997, the parties to Kyoto designated 1990 as the base year from which it would calculate its 2008-2012 national targets for lower emissions. The choice of 1990 created serious distortions which will sharply limit the entire effort's environmental impact. First, 1990 was the peak year of economic activity in the Soviet Union and Eastern Europe before their state-directed economic systems unraveled. The World Bank reports that Russia's economic production slumped from \$385 billion in 1990 (2000 \$) to \$286 billion in 2002, while Russian CO<sub>2</sub> emissions fell from 2.26 million tons to 1.43 million tons.<sup>19</sup> Since Russia's Kyoto target is an 8 percent reduction from its 1990 levels of 2.26 million tons, that base year relieves Russia of any obligation to reduce emissions and actually provides the Russian government with an enormous financial windfall in excess, tradable permits. According to one estimate, if the 38 nations assigned targets under Kyoto all participated in permit trading, Russia and the countries of Eastern Europe could sell about \$40 billion a year in excess permits (1990 dollars), principally to companies in the United States and Japan.<sup>20</sup>

Kyoto's 1990 base year also allows Germany and United Kingdom, which together account for 80 percent of the EU-15's targeted reductions, to avoid serious steps to reduce their emissions. Following Germany's reunification in October 1990, much of

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<sup>19</sup> World Bank, *World Development Indicators*, 2006.

<sup>20</sup> Nordhaus, op cit., results generated by 2001-Rice Model, a modification of the model described in *Warming the World: Economic Models of Global Warming*, by William Nordhaus and Joseph Boyer, MIT Press, 2000.

East Germany's out-dated and high-polluting state-owned industrial plants were dismantled or closed down. As a result, Germany's target of 8 percent reductions from a 1990 base also became, in effect, a license to increase emissions. Similarly, the privatization of British coal mining in the mid-1990s cut coal use in Britain just as its North Sea natural gas operations expanded, allowing Britain as well to meet an 8 percent reduction target calculated from a 1990 base which actually increasing its emissions.<sup>21</sup>

The 1990 baseline also penalizes countries that had already made substantial progress in reducing emissions. The Netherlands, Sweden, Denmark and Japan, which had controlled much of their emissions by 1990, will find it more difficult and expensive to further reduce them and will have to purchase additional permits from Russia and Eastern Europe. The Kyoto baseline would also effectively penalize the United States and Ireland for their relatively strong growth since 1990, which increased their energy use and emissions independent of steps they might take to reduce CO<sub>2</sub> emissions. With the U.S. withdrawal from the Kyoto arrangements, Ireland and the strong-growth countries of Scandinavia will pay more of Kyoto's total cost.

Kyoto's prospects for affecting climate change are further undermined by the blanket exemption granted most developing countries, including major global sources of CO<sub>2</sub> emissions such as China, India and Brazil. Those and other developing nations agreed to ratify Kyoto only if it posed no constraints on their economic development; and as recently as 2006, China reiterated its refusal to accept emission caps at any time. These exemptions sharply reduced the agreement's potential effectiveness by concentrating all of the reduction 38 countries that produce just a little over half of all emissions, and especially on the United States as the world's largest economy and CO<sub>2</sub> producer.<sup>22</sup> With the U.S. withdrawal, the agreement now covers just 30 percent of global emissions. The exemptions for developing countries also seriously impair the program's economic efficiency, since many of the most cost-effective opportunities to reduce emissions would occur as developing economies replace old industrial plant and build new energy infrastructure, or find alternatives to deforestation.

Exempting major producers of greenhouse gases in the developing world also could produce a series of environmentally-perverse results. The emission targets or caps applied to the 36 participating countries ("Annex-1" countries under the agreement) – or at least to some of them -- create a comparative economic advantage for the rest of the world in producing greenhouse-gas intensive goods ("non-Annex-1" countries). As a result, Kyoto could shift some CO<sub>2</sub> emitting plant from western countries subject to its targets to developing nations exempt from them, producing an appearance of progress without actually controlling any emissions. In addition, if the Kyoto targets reduce demand for oil and coal in Annex 1 countries, as intended, while non-Annex-1 countries are exempt from those targets, the lower demand in the covered countries may depress

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<sup>21</sup> Joseph Aldy, Scott Barrett and Robert Stavins, "Thirteen Plus One: A Comparison of Global Climate Policy Architectures," Kennedy School of Government Working Paper No. RWP03-012, Harvard University.

<sup>22</sup> Nordhaus, *op. cit.*

worldwide prices for oil and coal and so encourage their greater use in the exempt countries.<sup>23</sup>

An econometric simulation of the costs and benefits for the world's regions estimates that the benefits will exceed the costs only for those countries that are exempt from the costs -- the countries of the former Soviet Union and Eastern Europe, and the developing countries outside the system of targets and timetables.<sup>24</sup> If the United States participated, it could face net long-term costs of more than \$5 trillion, while Western Europe, Japan, Canada and Australia together would face \$2 trillion in net costs. Given such projections, the U.S. decision to withdraw was inevitable.

Much like the choice of the 1990 base year, the designation of those countries subject to Kyoto targets and those which are exempt has no clear economic or environmental justification. It is not based, for example, on a nation's ability to bear the costs: Kyoto covers numerous Eastern and Central European countries with *per capita* incomes of less than \$10,000 -- including Estonia, Slovakia, Croatia, Poland, Lithuania and Russia, and even the Ukraine with one of the world's lowest *per capita* GDP (\$1,766) -- while exempting not only genuinely poor countries in Africa, Asia and Latin America, but also wealthy Middle Eastern states such as Qatar with a *per capita* GDP of \$43,110, and the United Arab Emirates, Kuwait and Brunei, with *per capita* GDP of more than \$20,000. The exempt countries also include many major producers of greenhouse gases -- some with relatively low *per capita* incomes such as China, India, Brazil and Mexico, and other industrialized polluters with substantial *per capita* GDPs such as Singapore, Taiwan, Korea and Hong Kong.

