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Carbon Markets: Reducing Greenhouse Gas Emissions Through Emissions Trading

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The widespread agreement among scientists that the buildup of carbon and other emissions from human activity will result in disruptive and perhaps even catastrophic changes to the earth's climate has led to international environmental agreements that promise to begin to reduce the threat.[1] These agreements are aimed at reducing greenhouse gas emissions that accumulate in the atmosphere and cause warming beyond the natural greenhouse effect that is essential for life on earth.[2] The threat

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1. Tom Mintier & Reuters, *Global Warming Agreement Gains Final Approval*, CNN (Dec. 11, 1997), *at* http://www.cnn.com/EARTH/9712/11/climate.confer.approval/ (last visited Mar. 4, 2004).

2. *See id.*

of global warming is not the gradual increase in temperatures in and of itself.[3] In fact, global warming may produce some benefits in northern regions, such as longer growing seasons and milder weather.[4] Rather, the greater fear is that changes in climate will wreak havoc in some regions by increasing the intensity of heat waves, droughts, and storms; produce warming trends that harm agriculture and biodiversity; stimulate the spread of disease; cause the melting of glaciers and rise of sea level in coastal areas; and result in a host of other problems.[5]

While scientists from the United States have played a leading role in developing the science of climate change, U.S. political leaders have largely resisted global efforts to require major cuts in emissions of greenhouse gases.[6] Instead, multinational corporations, state and local government leaders in the United States, and leaders of other nations have taken the lead in designing responses to the threat of disruptive climate change.[7] A central element of the strategy developed by businesses and governments to reduce greenhouse gas emissions is the development of emissions trading programs.[8] In such programs, corporations set goals for reducing total greenhouse gas emissions and issue carbon allocations or targets to units of the company.[9] These units achieve their goals by making changes in materials or processes to improve efficiency and reduce emissions.[10] The companies allow these units to meet their goals by buying and selling emission credits; some also allow them to purchase carbon credits from agricultural sequestration, tree planting, and other activities.[11] Units that can reduce their emissions below their targets can sell their extra allocations to units that exceed their target.[12] As a result of this type of trading, many corporations are making significant progress in reducing their emissions of carbon dioxide and other greenhouses gases.[13] These companies have

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3. CLIMATE CHANGE POLICY: A SURVEY 31-35 (Stephen H. Schneider et al. eds., 2002).

4. *Russia 'Undecided' on Climate Deal*, BBC NEWS (Sept. 29, 2003), *at* http://news.bbc.co.uk/2/hi/science/nature/3147912.stm (last visited Mar. 4, 2004) [hereinafter *Russia 'Undecided' on Climate Deal*].

5. *Id.*

6. Gary C. Bryner, *Congress and the Politics of Climate Change*, *in* CLIMATE CHANGE AND AMERICAN FOREIGN POLICY 111 (Paul Harris ed., 2000).

7. *See generally* PAUL HAWKEN, ARMOY LOVINS & L. HUNTER LOVINS, NATURAL CAPITALISM: CREATING THE NEXT INDUSTRIAL REVOLUTION (1999).

8. *Id.*

9. JOSEPH J. ROMM, COOL COMPANIES: HOW THE BEST BUSINESSES BOOST PRACTICES AND PRODUCTIVITY BY CUTTING GREENHOUSE GAS EMISSIONS 208 (1999).

10. HAWKEN, *supra* note 7.

11. *Id.*

12. *Id.*

13. *Id.*

concluded that reducing emissions makes sense:[14] investments in reduced waste and improved efficiency lower costs and position companies for future business opportunities in addition to minimizing the threat that climate change poses.[15] A number of companies have made ecologically sound and economically profitable changes in the design, production, and distribution of goods and services.[16]

State and local governments are also enacting laws that require companies to reduce their emissions and allow them to meet their goals by some type of emissions trading.[17] Several states have begun requiring reductions in power plants, motor vehicles, and other major sources of greenhouse gases.[18] Cities have developed programs to ensure that some activities are greenhouse gas neutral, meaning that emissions in one area are offset by reductions elsewhere.[19] Some of these local governments are also establishing goals for reducing carbon dioxide emissions from their own operations, employing similar provisions that allow buying and selling of carbon allocations.[20] Many Western European countries have also begun to experiment with emissions trading for carbon dioxide and are beginning to develop markets for buying and selling greenhouse gas allowances.[21]

The reliance on emissions trading for reducing greenhouse gas emissions is controversial. Critics fear that trading programs, if not carefully designed, result in reductions on paper but fail to produce actual emission reductions. Emissions trading may seduce people into thinking they can escape making difficult choices about changes in behavior and consumption that will ultimately be required to significantly reduce the threat of climate change. Debates over carbon trading may also divert attention from direct actions such as investing in energy efficiency and cleaner fuels that promise clear benefits. There are numerous challenges to making carbon trading work as an effective way of reducing the threat of climate change. However, given the promise of carbon markets in

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14. *Id.*
15. *Id.*
16. *Id.*
17. GARY C. BRYNER, NEW TOOLS FOR IMPROVING GOVERNMENT REGULATION: AN ASSESSMENT OF EMISSIONS TRADING AND OTHER MARKET-BASED REGULATORY TOOLS 11-13 (1999).
18. *Id.* at 12-13.
19. *See generally* The Climate Trust, *at* http://www.climatetrust.org (last visited Mar. 4, 2004).
20. BRYNER, *supra* note 17, at 12-13.
21. *See id.* at 14; Greenhouse Gas Emissions Reduction Trading Pilot, *at* http://www.gert.org (last visited Mar. 4, 2004); UNCTAD/Earth Council Institute Carbon Market Programme, *at* http://r0.unctad.org/ghg/index.html (last visited Mar. 4, 2004).

minimizing the costs of reducing greenhouse gas emissions, including carbon trading in any voluntary or mandatory strategy has become a prerequisite for generating the necessary political support.

The purpose of this Article is to trace the evolution of carbon trading, examine what is required to make carbon markets work effectively, and assess the role of carbon markets in reducing the threat of climate change. The emerging markets in carbon are a useful means of exploring the challenges encountered in developing new markets, and the lessons learned here illustrate the costs and benefits of creating markets in pursuit of public policy goals elsewhere. This Article argues that carbon trading can be part of an effective response to the threat of climate change, yet it acknowledges there are considerable challenges in designing and implementing effective trading programs and substantial risks that trading will not produce significant emission reductions while diverting attention away from other actions that are required. Despite the limitations of carbon trading, the threat of climate change is so serious and the benefits from taking action so great that trading should be widely pursued as a way to help build support for the more ambitious regulatory programs that are required to produce a significant reduction in greenhouse gas emissions.

I. THE EVOLUTION OF CARBON TRADING

A. U.S. Government Policies

United States scientists and political leaders initially played a leading role in the evolution of efforts to identify climate change as a global environmental threat.[22] In speeches and hearings in 1987 and 1988, Senators Al Gore (D-TN), Tim Wirth (D-CO), and John Chafee (R-RI) were among the first politicians to draw attention to the threat of global warming and disruptive changes in climate due to increased emissions of greenhouse gases.[23] Research by American scientists played a key role in laying the foundation for the first global climate change meeting in 1988, where scientists called for a twenty percent reduction in carbon dioxide and other greenhouse gas emissions by 2005.[24] The first Bush Administration expressed some support for efforts to reduce the threat.[25] As a Presidential candidate, George Bush, Sr. promised those who were worried about the greenhouse effect that, if elected, he would

22. Bryner, *supra* note 6, at 111.
23. *Id.* at 112.
24. *Id.*
25. *Id.*

unleash the "White House effect" to solve the problem.[26] In 1989, Secretary of State James Baker suggested that the United States pursue a "no regrets" policy.[27] This policy included taking prudent steps such as investing in energy efficiency and reducing emissions of air pollutants "that are already justified on grounds other than climate change" and would produce significant benefits even if the threat of global warming turned out not to be serious.[28]

However, by 1990, support in the Bush Administration for a legally binding commitment to reduce greenhouse gas emissions began to wane.[29] Senior Administration officials warned that reducing emissions would threaten the U.S. economy and, during the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, the United States aggressively opposed efforts to negotiate a binding agreement to reduce greenhouse gas emissions.[30] Nevertheless, the United States and some 180 other nations eventually agreed to the United Nations Framework Convention on Climate Change (Framework Convention) and the treaty went into effect in 1994.[31] Under the accord, the United States and other countries committed to a voluntary, nonbinding agreement to stabilize greenhouse gas concentrations "at a level that would prevent dangerous anthropogenic interference with the climate system,"[32] "protect the climate system for the benefit of present and future generations of humankind,"[33] and "take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects."[34]

The Clinton Administration's climate change policies, formulated as part of the United States' obligation under the Framework Convention, were largely a set of voluntary measures aimed at industries, commercial establishments, and consumers.[35] The Administration rejected proposals

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26. JONATHAN WEINER, THE NEXT ONE HUNDRED YEARS: SHAPING THE FATE OF OUR LIVING EARTH 94-95 (1990) (quoting elder Bush's statement: "Those who think we're powerless to do anything about the 'greenhouse effect' are forgetting about the 'White House effect.' As President I intend to do something about it.").

27. Bryner, *supra* note 6, at 112 (citing Secretary of State James Baker, Speech at Response Strategies Working Group, Intergovernmental Panel on Climate Change (Jan. 30, 1989)).

28. *Id.*

29. *Id.* at 113.

30. *Id.*

31. United Nations Framework Convention on Climate Change, adopted May 9, 1992, S. TREATY DOC. NO. 102-38 (1992), 31 I.L.M. 849 (1992) (entered into force Mar. 21, 1994).

32. *Id.* art. 2.

33. *Id.* art. 3.

34. *Id.*

35. Bryner, *supra* note 6, at 113-14.

to pursue mandatory emission reductions such as higher fuel efficiency standards and increased energy taxes.[36] The result of the voluntary measures, along with decreased spending for energy conservation and increased energy consumption was a seven percent increase in greenhouse gas emissions from 1990 to 1996.[37] By 1997, opposition to climate change policies was so strong in Congress that the Senate passed, by a vote of ninety-five to zero, a resolution that (1) opposed U.S. participation in any climate accord that did not include binding limits on developing countries and/or would require action that might harm the U.S. economy and (2) required a bipartisan group of Senators to monitor climate change negotiations.[38]

During this time, delegates from participating nations negotiated a series of agreements or protocols to the Framework Convention that formulated more precise obligations, and the United States was an active participant in those talks.[39] The Kyoto Protocol, negotiated in December 1997, required thirty-eight advanced industrialized nations to reduce their emissions of six greenhouse gases by an average of about five percent from 1990 levels between 2008 and 2012.[40] The Clinton Administration agreed to a seven percent reduction for the United States, but also insisted that the Kyoto Protocol include certain "flexible measures."[41] These measures would allow countries to meet their targets by purchasing emission reduction credits from others who had exceeded their reduction goals and by investing in carbon sequestration projects such as tree planting that would remove carbon dioxide from the atmosphere and serve to reduce the climate change threat.[42] In 1998, during a subsequent meeting in Buenos Aires, the Clinton Administration signed the Kyoto Protocol, but indicated it would not submit the treaty for ratification until the accord required meaningful participation by the developing countries and included flexibility measures.[43]

Congress remained hostile to the Clinton Administration's commitment to reducing greenhouse gas emissions.[44] The Senate Budget Committee's fiscal year 1999 budget resolution contained no money for the Administration's climate change programs, and Republican leaders

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36. *Id.* at 115.
37. *Id.* at 114-15.
38. S. Res. 98, 105th Cong. (1997).
39. Mintier, *supra* note 1.
40. *Id.*
41. *Id.*
42. *Id.*
43. Bryner, *supra* note 6, at 117.
44. *See id.* at 118.

promised to block any new spending on the issue until the treaty was submitted to the Senate.[45] The 1999 House Appropriations bill for the Environmental Protection Agency (EPA) and other agencies prohibited any funds from being used to implement the Kyoto Protocol including meetings aimed at educating the public about climate change issues.[46] The final appropriations bill for that year deleted the ban on public education, but kept the prohibition on any effort to implement the Protocol.[47] The prohibition was included in the subsequent fiscal year as well.[48]

In 2001, shortly after taking office, President George W. Bush announced that his Administration was withdrawing from the Kyoto Protocol and promised to provide his own plan for reducing the threat of climate change.[49] The Administration subsequently proposed to revamp the federal reporting requirement for carbon dioxide emissions, proposed $4.6 billion in tax credits over five years as an incentive to reduce greenhouse gas emissions, and set a goal of reducing the carbon intensity of the U.S. economy through voluntary measures.[50] In 2002, 183 metric tons of carbon dioxide were released for every $1 million in GNP; the Administration's goal is to reduce that figure to 151 tons by 2012.[51] The goal of the Administration's policy is not to reduce the absolute level of greenhouse gas emissions, but to encourage the economy to become more efficient as it grows.[52] Essentially, the George W. Bush plan is to continue the recent trend of decreasing greenhouse gas emissions per unit of economic activity.[53] Despite the considerable improvements in efficiency, because of the growth of the economy, total emissions of greenhouse gases from U.S. sources, measured as carbon dioxide equivalent, grew by 10.9% between 1990 and 2002.[54]

In addition to President Bush's proposal, other legislation was also introduced during the early stages of Bush's Administration. In

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45. Charles Pope, *Opposition to Global Warming Treaty Is Cropping Up in Spending Bills,* CONG. Q. WKLY. REP., Aug. 1, 1998, at 2107.

46. Bryner, *supra* note 6, at 118.

47. Charles Pope, *Senate Clears Interior Bill, Setting Stage for Post-Veto Talks on Policy Riders*, CONG. Q. WKLY. REP., Oct. 23, 1999, at 2527-28.

48. *Id.*

49. Andrew C. Revkin, *Bush Plans Expected to Slow, Not Halt, Gas Emissions Rise*, N.Y. TIMES, Feb. 14, 2001, at A1.

50. *Id.*

51. *Id.*

52. Energy Info. Agency, U.S. Dep't of Energy, Pub. No. DOE/E1A-0573 (2002), Emissions of Greenhouse Gases in the United States 2002, at ix (Oct. 2003), *available at* http://www.eia.doe.gov/oiaf/1605/ggrpt/ (last visited June 23, 2004).

53. *Id.*

54. *Id.*

December 2001, Republican Senators John McCain (AZ) and Sam Brownback (KS) introduced legislation to establish a national emissions registry and to establish credits from voluntary programs that could be used in any eventual mandatory emission reduction program.[55] Companies would use the registry to record their emission cuts and third parties would verify the reductions.[56] Senator Jim Jeffords (I-VT) was lead sponsor of S. 556, the Clean Power Act of 2002, that would have required power plants to reduce carbon dioxide by twenty-three percent and other emissions (nitrogen oxide by eighty-three percent and sulfur dioxide by ninety percent) from current levels by 2008.[57] The bill was reported out by the Senate Environment and Public Works Committee by a ten to nine vote in June 2002.[58] A 2002 energy bill introduced in the House of Representatives would impose mandatory controls on carbon dioxide emissions if sixty percent of American companies do not register voluntary reductions with the federal government during the next five years.[59] None of these bills moved any further.[60]

In January 2003, Senators John McCain (R-AZ) and Joseph Lieberman (D-CT) introduced a greenhouse gas cap and trade bill that would require sources to reduce their greenhouse gas emissions by 2010 to year 2000 levels and to 1990 levels by 2016.[61] Industry and environmental groups contributed ideas to the bill, which was lauded by conservation leaders as a way to "jump-start" U.S. climate change policy.[62] The bill would allocate allowances or permits for greenhouse gas emissions to major sources and companies.[63] These companies could buy and sell credits in order to meet their required emission reduction; up to fifteen percent of the reduction could be met through the purchase of credits from others.[64]

As part of the negotiations over a major energy bill that moved slowly through Congress in 2003, Senate leaders agreed to hold a vote on

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55. Emission Reductions Incentive Act of 2001, S. 1781, 107th Cong. (2001).

56. *Id.*

57. Cat Lazaroff, *Senate Committee Backs Power Plant Emissions Bill*, ENV'T NEWS SERV., June 28, 2002, *available at* www.lexis.com.