The justification usually cited is historical equity: Since the developed countries were responsible for most of the current stock of greenhouse gases, they should bear the cost. It's true that wealthy countries were largely responsible for the greenhouse gases produced in the 1970s and 1980s. By 2002 when Kyoto was approved, however, six major non-Annex 1 countries -- China, India, Korea, Brazil, Mexico and South Africa -- already accounted for more than 25 percent of global CO<sub>2</sub> emissions.<sup>25</sup> China's carbon emissions alone increased 46 percent from 1990 to 2002, from nearly 2.4 million kilotons to more than 3.5 million kilotons; and its emissions are likely to overtake the United States within 10 years. By 2012, China and those five other large, exempt nations will produce more than one-third of global CO<sub>2</sub> emissions; and their rapid economic progress makes them fully capable of assuming responsibility to reduce them.<sup>26</sup>

The result of these exemptions and the 1990 base year is that under its current terms, Kyoto will produce no significant progress in global warming: Even if all of its provisions were successfully implemented and the United States participated fully, Kyoto

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<sup>23</sup> Aldy, *et. al.*, *op. cit.*

<sup>24</sup> *Ibid.* By this calculation, the former Soviet Union and Eastern Europe would gain about \$2 trillion, and the other developing nations would gain about \$750 billion.

<sup>25</sup> World Bank, World Development Indicators, 2006.

<sup>26</sup> Over the next decade, China plans to will build more coal-fired electricity plants than the United States and Europe combined, producing large CO<sub>2</sub> emissions for the next half-century.



would reduce emissions in 2010, compared to taking no action at all, by three-quarters of one percent,<sup>27</sup> and would abate the expected increase in global temperatures between now and 2050 by only 0.05 degrees Celsius.<sup>28</sup>

### *The Impact of Kyoto on the United States*

The United States decided to withdraw from Kyoto, because its original terms would have imposed large economic costs on the American economy while producing very little environmental benefits. First, it would shift most of its initial costs to the United States, because the 1990 base year creates caps that put little or no pressure on most other countries subject to its targets (the other exceptions Japan, Australia and Canada). From 1990 to 2002, while CO<sub>2</sub> emissions fell by some 13 percent in Germany (credit unification and slow growth), by nearly 5 percent in the United Kingdom (credit the privatization of British coal), and by 37 percent in Russia, they increased 21 percent in the fast-growing U.S. economy – and by 31 percent in Australia, which also withdrew from Kyoto, 24 percent in Canada and 12 percent in Japan.<sup>29</sup> As a result, according to analysis by Harvard economist Richard Cooper, Kyoto would require emissions cuts in 2010, relative to 1990 levels, of 29 percent by the United States, 30 percent by Australia and 25 percent by Japan. By contrast, it would require a 12 percent cut for Western Europe – and permit emission increases of 27 percent by Eastern European countries, 34 percent by Russia, 72 percent by the Ukraine, and unlimited increases by such major sources of CO<sub>2</sub> emissions as China, Korea, Brazil and Saudi Arabia.<sup>30</sup>

**Table 1. CO<sub>2</sub> Emissions, Selected Economies, 1990 and 2002 (kilotons)<sup>31</sup>**

	Emissions – 1990	Emissions – 2002	Percent Change
<b>United States</b>	<b>4,817,475</b>	<b>5,834,448</b>	<b>21.1%</b>
<b>Australia</b>	<b>272,232</b>	<b>355,760</b>	<b>30.7%</b>
<b>Japan</b>	<b>1,070,665</b>	<b>1,201,569</b>	<b>12.2%</b>
<b>Germany</b>	<b>980,549</b>	<b>849,967</b>	<b>- 13.3%</b>
<b>United Kingdom</b>	<b>569,294</b>	<b>542,745</b>	<b>- 4.7%</b>
<b>France</b>	<b>362,439</b>	<b>367,711</b>	<b>1.5%</b>
<b>Russia</b>	<b>2,262,336</b>	<b>1,430,569</b>	<b>-36.8%</b>
<b>Korea (exempt)</b>	<b>241,179</b>	<b>445,461</b>	<b>84.7%</b>
<b>Brazil (exempt)</b>	<b>202,612</b>	<b>313,242</b>	<b>54.6%</b>
<b>Saudi Arabia (exempt)</b>	<b>179,865</b>	<b>339,997</b>	<b>89.0%</b>
<b>China (exempt)</b>	<b>2,398,858</b>	<b>3,507,360</b>	<b>46.2%</b>

As noted earlier, the environmental benefits of this perversely selective approach would amount to a potential slowing in global warming of less than one-third of one degree Celsius by 2050. And the cost to the United States in 2010, according to four

<sup>27</sup> Nordhaus, *op. cit.*

<sup>28</sup> Richard Cooper, “The Kyoto Protocol: A Flawed Concept,” Fondazione Eni Enrico Mattei Series, Working Paper 52-2001, July 2001, <http://www.economics.harvard.edu/faculty/cooper/papers.html>.