58. *Id.*

59. John J. Fialka, *Entergy Gives Land to Create Refuge, Win Emissions Credit,* WALL ST. J., Aug. 26, 2002, at A4.

60. *See* Thomas Legislative Information on the Internet, http://Thomas.loc.gov (last visited Apr. 4, 2004).

61. Cat Lazaroff, *U.S. Senate Bill Would Cap Greenhouse Gas Emissions*, ENV'T NEWS SERV., Jan. 8, 2003, *available at* www.lexis.com.

62. *Id.*

63. *Id.*

64. *Id.*

the McCain-Lieberman legislation in August.[65] On August 30th, the bill was rejected by a vote of fifty-five to forty-three, with six Republicans, thirty-six Democrats, and Independent Senator Jeffords voting for the measure.[66] Senator James M. Inhofe (R-OK), a leader of the opposition to the bill, was quoted as saying: "A majority of the Senate today told the American people that mandatory carbon dioxide reductions are unacceptable, and rightly so. The science underlying this bill has been repudiated, the economic costs are far too high and the environmental benefits are nonexistent."[67] Proponents of the bill hailed it as a major victory, noting the dramatic shift from the ninety-five to zero vote in 1995 in the anti-Kyoto Protocol resolution, and predicted that "the basis for a winning hand in the Senate is on the table."[68] They also anticipated that, while it took Congress ten years to take action on acid rain, it would take much less time to pass a climate change bill.[69]

Other efforts are underway to pressure the federal government to regulate greenhouse gases. The EPA announced in August 2003 that carbon dioxide and other greenhouse gases were not pollutants and would, therefore, not be regulated under the Clean Air Act.[70] Three environmental groups petitioned the EPA to declare carbon dioxide from motor vehicles a pollutant and regulate it under the Clean Air Act, but the agency denied the petition in August 2003.[71] Shortly thereafter, California officials announced that they would challenge the EPA's decision in federal court.[72] Officials from Connecticut and eleven other states have also sued the EPA to force the agency to regulate greenhouse gases.[73]

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65. Jennifer 8. Lee, *2 Senators Aim to Put Others on Record on Emission Cap*, N.Y. TIMES, July 28, 2003, at A14.

66. Eric Pianin, *Senate Rejects Mandatory Cap on Greenhouse Gas Emissions*, WASH. POST, Oct. 31, 2003, at A4.

67. *Id.*

68. *Id.*

69. *Id.*

70. *See* Jeffrey Ball, *EPA Rejects Cap on Carbon Dioxide*, WALL ST. J., Aug. 29, 2003, at A3.

71. Chris Baltimore, *EPA Says Won't Regulate CO2 Emissions from Autos*, REUTERS DAILY WORLD ENV'T NEWS, Aug. 29, 2003, *at* www.planetark.org/avantgo/dailynewsstory.cfm?newsid=22035 (last visited Jan. 15, 2004).

72. *California Plans to Sue US EPA over Carbon Dioxide*, REUTERS DAILY WORLD ENV'T NEWS, Oct. 6, 2003, *at* www.planetark.org/avantgo/dailynewsstory.cfm?newsid=22462 (last visited Jan. 15, 2004).

73. Gregory B. Hladky, *States Act to Stop Global Warming*, NEW HAVEN REG., Oct. 24, 2003, *at* www.nhregister.com (last visited Apr. 4, 2004).

B. State and Local Governments

A number of U.S. cities and states have developed programs to reduce greenhouse gas emissions.[74] Massachusetts and New Hampshire were the first states to require power plants to reduce their carbon dioxide emissions.[75] New Hampshire has required the state's three fossil-fuel power pants to cut sulfur dioxide emissions by seventy-five percent, nitrogen oxides by seventy percent, and carbon dioxide by three percent from 1990 levels by 2007.[76] The plants may purchase pollution credits from out-of-state sources to meet their obligations, but there are incentives for the companies to purchase them from nearby states.[77] Some environmental groups criticized the proposal because it allowed public utilities to buy allowances rather than reduce emissions, but one sponsor of the bill said it would not have passed if the trading option were not included in the measure.[78] Massachusetts promulgated regulations requiring six coal and oil-fired power plants to reduce carbon dioxide, sulfur dioxide and nitrogen oxide emissions by 2006.[79] Companies can meet the carbon cap by increasing efficiency or by purchasing credits from other carbon dioxide reduction efforts approved by the State Department of Environmental Protection.[80] California passed a law in 2002 that ordered the state air quality board to regulate carbon dioxide emissions from motor vehicles.[81] As of October 2003, bills had been passed in twenty-nine states that placed caps on carbon dioxide emissions, created registries to track emissions and emissions trades, encouraged the production and use of alternative fuels, and/or encouraged carbon sequestration through agricultural practices and tree planting.[82]

A bipartisan group of governors from Northeastern states (New York, Connecticut, Vermont, New Hampshire, Delaware, Maine, New Jersey, Pennsylvania, Massachusetts, and Rhode Island) announced in July 2003 a plan to establish a cap and trade system for carbon dioxide

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74. *See generally* Bryner, *supra* note 6.
75. *Id.*
76. Jim Graham, *State First to Take on Global Warming*, CONCORD MONITOR, Apr. 19, 2002, at B1.
77. *Id.*
78. *Id.*
79. MASS. REGS. CODE tit. cccx, § 7.29 (2002).
80. *Id.*
81. Jennifer 8. Lee, *The Warming Is Global but the Legislating, in the U.S., Is All Local*, N.Y. TIMES, Oct. 29, 2003, at A20.
82. *Id.*

emissions from power plants.[83] Each state would establish a plan for reducing emissions, including a cap on total emissions; allocate limits for each power plant within the state; and allow plant owners to buy and sell emission credits to meet their limits.[84] Vermont has in place an executive order to reduce greenhouse gas emissions.[85] In the summer of 2003, Maine enacted a law requiring state officials to perform three tasks: (1) develop a climate action plan to reduce carbon dioxide emissions to 1990 levels by 2010; (2) cut carbon dioxide emissions by ten percent by 2020; and (3) eventually reduce carbon dioxide emissions by eighty percent.[86]

New Jersey was the first state to prepare an inventory of its greenhouse gas emissions, and it expects that companies will generate marketable greenhouse gas credits.[87] The state has already sold emission credits to the Netherlands as part of its effort to reduce net greenhouse gas emissions.[88] In 1998, former EPA administrator and then Governor Christie Whitman set a goal of reducing total greenhouse gas emissions by 3.5 percent below 1990 levels.[89] The state's fifty-six colleges and universities, a number of corporations, public schools, the state's dominant utility, and some 6000 religious congregations committed to reducing emissions.[90]

According to the International Council for Local Environmental Initiatives, some 140 cities and counties in the United States participate in its Climate Protection Campaign aimed at helping communities reduce their greenhouse gas emissions.[91] Oregon requires power plants to offset their carbon dioxide emissions; Portland's goal is to reduce greenhouse gas emissions by ten percent from 1990 levels by 2010.[92] The law

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83. Glenn Scherer, *A Green Revolt Against Bush*, SALON, July 21, 2003, *at* www.salon.com/news/feature/2003/07/21/emissions/print.html (last visited Jan. 15, 2004).

84. *Id.*

85. Joshua L. Weinstein, *Climate Change Law to Be First in Nation*, PORTLAND PRESS HERALD, June 25, 2003, at 1A.

86. *Id.*

87. Northeast States for Coordinated Air Use Mgmt., *Greenhouse Gas State Registry Collaborative: State Registry Programs Currently Running or Under Design*, *available at* http://www.nescaum.org (last visited Jan. 14, 2004) [hereinafter *Greenhouse Gas State Registry*].

88. Eric Pianin, *On Global Warming, States Act Locally*, WASH. POST, Nov. 11, 2002, at A3.

89. *Greenhouse Gas State Registry*, *supra* note 87.

90. Pianin, *supra* note 88.

91. Int'l Council for Local Envtl. Initiatives, *Welcome to Cities for Climate Protection*, *at* http://www.icle:.org/co2/index.htm (last visited June 22, 2004).

92. Press Release, The Climate Trust, The Climate Trust Awards $1 Million Contract to the City of Portland to Improve Energy Efficiency and Reduce CO2 Emissions (July 31, 2002), *at* http://www.climatetrust.org/CTNewsReleases.html (last visited May 31, 2004) [hereinafter *Contract to the City of Portland*].

requiring power plants to reduce their greenhouse gas emissions[93] also established the Climate Trust, a nongovernmental organization (NGO) that takes payments from plants and invests the money in greenhouse gas projects that avoid, displace, or sequester carbon dioxide emissions.[94] Projects funded through the Climate Trust include a five-year program to help owners of apartments and commercial buildings to improve energy efficiency,[95] a seven-year program to plant native hardwood trees in the Bilsa Biological Reserve in Ecuador,[96] and a five-year program to help landowners in the Deschutes Basin restore riparian areas that will also sequester carbon dioxide emissions.[97] Other projects include renewable energy from wind and landfill gas, an internet-based system to match carpool drivers and riders, and a forest sequestration in Washington.[98]

C. Other Countries

As of November 2003, the European Union and some seventy nations have ratified the Kyoto Protocol, including Japan and most of the industrialized nations.[99] The Protocol will take effect if nations responsible for at least fifty-five percent of total global greenhouse gas emissions have accepted it.[100] The failure of the United States to ratify the Protocol originally caused many to believe that its future was doomed, since virtually all other industrialized nations must ratify it if the United States does not.[101] However, support for the accord has been sufficiently strong and, if Russia ratifies the treaty, it will become a binding international agreement that will impose emission reductions

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93. The Climate Trust, *Strategic Plan of the Climate Trust*, *at* http://www.climatetrust.org/strategy.html (last visited May 31, 2004).

94. The Climate Trust, *About the Climate Trust*, *at* http://www.climatetrust.org/aboutus.html (last visited May 31, 2004).

95. *Contract to the City of Portland*, *supra* note 92.

96. Press Release, The Climate Trust, The Climate Trust Awards Contract to Conservation Groups to Capture Global Warming Pollution in Ecuador (May 24, 2002), *at* http://www.ewire.com/display.cfm/Wire_1D/1168 (last visited Apr. 4, 2004).

97. Press Release, The Climate Trust, The Climate Trust Awards Contract to the Deschutes Resources Conservancy to Capture Atmospheric Carbon Through Riparian Reforestation (Aug. 7, 2002), *at* http://www.climatetrust.org/CTNewsReleases.html (last visited May 31, 2004).

98. The Climate Trust, *The Climate Trust Projects*, *at* http://www.climatetrust.org/CTProjects.html (last visited Apr. 4, 2004).

99. James Pugsley, *Wild Numbers: The Kyoto Battle*, CANADIAN WILDLIFE, Fall 2002, *available at* http://www.findarticles.com/cf_0/m0NQN/4_897727957/p1/article.jhtml (last visited Apr. 4, 2004).

100. *Id.*

101. *See* Jim Plouffe, *Australian Roundup-Kyoto*, THE GALT GLOBAL REV., Nov. 26, 2002, *at* http://www.galtglobalreview.com/australia/australia_roundup10.html (last visited Jan. 30, 2004).

between 2008 and 2012.[102] Russia was expected to ratify the Protocol in 2003, but Russian President Vladimir Putin reported in September 2003 that his country was still studying the issue.[103] Russia would clearly benefit economically from the emissions trading provisions of the Kyoto Protocol, as Russia's total emissions fell dramatically after many of the state-subsidized industries closed when the Soviet Union collapsed.[104] As a result, its current emissions levels are much lower than 1990 levels and, under the Kyoto Protocol, it can sell as emission credits the difference between current and 1990 levels.[105] However, some Russians believe that the country may benefit from a warmer climate, and others believe the country is in a position to exact even more benefits before it ratifies the accord and causes it to take effect.[106]

Even though the Kyoto Protocol has not yet gone into effect, some countries have launched national policies to begin to bring them into compliance with its provisions.[107] Canada has embraced the goal of reducing its greenhouse gas emissions by six percent from 1990 levels and established a pilot program where buyers and sellers of carbon credits submit documentation of their exchanges; if the exchanges are approved, the government promises to recognize the reductions in a future mandatory greenhouse gas reduction program.[108] The province of Alberta is developing a plan to award greenhouse gas reduction credits to companies with employees that telecommute.[109] In turn, these credits can be sold to other companies that need more time to reduce their greenhouse gas emissions.[110] Employees who work from their home computers a few days a week rather than driving forty kilometers to work save approximately 8.4 kilograms of carbon dioxide emissions each day they do not drive; employers can aggregate such reductions and sell credits based on the actual numbers.[111]

The Danish and Dutch governments have in place pilot projects for carbon trading.[112] The Dutch government has announced its commitment

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102. *Russia 'Undecided' on Climate Deal*, *supra* note 4.
103. *Id.*
104. *Id.*
105. *Id.*
106. *Id.*
107. Charlie Gillis, *Work-at-Home Plan Targets Gas Emissions*, NAT'L POST, Oct. 28, 2002, at A6.
108. *Id.*
109. *Id.*
110. *Id.*
111. *Id.*
112. Richard Black, *Emissions Trading Launches in UK*, BBC NEWS (Apr. 2, 2002), *at* http://news.bbc.co.uk/1/hi/sci/tech/1906322.stm (last visited on Jan. 16, 2004).

to purchase 250 million tons of credits over the next few years.[113] The Dutch government signed a three-year $40 million contract with the World Bank to develop clean energy projects in developing countries in exchange for ten million tons of carbon dioxide equivalent (CO_2e) credits.[114] The Dutch government also entered into an agreement with Panama to purchase up to twenty million tons of CO_2e credits by funding construction of clean energy power in that country.[115] In December 2001, Danish, German, and U.S. power companies announced a deal involving 160,000 tons of CO_2e.[116] No price was provided, but parties indicated that tons were traded at less than forty Danish Crowns (US$4.78), the price Danish firms must pay if they exceed their carbon dioxide caps.[117] Australia, Canada, and the European Union are also designing carbon trading systems.[118]

In April 2002, the British government launched the first national system for trading carbon emissions anywhere in the world as part of its goal of reducing emissions by 12.5% by 2008.[119] Some thirty-six companies joined the initial effort, agreeing to reduce greenhouse gas emissions by a certain amount in exchange for financial support from the government.[120] Companies can buy and sell carbon credits in order to meet their goals.[121] Trading began on April 2, 2002, as forty-six companies bid for 215 pounds sterling (US$151 million) in funds spread over five years; bids were awarded to companies promising to make the largest emission reductions.[122] The British government also imposed a carbon tax, called a climate levy, on companies that produced

113. Matt Daily, *Dutch, World Bank Sign First Clean Energy Deal Carbon Credit Deal*, REUTERS DAILY WORLD ENV'T NEWS, Jan. 21, 2002, *at* http://www.planetark.com/dailynewsstory.cfm/newsid/14110story.htm (last visited Apr. 5, 2004).

114. *Id.*

115. *Dutch Sign CO2 Cutting Agreement with Panama*, REUTERS DAILY WORLD ENV'T NEWS, Dec. 6, 2001, *at* http://www.planetark.com/dailynewsstory.cfm/newsid/13586/story.htm (last visited Apr. 5, 2004).

116. Birgitte Dyrekilde, *Denmark Seals Its First CO2 Pollution Deals*, REUTERS DAILY WORLD ENV'T NEWS, Dec. 7, 2001, *at* http://www.planetark.com/dailynewsstory.cfm/newsid/13611/story.htm (last visited Apr. 5, 2004).