<sup>29</sup> *Ibid.*

<sup>30</sup> Cooper, “Alternatives to Kyoto,” *op. cit.*

<sup>31</sup> World Bank, World Development Indicators, 2006

independent estimates, could range from \$93 billion to \$154 billion (2006 \$), much of which would have flowed in permit payments to Russia, the Ukraine and Eastern Europe, or, if they received credits for clean-energy projects, to places such as China and Iran.<sup>32</sup>

Any serious program to address climate change will involve substantial commitments for the United States, because it is the world's largest economy and the largest producer CO<sub>2</sub> emissions.<sup>33</sup> A serious climate-control program also would provide important incentives and opportunities for the U.S. economy to become less carbon-intensive and more energy-efficient – as it also should for countries such as China, Singapore and Saudi Arabia, which are less energy-efficient than the United States. In 2005, the United States produced almost 21 kilograms of CO<sub>2</sub> emissions for every \$1 of GDP (2000 PPP), more than three times the emissions per-dollar as Germany, more than twice the per-dollar emissions of Italy, France or Sweden, and 85 percent more emissions per-dollar than Japan. (Table 2).<sup>34</sup> The United States may always generate more CO<sub>2</sub> per-dollar of GDP than most European economies, because America's vast geographical area requires greater use of transportation. But the current disparities also reflect much stronger incentives in Europe and Japan for energy efficiency created by their higher energy taxes.

**Table 2. CO<sub>2</sub> Emissions Per Dollar of GDP), Selected Economies, and Their Carbon Efficiency Relative to the United States<sup>35</sup>**

	CO <sub>2</sub> Emissions Per \$ GDP (2000 PPP)	Carbon Efficiency Relative to U.S.
<b>Germany</b>	<b>6.01 kilograms</b>	<b>348%</b>
<b>Brazil</b>	<b>6.23 kilograms</b>	<b>335%</b>
<b>France</b>	<b>9.78 kilograms</b>	<b>214%</b>
<b>Sweden</b>	<b>9.92 kilograms</b>	<b>211%</b>
<b>Japan</b>	<b>11.27 kilograms</b>	<b>185%</b>
<b>United Kingdom</b>	<b>13.82 kilograms</b>	<b>151%</b>
<b><i>United States</i></b>	<b><i>20.89 kilograms</i></b>	<b><i>--</i></b>
<b>Russia</b>	<b>21.20 kilograms</b>	<b>98%</b>
<b>Saudi Arabia</b>	<b>26.73 kilograms</b>	<b>82%</b>
<b>Singapore</b>	<b>28.57 kilograms</b>	<b>63%</b>
<b>China</b>	<b>39.07 kilograms</b>	<b>13%</b>

<sup>32</sup> Michael E. Canes, "Economic Modeling of Climate Policy Impacts," The Climate Policy Center, November 2003.

<sup>33</sup> In 2005, the United States produced 7.15 million metric of CO<sub>2</sub>, an increase of about 1 million metric tons or roughly 17 percent since 1990. The electric power sector accounts for about 40 percent of those emissions, transportation another 33 percent, and the remaining 26 percent come from non-electricity related energy use by households, commercial businesses and industrial plants. Roughly 42 percent of U.S. CO<sub>2</sub> emissions come from petroleum, followed by coal-related emissions at 37 percent and natural gas related emissions at 21 percent. Energy Information Administration, U.S. Department of Energy, [http://www.eia.doe.gov/oiaf/1605/ggrpt/executive\\_summary.html](http://www.eia.doe.gov/oiaf/1605/ggrpt/executive_summary.html).

<sup>34</sup> World Bank, "World Development Indicators," 2006.

<sup>35</sup> *Ibid.*

### III. Cap-and-Trade Programs in Practice

#### *The U.S. Acid Rain Program*

The United States has considerable experience with emission-trading programs. Since 1974, the Environmental Protection Agency (EPA) has allowed companies to meet certain requirements of the Clean Air Act by using “credits” from one source within a plant to offset other highly-polluting sources in the same plant. Moreover, the Acid Rain Program applies a cap-and-trade system to sulfur dioxide (SO<sub>2</sub>) emissions, with the goal of reducing those emissions by 2010 to half their 1980 levels.<sup>36</sup> In the program’s first phase from 1995 to 2000, the EPA distributed permits to 61 electrical utilities operating 263 SO<sub>2</sub>-intensive units at 110 plants.<sup>37</sup> In Phase II beginning January 1, 2000, the EPA extended the program to cover nearly all U.S. electricity-generating plants and allowed plants that reduce their emissions below their allotted allowances to sell their excess permits to other plants and companies through commodity brokers or designated non-profit organizations. The EPA monitors and tracks each plant’s emissions, imposes substantial fines (\$2,000 per-ton) and reductions in future allowances for plants exceeding their allotted allowances, and retains additional permits that can be purchased through public auctions.<sup>38</sup>

On its current path, the Acid Rain Program will reduce SO<sub>2</sub> emissions by roughly 8 million tons in 2010 or close to its stated goal.<sup>39</sup> Some scientists have questioned the ecological significance of these reductions, and some economists question the role of the tradable permits in securing them; but most analysts have concluded that the reductions will produce substantial health benefits, mainly from reductions in airborne particulates.<sup>40</sup> However, virtually all of the evaluations link these successes to factors that would be notably absent from a global CO<sub>2</sub> cap-and-trade program – its relatively small scale, which facilitates accurate monitoring and enforcement, and its centralized and uniform monitoring and enforcement operations by the EPA.<sup>41</sup> It’s noteworthy that even so, violations have been common. In 2003, for example, the EPA successfully prosecuted 20 Texas facilities for failing to disclose nearly 16,000 tons of pollutants,<sup>42</sup> the Wisconsin Electric Power Company for increasing its emissions without installing required

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<sup>36</sup> One allowance allows a source to emit one ton of sulfur dioxide. EPA, “Cap and Trade: Acid Rain Program, Basics” <http://www.epa.gov/airmarkets/capandtrade/arbasics.pdf>.

<sup>37</sup> Robert Stavins, “Experience with Market-Based Environmental Policy Instruments,” Kennedy School of Government Working Paper No. 00-004, Harvard University, 2002.

<sup>38</sup> Approximately 3 percent of all allowances are available by public auction each March by the EPA.

<sup>39</sup> Approximately 80 percent of this reduction comes from reductions in sulfur dioxide emissions from their 1990 levels and the other 20 percent is a result of preventing an increase in emissions. Chestnut, Lauraine G., Mills, David M., “A fresh look at the benefits and costs of the US acid rain program,” *Journal of Environmental Management*, September 19, 2005, p. 254. Also, Carlson, Curtis, Burtraw, Dallas, Cropper Maureen, and Palmer Karen, “Sulfur Dioxide Control by Electric Utilities: What Are the Gains from Trade?” *Resources for the Future*, Discussion Paper 98-44-REV, April 2000, pp. 3-4.

<sup>40</sup> *Ibid.*

<sup>41</sup> EPA, “Cap and Trade: Acid Rain Program Basics,” op. cit. .

<sup>42</sup> <https://www.environmenttexas.org/newsroom/clean-air-news/clean-air-news/report-major-texas-polluters-under-reporting-80-percent-of-emissions>.

controls,<sup>43</sup> and the Virginia Electric and Power Company for major violations of its SO<sub>2</sub> and N<sub>2</sub>O caps.<sup>44</sup> And as noted earlier, the program's quantity caps on SO<sub>2</sub> and NO<sub>x</sub> emissions produced fluctuations averaging 10 percent a month and 43 percent a year in the trading price of the permits.<sup>45</sup>

### *The European Emissions Trading Scheme*

Under the European Emissions Trading Scheme (ETS), the 25 countries of the European Union elected to treat their Kyoto targets as emissions caps or allowances, directed each member-country to propose a National Allocation Plan (NAP) to allocate its capped emissions through permits distributed to its industries and firms, and authorized these countries and their industries to trade those permits among themselves.<sup>46</sup> Phase I of the ETS began January 1, 2005, covering CO<sub>2</sub> emissions from 11,400 major sources owned by 5,000 companies in six key industries (energy, steel, cement, glass, brick-making and paper-cardboard), which together account for about half of EU carbon emissions.<sup>47</sup> Phase II is scheduled to run from 2008 to 2012 and will apply lower caps to CO<sub>2</sub> emissions and cover other greenhouse gases and additional sources.<sup>48</sup>

Much like the U.S. acid rain program, the ETS is designed to focus emission reductions where they can be achieved most cheaply and efficiently: A company that can reduce its emissions for less than the going price for a permit presumably will do so and sell its excess permits to other companies unable to reduce their emissions for less than the price of a permit.<sup>49</sup> But the two programs are very different in scale, basic administrative approaches and, so far, effectiveness. While the EPA manages and enforces the acid rain program, each country in the ETS sets, distributes and enforces its emission allowances independently, with no single authority overseeing the whole trading system. This decentralized structure assured the small nation-members of the ETS that the large EU countries would not be able to dictate their emission arrangements, but at significant cost to the program's effectiveness.<sup>50</sup> The ETS also adopted many of the deficiencies of Kyoto, minimizing each country's burden of adjustment by using "grandfathering" provisions and various high-emission years as their baselines.<sup>51</sup> These deficiencies often extend to the allocation of permits within countries, with energy-intensive industries using inflated baselines to secure large emission allowances.<sup>52</sup>

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<sup>43</sup> <http://yosemite.epa.gov/opa/admpress.nsf/b1ab9f485b098972852562e7004dc686/383a40d0cc9b8e6285256d17005a99e4!OpenDocument>.

<sup>44</sup> *Ibid.* Other violators in 2003 include Archer Daniels Midland and Alcoa, which each agreed to fines of \$330 million to \$340 million. .

<sup>45</sup> *Ibid.*

<sup>46</sup> "The European Union Emissions Trading Scheme (EU-ETS) Insights and Opportunities," Pew Center on Global Climate Change, p. 7.

<sup>47</sup> "National Allocation Plans 2005-7: Do They Deliver? Key Lessons for Phase II of the EU ETS," Climate Action Network Europe, 2006.

<sup>48</sup> "The European Union Emissions Trading Scheme (EU-ETS) Insights and Opportunities," *op. cit.*, p. 7.

<sup>49</sup> "National Allocation Plans 2005-2007: Do They Deliver?" Climate Action Network Europe, April 2006.