117. *Id.*

118. BRYNER, *supra* note 17, at 14.

119. Black, *supra* note 112.

120. *Id.*

121. *Id.*

122. *UK Appoints Former Oil Boss to Push Emissions Trade*, REUTERS DAILY WORLD ENV'T NEWS, Feb. 5, 2002, *at* http://www.planetark.com/dailynewsstory.cfm/newsid/14376/story.htm (last visited Jan. 16, 2004).

greenhouse gases, but it excused companies that achieved their target from paying eighty percent of the tax.[123]

D. Voluntary Industry Programs

A wide range of companies have developed voluntary programs to cap and reduce greenhouse gas emissions.[124] These companies typically allow trading of emission credits across divisions and even externally to give managers flexibility in meeting emission goals.[125] Credits can be generated by reducing emissions or by investing in projects that sequester carbon dioxide.[126] Kodak's goal, for example, is to cut emissions by twenty percent by 2004.[127] L'Oreal, the world's largest cosmetics manufacturer, increased production by sixty percent between 1990 and 2000 while cutting greenhouse emissions by forty-four percent through energy conservation programs.[128]

British Petroleum (BP) was one of the first companies to take action on greenhouse gas emissions.[129] In September 1998, Sir John Browne pledged that BP would reduce its emissions of greenhouse gases by ten percent from 1990 levels by 2010.[130] To accomplish that goal in the most cost-effective way possible, BP instituted a company-wide emissions trading system.[131] The company met its goal in October 2001, more than eight years ahead of schedule.[132] BP's emissions trading system was based on a cap and trade structure.[133] Each business unit was allocated a fixed number of annual allowances to emit greenhouse gases.[134] Trading

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123. Jeffrey Ball, *New Market Shows Industry Moving on Global Warming* WALL ST. J., Jan. 16, 2003, at A1.

124. *See generally* Andre C. Revkin, *U.S. Is Pressuring Industries to Cut Greenhouse Gases*, N.Y. TIMES, Jan. 20, 2003, at A1.

125. *Id.*

126. *Id.*

127. Amanda Griscom, *In Good Company: Cutting Emissions to Raise Profits*, GRIST MAG., July 31, 2002, *at* http://www.gristmagazine.com/powers/powers073102.asp? (last visited May 31, 2004).

128. *Id.*

129. BP, *Climate Change*, *at* http://www.bp.com/subsection.do?categoryID=20011497&contentID=2010947 (last visited May 31, 2004) [hereinafter BP, *Climate Change*].

130. Griscom, *supra* note 127.

131. BP, *Climate Change*, *supra* note 129.

132. Griscom, *supra* note 127. The cap and trade system began with twelve business units, and expanded to all 127 units of the company in 2000, after merging with Amoco. According to one account, BP achieved most of the emissions reductions from making operational changes rather than capital expenditures. *The Carbon Challenge—Industry, Climate Change, and Kyoto, Case Study, BP/Shell: Energy Giants Lead the Way on Emissions Trading*, ENVTL. FIN., Oct. 2000, Supp., at xxvii-iii [hereinafter *Case Study, BP/Shell*].

133. *Case Study, BP/Shell*, *supra* note 132, at xxvii-iii.

134. *Id.*

occurred across all 127 business units of BP, and units could trade carbon dioxide credits as well as allowances in achieving their annual emissions goal.[135] At the end of each year, if allowances were exceeded, units could purchase excess allowances from other units whose emissions fell below allowances.[136] All trades were registered and traded through a central broker.[137] Each allowance represented one metric ton of CO_2e and had a serial number used to track its movement.[138] Both carbon dioxide and methane were traded in the BP system.[139] Because methane has a global warming potential twenty-one times that of carbon dioxide, methane units were converted to CO_2e units for trading: a reduction of one ton of methane equaled twenty-one tons of carbon dioxide.[140] A key to the success of the BP system was its integration with other corporate performance goals and rewards; greenhouse gas allocations were included in performance contracts of business unit leaders.[141] The trading program was dismantled once the reductions were achieved, and company officials reported that the program produced some $650 million in revenue from improved efficiency, reduced waste, and marketing of new products.[142]

Similarly, in 2000, Shell agreed to cut emissions twenty-five percent by the year 2002, and it has already exceeded that goal.[143] At the beginning of each year, Shell allocates permits to each unit for each of three years based on ninety-eight percent of its 1998 emissions.[144] Five percent of each allocation along with three percent of the allocation from 2001 and one percent of the allocation from 2002 are withheld, and then auctioned, to help stimulate a market and help managers determine the most cost-effective mechanism for their unit—reducing emissions or purchasing credits.[145] Participation in the program is voluntary and restricted to business units operating in developed nations.[146] Sales take

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135. *Id.*

136. *Id.*

137. Jeff Morgheim, BP's Emissions Trading System: Harnessing Market Forces to Meet Environmental Goals Cost-Effectively, Presentation at the Annual Convention of the American Association of Petroleum Geologists (June 3-6, 2001) (on file with author).

138. *Id.*

139. *Id.*

140. *Id.*

141. *Id.*

142. Sylvia Baca, Presentation at 48th Annual Rocky Mountain Mineral Law Institute, San Diego, CA (July 25, 2003) (on file with author).

143. Griscom, *supra* note 127.

144. *Case Study, BP/Shell*, *supra* note 132, at xxvii-iii.

145. *Id.*

146. *Id.*

place through a sales manager, not directly between units.[147] The manager keeps a registry of all transactions and ensures that units have the requisite number of permits to cover their emissions at the end of each year; if not, the unit is fined three times the average permit price during the fourth quarter of the year.[148]

DuPont has committed to reduce emissions by sixty-five percent between 1990 and 2010.[149] In 1990, Dupont generated eighty-six million tons of CO_2e, sixty percent of which was nitrous oxide emissions (nitrous oxide emissions are approximately 310 times as potent as carbon dioxide in warming the climate).[150] In 1995, corporate executives announced they would reduce greenhouse gas emissions by forty percent from 1990 levels by 2000.[151] To reduce its nitrous oxide emissions, each factory spent $10 to $20 million on equipment that breaks the gas molecules into harmless nitrogen and oxygen; each factory also spends $1 million a year to replace catalysts that must be changed at least annually.[152] In order to help offset the cost of the reductions, DuPont began selling credits.[153] Most of the twenty carbon trades DuPont has engaged in so far have been with Canadian and U.S. companies that have pledged to cut emissions but been unable to do so on their own.[154] For example, in 2001, the Entergy Corporation, a New Orleans energy company, announced its goal of keeping greenhouse gas emissions at 2000 levels through 2005.[155] DuPont approached Entergy in early 2002 and offered to sell it credits from a factory that was located near an Entergy-owned power plant.[156] Entergy officials liked the idea of offsetting their power plant emissions with reductions secured from a neighboring factory and, in late 2002, the two companies agreed to transfer 125,000 tons of CO_2e at a price they described as between $1 and $5 per ton.[157] The revenue from the carbon sales was not even close to offsetting the investment to reduce emissions, but Dupont had already committed to making the reductions and selling credits was a bonus.[158] In addition, the company has an internal climate

147. *Id.*
148. *Id.*
149. Griscom, *supra* note 127.
150. Ball, *supra* note 123, at A1.
151. *Id.*
152. *Id.*
153. *Id.*
154. *Id.*
155. *Id.*
156. *Id.*
157. *Id.*
158. *See id.*

change steering committee that reviews big trades to ensure they contribute to its green reputation.[159]

In February 2002, a group of Canadian energy companies, the Greenhouse Emissions Management Consortium (GEMC), announced a plan to buy options for up to 3.5 million tons of greenhouse gas emission reduction credits generated by a Canadian company's involvement in telecommuting.[160] The Canadian company plans to use a computer program utilized in the United States as part of an eCommute pilot project in several cities.[161] The program verifies reductions in private vehicle emissions when employees work from home or a satellite office at least once a week.[162]

Other groups formed to promote greenhouse gas emission reductions include the following:

- Climate Savers, founded by the Center for Energy & Climate Solutions and the World Wildlife Fund, works with companies to reduce greenhouse gas emissions.[163] The organization has worked with Johnson & Johnson who agreed to reduce greenhouse gas emissions by seven percent below 1990 levels by 2010; IBM, four percent by 2004; Polaroid, twenty percent by 2005; Nike, thirteen percent by 2005; and LaFarge (the world's largest concrete manufacturer), ten percent by 2010.[164]
- The Coalition for Environmentally Responsible Economies, including GM and over seventy other companies, works to make "continual progress toward eliminating the release of any substance that may cause environmental damage."[165]
- Some thirty-eight major corporations have joined the Pew Center for Global Climate Change Business Environmental Leadership Council and are working to achieve greenhouse gas emission goals that also reduce costs, improve productivity, and increase sales.[166]

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159. *Id.*

160. *Canadian Report*, EM: AIR & WASTE MGMT. ASSOCIATION'S MAG. FOR ENVTL. MANAGERS, Feb. 2002, at 8.