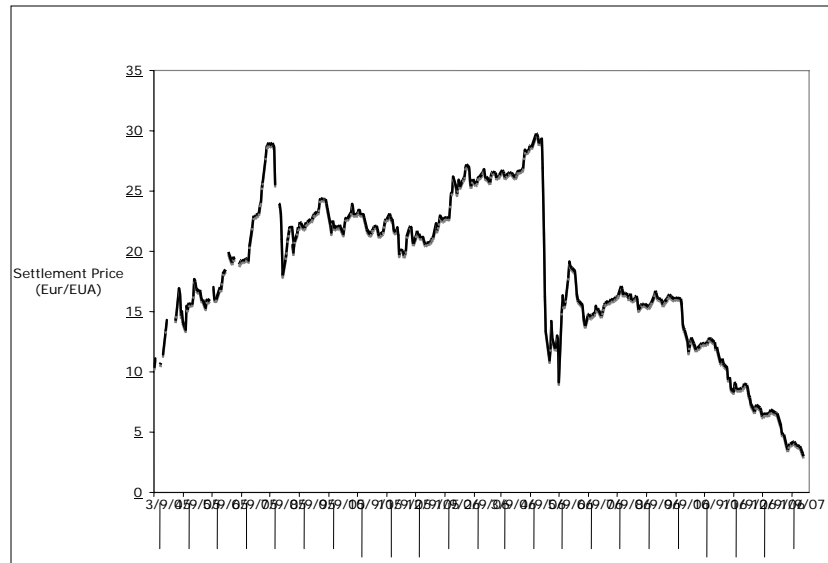
<sup>50</sup> Egenhofer, Christian, Fujiwara, Noriko, Ahman, Markus, Zetterberg, Lars, "The EU Emissions Trading Scheme: Taking Stock and Looking Ahead," *European Climate Platform*, July 2006, p. 3.

<sup>51</sup> "National Allocation Plans 2005-2007: Do They Deliver?" Climate Action Network Europe, April 2006.

<sup>52</sup> Egenhofer, Christian, *et. al.*, *op. cit.*, p. 3.

In Phase I, these approaches produced an overall emissions cap so high that it exceeded total EU emissions by 100 million tons in 2005; and of the 25 countries, only Germany, Austria and Spain had caps lower than their actual emissions.<sup>53</sup> In addition, the overall price volatility of ETS permits has been as great as under the acid rain program, moving up or down by an average of 10 percent per-month in its first 12 months and 23 percent per-month since March 2006.<sup>54</sup> From March 2005 to February 2006, permit prices predominantly moved up, with initial increases of 17 percent per-month in the first four months, before the over-allocation of permits became fully apparent, and average increases of 6 percent per-month for the first 12 months. Since then, ETS permit prices have moved predominantly down, with average price declines of 23 percent per-month. These sharp declines in permit prices have greatly reduced incentives for firms to limit their emissions.<sup>55</sup>

**Figure 3. European Emissions Trading Scheme:  
Daily Price Movements of CO<sub>2</sub> Permits, March 2005 – January 2007<sup>56</sup>**



Some European governments have allocated their permits in ways that further blunt the impact of their emissions caps. For example, new plants in Germany receive permits corresponding to 130 percent of their expected emission levels (by contrast, new plants in Sweden receive permits covering just 60 percent of the levels of existing plants

<sup>53</sup> “EU states accused over ‘permits to pollute’ system,” Times Online, October 9, 2006, retrieved from <http://www.timesonline.co.uk/article/0,,5-2394909,00.html>, January 9, 2007.

<sup>54</sup> European Energy Exchange, EU Emission Allowances, 2007, [www.eex.de/get.php?f=emission\\_spot\\_historie\\_2005](http://www.eex.de/get.php?f=emission_spot_historie_2005), [www.eex.de/get.php?f=emission\\_spot\\_historie\\_2006](http://www.eex.de/get.php?f=emission_spot_historie_2006), [www.eex.de/get.php?f=emission\\_spot\\_historie\\_2007](http://www.eex.de/get.php?f=emission_spot_historie_2007).

<sup>55</sup> That is, industries have been able to produce as much CO<sub>2</sub> as they want without incurring any additional costs. “EU trading of pollution credits fails on goals,” *International Herald Tribune*, July 24, 2006.

<sup>56</sup> European Energy Exchange, EU Emission Allowances, 2007, *op. cit.*

in the same industry.<sup>57</sup> Most governments also reclaim the allowance for any plant closed by a firm, reducing a company's incentive to close high-emissions facilities and open plants with cleaner technologies.<sup>58</sup>

As predicted, the ETS also appears vulnerable to favoritism and evasion. Most ETS members ignored EU directives to conduct two rounds of open, public consultations to develop their national allocation plans, and instead worked with industry groups behind closed doors.<sup>59</sup> Climate Action Network Europe (CAN-Europe), the region's leading umbrella group for environmental organizations, also has found that many ETS members have little capacity to monitor or verify the energy use or emissions of those who hold the permits.<sup>60</sup> Without strict monitoring and verification, companies have powerful incentives to underreport their energy and emissions and so profit from trading "excess" allowances.

As a result of all of these factors and deficiencies, the ETS is failing to reduce European CO<sub>2</sub> emissions. In 2005, total CO<sub>2</sub> emissions across the EU-25 actually increased by 0.4 percent, and by 0.6 percent among the EU-15.<sup>61</sup> Nor are the signs more encouraging for Phase-2 of the ETS. The EU reports that 11 of the EU-25 have failed to submit their completed NAPs for Phase-2,<sup>62</sup> and those which did comply consistently project much higher emissions than most independent analyses.<sup>63</sup> Finally, the European Environmental Agency has projected that the EU is likely to achieve no more than one-quarter of its Kyoto-targeted reductions by 2012,<sup>64</sup> and much of those "reductions" will simply reflect credits purchased from Russia or non-Annex-I countries, with no net environmental benefits.

## V. The Case for Carbon Taxes

A system of carbon-based taxes is the major and preferable alternative to a cap-and-trade regime, for both reducing greenhouse gas emissions and providing additional incentives for the development and spread of new, climate-friendly technologies. Here,

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<sup>57</sup> Egenhofer *et. al.*, *op cit.*, p. 4

<sup>58</sup> *Ibid.*, p. 5.