161. *Id.*

162. *Id.*

163. Griscom, *supra* note 127.

164. *Id.*

165. *Id.*

166. Bus. Envtl. Leadership Council (BELC), *Overview*, *at* http://www.pewclimate.org/companies_leading_the_way_belc (last visited Jan. 14, 2004).

- Seven companies worked with Environmental Defense, a conservation group, to reduce their collective emissions by eighty million metric tons of CO_2e by 2010. They are developing a trading system among themselves to help find the lowest cost methods to achieve the cap.[167]
- Some 222 companies have filed with the Department of Energy's registry of voluntary corporate efforts to track and report emissions and emissions reductions.[168]

Examples of recent carbon trades in the United States include the following:

- Entergy Corp. donated 600 acres of land along the Red River in Louisiana to the federal government to be part of the Red River National Wildlife Refuge.[169] The land was purchased from farmers for $500,000.[170] The company will receive carbon credits for the planting of 180,000 trees that the Department of Interior guarantees will not be harvested during the next seventy years.[171]
- Ontario Power Generation, a Canadian company, has purchased the emission reduction credits from a project that will inject nine million tons of carbon dioxide produced from natural gas processing into oilfields in Wyoming, Texas, and Mississippi.[172] This is, according to one source, the largest public trade of greenhouse gas credits as of July 2002.[173]
- Ben & Jerry's announced in 2002 that it would offset a year's worth of carbon dioxide emissions from its Vermont ice cream manufacturing operations by supporting the construction of a wind turbine on the Rosebud Sioux Tribe's reservation in South Dakota.[174] The agreement will offset 5000 tons of carbon dioxide.[175]

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167. Envtl. Def., *Global Corporations and Environmental Defense Partner to Reduce Greenhouse Gas Emissions*, Oct. 17, 2000, *available at* http://www.environmentaldefense.org/article.cfm?contentid=503 (last visited Apr. 5, 2004).

168. Fialka, *supra* note 59, at A4.

169. *Id.*

170. *Id.*

171. *Id.*

172. *Carbon Sequestration: Fired up with Ideas*, ECONOMIST, July 6, 2002, at 78-79.

173. *Id.*

174. Press Release, Ben & Jerry's, Ben & Jerry's and NativeEnergy Partner to Fight Global Warming: Ice Cream Maker to Cool Planet with Wind (Aug. 1, 2002), *available at* http://www.ewire.com/display.cfm?Wire_ID=1273 (last visited Apr. 5, 2004).

175. *Id.*

- The London office of Sustainable Forestry Management (SFM) purchased emission reduction credits from the Confederated Salish and Kootenai Tribes of Montana.[176] In exchange for some 48,000 tons of CO_2e offsets, SFM will reforest 250 acres of the reservation's pinelands which were destroyed by fire.[177]

Another voluntary business-government partnership has been created in the Northeastern region of the United States.[178] Fourteen companies, environmental groups, and other organizations from Canada and the United States have worked with the Northeastern states to take voluntary actions to reduce greenhouse gas emissions.[179] During the first phase of the partnership, nine groups launched separate projects, such as the conversion to natural gas and battery-powered shuttle buses by power plants and industrial boilers.[180] The projects resulted in a nearly two-million-ton reduction of CO_2e, and another 1.8-million-ton-reduction is projected by 2007.[181] The second phase of the partnership will include additional projects, development of a baseline of emissions, exploration of a regional greenhouse gas registry, creation of criteria for assessing submissions to the Department of Energy's Energy Information Agency's Voluntary Reporting Program for Greenhouse Gas Emissions Reductions (called the section 1605(b) database), and formation of standards for submissions to an early crediting or baseline protection program.[182]

E. Carbon Transactions

One of the most important voluntary programs is an innovative partnership between businesses and local governments, the Chicago Climate Exchange.[183] The Exchange began operating in 2003 and

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176. Rana Foroohar, *The New Green Game: Tradable Allowances for Greenhouse Gases May One Day Become the World's Biggest Commodities Market*, NEWSWEEK, Aug. 27, 2001, at 62.

177. *Id.*

178. *See generally* Northeast States for Coordinated Air Use Mgmt., *at* http://www.nescaum.org (last visited Apr. 5, 2004).

179. Northeast States for Coordinated Air Use Mgmt., *Overview of the NESCAUM Greenhouse Gas Emissions Trading Demonstration Project: Phase II, available at* http://www.nescaum.org/Greenhouse/Private/Project_Description.doc (last visited Apr. 5, 2004).

180. *Id.*

181. *Id.*

182. *Greenhouse Gas State Registry*, *supra* note 87.

183. *See generally* Chicago Climate Exchange, *at* www.chicagoclimatex.com (last visited Jan. 30, 2004).

eventually plans to expand throughout North America and beyond.[184] The forty entities that joined the design phase of the Exchange include cities such as Chicago and Mexico City, a number of companies that emit greenhouse gases, agricultural and forestry groups that plan to generate carbon credits by sequestering carbon dioxide, and conservation groups.[185] Companies plan to generate credits through producing or purchasing power from wind and solar energy systems; investing in energy efficiency; switching to cleaner, less carbon intensive fuels; recovering and using methane; and sequestering carbon dioxide through no-till farming and tree and grass planting.[186] Parties agree to reduce emissions of all six greenhouse gases (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride), but most of the attention is directed toward reducing carbon dioxide and methane emissions.[187] Parties agree initially to reduce emissions two percent below 1999 levels and by one percent a year thereafter.[188] In 2002, the Exchange announced that the National Association of Securities Dealers (NASD) would provide a number of oversight and verification services, including auditing of emission baselines and offsets and monitoring trading activity.[189] In September 2003, the exchange announced the result of its first auction of carbon dioxide allowances: 100,000 metric tons of allowances from reductions in 2003 and 25,000 metric tons having a 2005 vintage.[190] The 2003 allowances sold for $0.98/metric ton of carbon dioxide; the 2005 allowances for $0.84/metric ton of carbon dioxide.[191]

A study for the Dutch Ministry of Environment estimated a future market of about 1.8 trillion metric tons of carbon dioxide, assuming ratification of the Kyoto Protocol without the participation of the United

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184. Gary C. Bryner, *Policy Devolution and Environmental Law: Exploring the Transition to Sustainable Development*, 26 ENVIRONS ENVTL. L. & POL'Y J. 1, 25 (2002); Chicago Climate Exchange, *Program*, *available at* http://www.chicagoclimatex.com/about/program.html (last visited Jan. 30, 2004).

185. Chicago Climate Exchange, *Chicago Climate Exchange Members*, *available at* http://www.chicagoclimatex.com/about/members.html (last visited Apr. 5, 2004).

186. *Id.*

187. *Id.*

188. *The Chicago Climate Exchange: Trading Hot Air*, ECONOMIST, Oct. 19, 2002, at 60.

189. Press Release, NASD, NASD and The Chicago Climate Exchange® Reach Historic Agreement (Sept. 23, 2002), *available at* http://www.nasdr.com/news/pr2002/release_02_046.html (last visited Jan. 14, 2004).

190. Press Release, Chicago Climate Exchange, Chicago Climate Exchange Announces Results of First Auction (Sept. 30, 2003), *available at* http://www.chicagoclimatex.com/news/pdf/CCXAuction.pdf (last visited May 31, 2004).