<sup>59</sup> "National Allocation Plans 2005-2007: Do They Deliver?" Climate Action Network Europe, April 2006, p. 7.

<sup>60</sup> *Ibid.* p. 7.

<sup>61</sup> "Annual European Community greenhouse gas inventory 1990-2004 and inventory report 2006," Submission to the UNFCCC Secretariat, European Environment Agency, December 2006, pp. 12-13. Spain was the standout, with CO<sub>2</sub> emissions rising by nearly 20 million tons after a drought forced Spanish utilities to substitute fossil fuels for hydropower..

<sup>62</sup> "Climate change: Commission takes legal action over missing national allocation plans, incomplete emissions reports," December 12, 2006, <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/06/1763&format=HTML&aged=0&language=EN&guiLanguage=en>.

<sup>63</sup> Rathmann, Max, Reece, Gemma, Philipsen, Dian, and Voogt, Monique, "Initial Assessment of National Allocation Plans for Phase II of the EU Emission Trading Scheme," *Ecofys*, November 2006, p. 9.

<sup>64</sup> "Greenhouse gas emission trends and projections in Europe 2006," European Environment Agency, EEA Report no 9/2006, p. 5.

we review the evidence and analysis which indicate that a carbon-tax approach would be more efficient and effective than cap-and-trade.

The first burden for any tax-based regulatory approach is the general proposition that taxes make an economy less efficient by affecting its “relative prices.” The gist of this point is that whatever is taxed becomes more expensive relative to what remains untaxed, so what consumers and corporations buy and use is no longer determined simply by market prices reflecting the costs to produce them. Since every government needs revenues, the challenge is to design taxes so they distort those relative prices as little as possible. Part of the answer is to make the base of the tax as broad as possible, so its rate can be low and most people and activities are affected equally. Carbon taxes generally meet this criterion, although not as well as broad income or consumption taxes. However, their economic drawback of raising the price of carbon-intensive products and operations, relative to those which are not carbon-intensive, is also their environmental purpose.

A close analysis shows that concern about the efficiency effects of carbon taxes on relative prices is largely misplaced. Efficient markets depend on not only the government’s disturbing relative prices as little as possible, but also on a close correspondence between the prices of goods and services and the total costs to produce them. Economists have long recognized, however, that the pollution created by the production and use of fossil fuels is a cost of those fuels not captured in their price. These “externality” costs fall not on those who purchase fuel or the goods produced with it, but on those who live or work close to where the fuel is produced or used, usually in the form of higher health-care costs. In the case of greenhouse gases and climate change, these costs are borne today by almost everyone, but again based not on how much fuel a person uses but on where he or she happens to live.

A carbon-based tax could capture the externality costs of those pollution emissions and embed them in the market price of fuel, creating what economists call a market-perfecting Pigouvian tax (after Arthur Pigou, the English economist who first wrote about these issues). Using a Pigouvian tax that raises the price of a fuel to accurately reflect its externality costs would improve economic efficiency by better aligning the relative prices of things with all of their costs, especially if the revenues were used to offset the costs borne by those subject to its pollution.<sup>65</sup> While we do not know what precise level of carbon tax would capture all of these costs, a tax which embeds a significant part of those costs should still improve the efficiency of prices.

Another critical economic issue is the degree to which a carbon tax would focus environmental improvements where they can be achieved most cheaply or efficiently – getting the biggest environmental bang for the dollar, Euro or yen. Cap-and-trade programs achieve this by using tradable permits: In principle, companies that can reduce their emissions enough to achieve their caps for less than the price of a permit can be expected to do that; while companies that would have to spend more to reduce their

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<sup>65</sup> Nordhaus, *op. cit.*, states this goal in describing an ideal carbon tax as one that “balances the discounted social marginal costs and marginal benefits of additional emissions.”



emissions that the price of a permit will buy the permits from those who can do it more cheaply. In practice, Kyoto's 1990 base year sharply reduced this benefit by effectively relieving companies in Russia, Eastern Europe and Germany from making these calculations, along with companies in every developing nation. A global cap-and-trade program's special vulnerability to cheating will further reduce these potential gains: Many companies and countries are likely to bring their emissions under their caps by simply understating them, without bothering to invest in energy-efficient technologies, shift to alternative fuels or buy permits from others who have done so.

Carbon taxes can achieve this form of economic efficiency without a cumbersome trading mechanism susceptible to cheating and other distortions. The tax would raise the price of carbon-based energy in proportion to its carbon content, so that countries and companies that can reduce their carbon emissions for less than the cost of the tax can be expected to do so while those which find that reducing emissions would cost more than the tax will pay it. The consequent reductions in emissions should be greatest where the cost of achieving them is lowest, both within each country and worldwide, assuming that the world's major greenhouse gas producing countries sign on.

Carbon taxes also should provide greater incentives for companies to develop new, environmentally-friendly technologies or abatement strategies than a cap-and-trade program. The tax would provide "a continual incentive to reduce the costs of carbon abatement,"<sup>66</sup> as a leading energy economist put it, because the permanent increase in the cost of carbon-intensive energy would raise the rate of return on the development and use of technologies that reduce the consumption of those forms of energy. Cap-and-trade provides less powerful incentives in this respect, because its impact on energy prices is less constant and more volatile. And under flawed versions of the cap-and-trade strategy, such as Kyoto-based targets, the availability of excess permits further weakens the incentives to develop and use alternative fuels and more energy-efficient technologies.