191. *Id.*

States.[192] European policy makers are designing a carbon trading system that is projected to be implemented in 2005.[193] A World Bank study of carbon trading estimated that some 200 million metric tons of carbon dioxide equivalent credits have been traded since 1996, and that trading in 2003 would likely reach $400 million,[194] then explode to a $10 billion market by 2005.[195] A study released by the World Bank and Natsource LLC, a company that brokers environmental trades, concluded that the volume of carbon trades would quadruple from 2001 to 2002, as more European countries put in place regulatory systems to reduce carbon emissions that will affect 5000 companies.[196] In 2001, the study tracked twelve million metric tons of carbon dioxide trades and projected some sixty-seven million metric tons in 2002.[197] Given that the regulatory systems are just beginning to take effect, some companies are buying credits now as a hedge against the future.[198]

A March 2002 review of the carbon market found that publicly announced trades identified in one proprietary database had logged sixty-nine transactions worth $350 million that involved eighty-one million metric tons of CO_2e primarily produced from forest sequestration and renewable energy projects.[199] The average transaction size was 1.342 million tons of CO_2e for credits produced and purchased over a five-to-ten-year time frame.[200] The nonweighted average price paid per ton of CO_2e was $4.45, with a range of a few cents to $6.00, and the weighted average was less than $1.50.[201] Prices have hovered between $1.50 and $5.00 in what is described as a "buyer's market," given the uncertainties surrounding legal requirements for emissions reductions.[202]

A report issued by the Pew Center on Global Climate Change estimated that at least sixty-five trades of greenhouse gas emissions, totaling from fifty-five to seventy-seven million tons of CO_2e, occurred between 1997 and 2002, and suggested that it likely underestimated

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192. Amy Ellsworth & Phil Doyle, How Big Is the Carbon Market Really? (Mar. 2002) (unpublished manuscript, on file with author).

193. Ball, *supra* note 123.

194. *Id.*

195. Cait Murphy, *Hog Wild for Pollution Trading: Why Environmental Markets Are Becoming a Very Big Deal*, FORTUNE, Sept. 2, 2002, at 137-39.

196. John J. Fialka, *Emissions Trading Rises, Anticipating the Kyoto Protocol*, WALL ST. J., Oct. 18, 2002, at A2, A7.

197. *Id.* at A2.

198. *Id.* at A2, A7.

199. Ellsworth & Doyle, *supra* note 192.

200. *Id.*

201. *Id.*

202. *Id.*

activity.[203] Emissions traded at prices per ton that ranged from $0.60 to $3.50.[204] Another estimate suggested as many as 200 million tons of CO_2e have been traded between 1997 and 2002.[205] The New Zealand government has proposed a tax of up to NZ$25 (US$11.17) per ton of CO_2e to be levied beginning in 2007 if the Kyoto Protocol comes into force.[206] PacifiCorp, a Northwestern U.S. power company owned by a Scottish firm, uses the figure of $8/ton of CO_2e in its planning process, based on its review of carbon trading in Europe.[207]

A July 2002 study interviewed representatives of thirty-five companies that have had some involvement with the carbon market and asked them to estimate current and future prices of carbon.[208] It concluded that buyers and sellers could expect a current price of about $5/ton of CO_2e and $11/ton in 2010 (the middle of the Kyoto Protocol compliance period).[209] The study also reviewed the limited information available about actual transactions and found that prices ranged from $1.15 to $5.00/ton for reductions to occur between 2000 and 2008.[210] It concluded that, until 2008, prices are likely to stay below $5/ton, then increase to between $5 and $11/ton during the Kyoto Protocol compliance period (2008-2112).[211] One of the highest figures reported for carbon trading was $16/ton, reported by an official at Natsource for trades during the fall of 2002.[212] Prices of carbon traded in the United Kingdom for energy companies have gone as high as $18.60/ton.[213]

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203. Julie Vorman, *Update—Greenhouse Trading Takes Off, U.S. on Sidelines*, REUTERS DAILY WORLD ENV'T NEWS, Mar. 21, 2002, *at* http://www.planetark.com/dailynewsstory.cfm?newsid=15107 (last visited Apr. 5, 2004).

204. *Id.*

205. Murphy, *supra* note 195.

206. *NZ Govt Favours Carbon Tax to Meet Kyoto Target*, REUTERS DAILY WORLD ENV'T NEWS, May 1, 2002, *at* http://www.planetark.com/dailynewsstory.cfm?newsid=15739 (last visited Apr. 5, 2004).

207. Bill Edmunds, Presentation at Fall Meeting of American Bar Association, Section of Environment, Energy and Resources, Portland, OR (Oct. 9-13, 2002).

208. *Assessment of Private Sector Anticipatory Response to Greenhouse Gas Market Development*, Natsource LOLC & GCSI, July 2002, *at* http://www.natsource.com/news/index.asp?n=295 (last visited Apr. 5, 2004).

209. *Id.*

210. *Id.*

211. *Id.*

212. Jonas Broth, *World Carbon Credit Trading World Bank Report*, Oct. 21, 2002, *available at* http://csf.colorado.edu/eco/econ/2002/msg00791.html (last visited Apr. 5, 2004).

213. Gillis, *supra* note 107.

Another way to estimate the market for carbon credits is to examine the average cost of removing carbon dioxide from emissions.[214] At an Iowa agriculture conference in August 2000, for example, one farmer argued that the price of sequestered carbon dioxide should be $100/ton and that farmers should be paid for providing that public good as they are for providing other ecological benefits.[215] One energy analyst argued that the cost of removing carbon dioxide from the flue gas emissions of power plants was currently $50-100/ton, although industry experts hope that technologies to be developed might bring that cost down to $20-30/ton.[216]

II. REQUIREMENTS FOR EFFECTIVE CARBON MARKETS

Carbon trading programs typically trace their origins to the federal acid rain program.[217] The Clean Air Act amendments of 1990 established a cap and trade system to reduce acid rain-producing emissions from coal-fired power plants.[218] The heart of the acid rain emissions trading system is the cap on total emissions projected, by the year 2010, to result in a ten million ton reduction of sulfur dioxide emissions from 1980 levels.[219] The experience of the acid rain and other trading programs in the United States suggests the importance of the following factors:

- an accurate emissions inventory in place for determining the allocation of allowances;[220]
- the selection of a baseline that fairly reflects economic ups and downs, breakdowns and other problems with maintenance and operation, investments in and performance of pollution control equipment, and other factors;[221]
- sufficient authority and resources for effective monitoring and enforcement;[222]
- continuous and accurate emissions monitoring;[223]

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214. *See, e.g.*, Jerry Perkins, *Farmers Can Help Fight Warming; They Can "Tie Up" Carbon and Reduce Emissions; The Question Is How to Pay Them for Their Efforts*, DES MOINES REG., Sept. 3, 2000, at 1D.

215. *Id.*

216. Mark Trexler, Presentation at Fall Meeting of American Bar Association, Section of Environment, Energy and Resources, Portland, OR (Oct. 9-13, 2002).

217. Jennifer Yelin-Kefer, Note, *Warming up to an International Greenhouse Gas Market: Lessons from the U.S. Acid Rain Experience*, 20 STAN. ENVTL. L.J. 221, 223 (2001).

218. BRYNER, *supra* note 17, at 10.

219. *Id.*

220. *Id.* at 22.

221. *Id.*

222. *Id.*

- determinations that emissions reductions are surplus, quantifiable, permanent, and enforceable;[224] and
- allocation of extra allowances in the cap and trade system that allow policy makers to deal with distributional issues such as who would be responsible for making the reductions and to help overcome resistance from those who are responsible for cleanup costs.[225]

These conditions largely do not exist for greenhouse gases.[226] For example, there is not yet in place an accurate, comprehensive monitoring system to determine carbon dioxide emissions and to ensure compliance with emission limits.[227] Nor is there even the basis of an adequate enforcement mechanism.[228] Both buyers and sellers have an incentive to inflate the reductions traded and there may not be clear incentives to ensure that reductions have actually occurred.[229] A carbon trading program must be carefully designed and implemented to ensure that reductions are additional to those expected to result from "business as usual" investments and that the reductions are permanent and verifiable.[230] Two key actions, establishing an inventory and certifying emission reduction credits, illustrate some of the challenges involved in making carbon trading work.

A. Establishing an Inventory

The first step companies take in developing a greenhouse gas reduction program is to determine the inventory of emissions.[231] The year 1990 is often used as a baseline because of its use in international agreements, but the lack of data makes verifying emissions that far back difficult.[232] The dynamic nature of many companies also makes the calculation of a baseline difficult, since emissions vary considerably over

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223. *Id.* at 21; Daniel H. Cole & Peter Z. Grossman, *When Is Command-and-Control Efficient? Institutions, Technology, and the Comparative Efficiency of Alternative Regulatory Regimes for Environmental Protection*, 1999 WIS. L. REV. 887, 933.

224. BRYNER, *supra* note 17, at 22.

225. *Id.* at 21.