For all of its environmental and economic advantages over cap-and-trade, a global carbon tax regime would present serious challenges. Significant CO<sub>2</sub> producers – the world's major energy consumers and energy producers – have to agree on what is to be taxed, the rate, and, perhaps most difficult, how to treat other taxes and government spending that may reduce or increase the effective burden of a carbon tax for particular industries. As one analyst points out, "countries could offset a tax on emissions with less visible compensatory policies that offer loopholes for energy-intensive and export-oriented firms that would be most adversely affected by the new carbon tax."<sup>67</sup> It would be unrealistic to expect governments to strip their budgets and tax codes of all their existing instances of preferential treatment for energy companies or energy-intensive manufacturers. Instead, the agreement could set a uniform "net carbon tax" for all countries and create an arbitration body to determine each country's current net carbon tax burden based on its existing fuel-related subsidies, taxes, credit programs and other preferences, plus the additional tax required to achieve a roughly uniform carbon tax

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<sup>66</sup> Marc Chupka, "Carbon Taxes and Climate Change," *Encyclopedia of Energy*, Volume 1, 2001.

<sup>67</sup> David Victor, *The Collapse of the Kyoto Protocol and the Struggle to Slow Global Warming*, Princeton University Press, 2001, p. 86



level.<sup>68</sup> These issues are complicated but technically manageable, since most countries currently determine their taxes and subsidies through public legislative processes. The International Monetary Fund (IMF) could review these net carbon tax burdens as part of its annual consultations with every nation (except Cuba and North Korea) about their macroeconomic and fiscal policies.<sup>69</sup> Panels of experts could resolve technical disagreements about how to measure and compare the energy-related taxes, regulations, spending and credit programs of different countries, on the model of the expert panels that resolve technical issues in trade disputes before the World Trade Organization.

Once the terms of the tax are established, most countries would apply it at the points where energy is generated or distributed, based on the fuel's carbon content, much as caps and permits are usually distributed at such points. In other respects, a carbon tax would be simpler and less expensive to administer and enforce than cap-and-trade. While cap-and-trade requires additional administrative systems and structures to allocate the permits and monitor their subsequent trades, every government has a tax system in place already, and most of them already tax energy. Nor would a carbon tax create the possibilities for financial manipulation inherent in tradable permit systems, since tax collections do not create their own financial instruments.

Governments also could enforce a carbon tax system more effectively and cheaply than a cap-and-trade regime. Companies subject to the tax may be tempted to minimize their payments through various forms of evasion or cheating; but on the other side of this transaction, governments will have equally strong incentives to prevent it. Under cap-and-trade, a dishonest energy producer or distributor might understate its fuel production or distribution, so it could sell permits covering the difference between that level and its actual production or distribution; but in that case, the producer or distributor looking to purchase permits has no incentive or interest in preventing the cheating.

For all of these reasons, a carbon tax regime should be more effective and less economically disruptive than a cap-and-trade program. This expectation is supported by recent econometric modeling that compared the impact on CO<sub>2</sub> emissions of the Kyoto version of cap-and-trade, with and without U.S. participation, and a hypothetical global carbon tax that limited CO<sub>2</sub> concentrations to twice their pre-industrial levels by 2075.<sup>70</sup> By 2025, the hypothetical carbon tax would reduce worldwide CO<sub>2</sub> emissions by 17 percent compared to their 1990 levels, while Kyoto could reduce those emissions by 12 percent with U.S. participation and by 3 percent without the United States. By 2045, the carbon tax would bring down emissions by 30 percent from their 1990 levels, while

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<sup>68</sup> One expert, Richard Cooper of Harvard University, has suggested that a carbon tax go on top of all existing taxes, noting that "global climate change is a newly recognized problem for purposes of collective action, and all parties should add new incentives for the reduction of emissions." (Cooper, "Alternatives to Kyoto: The Case for a Carbon Tax," 2005.). However, most countries with high energy taxes today would likely reject this proposition, while counting existing taxes so that every country would apply roughly the same net carbon tax burden would minimize the impact on relative prices across countries..

<sup>69</sup> Richard Cooper, "Toward a Real Treaty on Global Warming," *Foreign Affairs*, Vol. 77, No. 2, 1998.

<sup>70</sup> Nordhaus, *op cit.*, results generated by 2001-Rice Model, a modification of the model described in *Warming the World: Economic Models of Global Warming*, by William Nordhaus and Joseph Boyer, MIT Press, 2000.

Kyoto would produce reductions of 15 percent with U.S. participation and still 3 percent without the United States. By 2075, the hypothetical carbon tax reduced emissions by fully 40 percent compared to their 1990 levels, while Kyoto could achieve only a 16 percent reduction with American participation and less than 4 percent without it.

The particular deficiencies of Kyoto apparent in this simulation largely reflect the political compromises required to achieve agreement. (By this simulation, the United States would be responsible for 75 to 80 percent of all emission reductions under Kyoto, if it participated.) There are reasons to expect, however, that a serious effort to establish harmonized carbon taxes could face less political resistance and therefore require fewer disabling compromises.

The great political advantage of carbon taxes is that they raise large revenues which governments can use to reduce other unpopular and more distorting taxes or finance popular spending programs. A government could use the revenues, for example, to reduce payroll taxes and lessen their negative effects on work, job creation and incomes, or to lower corporate tax rates and lessen their negative effects on investment, productivity and incomes. These kinds of tax shifts, at once, could be politically popular, environmentally effective, and improve economic performance. In countries facing fiscal squeezes as their boomer generations retire, carbon tax revenues also could be used to maintain public pension or health care programs. And in developing countries, governments could use carbon-tax revenues to finance infrastructure improvements, educational opportunities and other parts of their economic development strategies. None of these options are available under a worldwide or national cap-and-trade system..

Some analysts question whether a carbon tax system could or should be truly global, arguing that fairness dictates that poor countries not be expected to increase their tax burdens at the cost of dampening their growth, in order to produce distant benefits for other, richer countries.<sup>71</sup> Yet carbon taxes could help direct development in poor countries towards more energy-efficient technologies and approaches, while supporting the education, infrastructure and business development vital to their long-term growth. If fairness concerns nevertheless move nations to link participation to a country's level of economic development, countries might be expected to participate when their *per capita* income reaches a certain level, such as \$5,000.

### *The Way Forward*

Very few countries seem prepared today to pay a significant price to reduce greenhouse gas emissions and the risks of global warming. The Kyoto agreement was achieved, but only after ensuring that most nations would pay little or no price. The United States, Australia, Japan and Canada were left with large potential burdens, so the United States and Australia opted out, and Canada and Japan reinterpreted key provisions of Kyoto to sharply reduce their costs. The ultimate result is clear: "The current

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<sup>71</sup> Nordhaus (op. cit.) makes this argument: "...some form of transfer will be necessary."

agreement requires reductions that do not constitute a significant step in accomplishing the long-term objectives of the [United Nations] Framework Convention.”<sup>72</sup>

The risks of climate change continue to grow. Global, harmonized net carbon taxes could contain those risks in an economically-efficient and politically-feasible way. The task is to persuade the world’s major energy producing and energy consuming countries to adopt them. The United States has a singular role to play in this regard. As the world’s largest producer of greenhouse gases, the United States has a special responsibility to implement an effective and efficient strategy for reducing those emissions. Moreover, as the leading developer of new technologies, the United States can use its technological capacity to develop alternative fuels and more energy-efficient and carbon-reducing technologies. A carbon tax would both directly reduce greenhouse gas emissions and provide powerful incentives for technological progress in this area. It offers best way forward in the national and global debate over climate change.

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<sup>72</sup> Mustafa Babiker, Henry Jacoby, John Reilly, David Reiner, “The evolution of a climate regime: Kyoto to Marrakech and beyond,” *Environmental Science & Policy*, Vol. 5, 2002.

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### *About the Authors*

**Robert J. Shapiro** is the chairman of Sonecon, LLC, a private firm that advises U.S. and foreign businesses, governments and non-profit organizations on market conditions and economic policy. Dr. Shapiro has advised, among others, U.S. President Bill Clinton and British Prime Minister Tony Blair; private firms including MCI, Inc., New York Life Insurance Co., SLM Corporation, Amgen, Nordstjernan of Sweden, and Fujitsu of Japan; and non-profit organizations including the American Public Transportation Association, the Education Finance Council, the U.S. Chamber of Commerce and the Investors Action Alliance. He is also Senior Fellow of the Progressive Policy Institute (PPI), a director of the Ax:son-Johnson Foundation in Sweden, and co-chair of Argentina Task Force America. From 1997 to 2001, he was Under Secretary of Commerce for Economic Affairs. In that post, he oversaw the Nation's major statistical agencies, including the Census Bureau before and during the 2000 decennial census, and directed economic policy for the Commerce Department. Prior to that, he was co-founder and Vice President of PPI. Dr. Shapiro also served as principal economic advisor in William Clinton's 1991-1992 presidential campaign, senior economic advisor to Albert Gore, Jr. in 2000 and John Kerry in 2004 in their presidential campaigns, Legislative Director for Senator Daniel P. Moynihan, and Associate Editor of *U.S. News & World Report*. He has been a Fellow of Harvard University, the Brookings Institution and the National Bureau of Economic Research, and Counselor to the U.S. Conference Board. He holds a Ph.D. from Harvard, as well as degrees from the University of Chicago and the London School of Economics and Political Science.

**Nancy Soderberg** is currently a Distinguished Visiting Scholar at the University of Northern Florida in Jacksonville. From 2001-2005, Ambassador Soderberg was Vice president and director of the New York office of the International Crisis Group, an international non-profit organization which advocates policies to prevent and contain conflict. From 1997 to 2001, Ambassador Soderberg served as Alternate Representative to the United Nations, representing the United States at the Security Council on a wide range of current national security issues, including conflict resolution, promotion of democracy abroad, trade policy, and arms control, and participating in missions to key conflict areas. From 1993-97, she was Deputy Assistant to the President for National Security Affairs, responsible for day-to-day crisis management, briefing the President, developing U.S. national security policy and handling issues regarding the press and Congress. Prior to serving at the White House, Ambassador Soderberg served as the Foreign Policy Director for the Clinton-Gore 1992 Campaign and Senior Foreign Policy Advisor to Senator Edward M. Kennedy. She publishes and speaks regularly on national security policy, and her recent book, *The Superpower Myth*, analyzes the use of force and diplomacy over the last decade. She is a member of the Council on Foreign Relations, a member of the board of Concern Worldwide, co-chair of Argentina Task Force America, and an advisory board member for the National Committee on American Foreign Policy and the Tannenbaum Center. She also has served as an adjunct professor at Columbia University's School of International and Public Affairs. She holds a B.A. from Vanderbilt University and a Masters of Science from Georgetown University's School of Foreign Service.