226. *See id.*

227. *See id.*

228. *See id.*

229. *See id.*

230. CHRISTOPHER P. LORETI ET AL., AN OVERVIEW OF GREENHOUSE GAS EMISSIONS VERIFICATION ISSUES 25 (2001).

231. *Id.* at iii.

232. *Id.* at 38.

time as a result of changes in processes, production levels, mergers and acquisitions, and a host of other factors.[233]

A related issue centers on defining the boundaries of a firm's emissions.[234] A World Resources Institute report suggests that companies use organizational boundaries for determining greenhouse gas emissions responsibility that are consistent with boundaries established for financial reporting.[235] The Institute recommends that emission inventories include emissions over which companies have "significant control" and represent direct emissions as well as indirect ones resulting from the electricity they purchase.[236] Control is defined as "the ability of a company to direct the operating policies of another entity/facility. Usually, if the company owns more than fifty percent of the voting interests, this implies control."[237] Significant influence is a function of the following factors: (1) the company owns voting interests of between twenty and fifty percent, (2) the company has the power to participate in the financial and operating policy decisions of the entity/facility, and (3) the company has a long-term interest in the entity/facility.[238] The report recommends the following emissions be reported, as determined by the specific business and industry context and based on accepted financial and accounting standards:

- all greenhouse gas emissions from those entities/facilities that are defined as being wholly owned or controlled;[239]
- the equity share of emissions from jointly controlled assets/entities;[240]
- the equity share of emissions from entities/facilities over which the reporting company has significant influence but does not control.[241]

Direct emissions include production of electricity, heat, and steam; physical or chemical processing; transportation of materials, products, waste, and employees; and fugitive emissions.[242] Indirect emissions include emissions associated with the generation of imported or

233. *Id.*
234. *Id.*
235. WORLD BUS. COUNCIL FOR SUSTAINABLE DEV. & WORLD RES. INST., THE GREENHOUSE GAS PROTOCOL: A CORPORATE ACCOUNTING AND REPORTING STANDARD 14 (Sept. 2001) [hereinafter THE GREENHOUSE GAS PROTOCOL].
236. LORETI ET AL., *supra* note 230, at 5-6, 17-18, 27-29, 38-39.
237. THE GREENHOUSE GAS PROTOCOL, *supra* note 235, at 14.
238. *Id.*
239. *Id.* at 16.
240. *Id.*
241. *Id.*
242. *Id.* at 21.

purchased electricity, heat, and steam, and should be reported separately.[243] Other indirect emissions that could be reported include outsourced activities, contract manufacturing, and franchises; emissions from waste generated by the reporting company that actually occur at other sites not owned by the company, such as methane from landfills; emissions from the use and end-of-life phases of products and services produced by the reporting company; employees commuting to and from work; and production of imported materials.[244]

The World Business Council for Sustainable Development and the World Resources Institute's Greenhouse Gas Protocol Initiative suggests the following principles to guide greenhouse gas accounting and reporting:

- "Define boundaries that appropriately reflect the greenhouse gas emissions of the business and the decision-making needs of users."[245]
- "Account for all greenhouse gas emissions sources and activities within the chosen organizational and operational boundaries. Any specific exclusions should be stated and justified."[246]
- "Allow meaningful comparison of emissions performance over time. Any changes to the basis of reporting should be clearly stated to enable continued valid comparison."[247]
- "Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Important assumptions should be disclosed and appropriate references made to the calculation methodologies used."[248]
- "Exercise due diligence to ensure that greenhouse gas calculations have the precision needed for their intended use, and provide reasonable assurance on the integrity of reported greenhouse gas information."[249]

Another challenge is defining and verifying emissions throughout the life cycle of a product.[250] Emissions can occur during the processing of raw materials purchased for manufacturing; the production of the

243. *Id.*
244. *Id.*
245. *Id.* at 7.
246. *Id.*
247. *Id.*
248. *Id.*
249. *Id.*
250. LORETI ET AL., *supra* note 230, at 39.

electricity used in manufacturing components; the transporting, using, and disposing of products; and other activities.[251] These complex calculations must be broad and inclusive to ensure no emissions are excluded.[252] Reporting and monitoring mechanisms need to be efficiently integrated with requirements under environmental laws in order to minimize the costs of participating in the program.[253]

Determining the benchmark is also difficult. The generation of greenhouse gas reduction credits is based on the calculation of the level of greenhouse gases that would have been emitted in the absence of a project.[254] This is a hypothetical figure that is difficult to calculate. There is a strong incentive for sources and nations to inflate their greenhouse gas inventory in order to be in a position to claim more reduction credits. Governments may be hard pressed to calculate accurate baselines. There are strong incentives to establish generous baselines and credits. The calculation of credits requires that certifying bodies can ensure that reductions are permanent and additional.[255] Should projects aimed at reducing local air pollution be eligible for funding as a source of greenhouse gas credits? Should projects planned for other reasons be part of the baseline? Should governments be able to claim credits for reducing subsidies, reforming prices, deregulating economic sectors, or restructuring energy production?

B. Certifying Emissions and Emission Reduction Credits

The EPA's Climate Leaders program requires third party verification for parties that want to receive the highest recognition level.[256] Joint Implementation and Clean Development Mechanisms under the Kyoto Protocol require participating companies to verify their emission reductions.[257] The United Kingdom's Emissions Trading Scheme requires third party verification of emission baselines and annual emissions.[258] Other programs, such as the U.S. Department of Energy's voluntary emission reporting program, the Pilot Emission Reduction Trading Project, and the Greenhouse Gas Emission Reduction Trading Pilot program do not require third party verification in order to

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251. *Id.*
252. *Id.*
253. *Id.* at 30.
254. *Id.* at 9.
255. *Id.* at 25.
256. *Id.* at 5.
257. *Id.*
258. *Id.* at 8.

avoid discouraging participation because of the cost of verification.[259] Canada's Climate Change Voluntary Challenge & Registry Inc. requires that emission reductions be verifiable, but not that they actually be verified.[260] One survey of twelve companies that have internal reporting systems for greenhouse gas emissions found that seven relied on third-party verification, two used internal reviews, and three did not do any verification.[261] The greater the confidence in the monitoring and tracking system, the greater the value of the credits in the marketplace.

In the absence of federal action, at least four states have developed or are designing greenhouse gas registries: California, New Hampshire, New Jersey, and Wisconsin.[262] All are voluntary programs that encourage companies to reduce emissions. California, for example, has established a Climate Action Registry, where parties can submit certified emissions information that is verified by third parties.[263] These efforts and other voluntary programs can produce the experience required to inform the formulation of national policies to regulate the reporting, trading, and monitoring of carbon trading.[264] New Jersey's Open Market Emissions Trading program was amended to include greenhouse gases in addition to pollutants regulated under the federal Clean Air Act; credits in this program must be verified by either a professional engineer or certified public accountant.[265] The New Jersey program does not spell out the steps required in verification but does require that verifiers certify the following for credits to be verified:

- "The credit generation notice must contain all of the required information, supporting documentation, and certification required under the regulation and the applicable quantification protocol for the pollutant."[266]
- "The credit generation notice must appear on its face to be true, accurate, and complete."[267]
- "All calculations must be performed as required under New Jersey regulations in accordance with a quantification protocol that also meets the state's requirements."[268]

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259. *Id.* at 13.
260. *Id.* at 5.
261. *Id.* at 17-18.
262. *Id.* at 20, 27.
263. *Id.* at 20.
264. *Id.* at 21-23.
265. *Id.* at 27-29.
266. *Id.* at 29.
267. *Id.*
268. *Id.*

- "The credit generation notice must establish that the credits are based on real and surplus emissions reductions that satisfy the state's requirements for the generation of credits."[269]

C. Other Challenges

There are other challenges in making carbon trading work as an effective way of reducing the threat of climate change. From the perspective of economic efficiency, for example, trading should be as broad as possible and be open to as many parties as possible.[270] Trading also poses the problem of allowing sources to buy credits from others rather than reducing their emissions.[271] Thus, trading allows polluters to "escape" the obligation to reduce emissions.[272] Limiting trading to, for example, fifty percent of total allowances—permitting nations to purchase no more than fifty percent of their emission reduction obligations through trading—would help allay the charge that wealthy sources are not doing their share to clean up but are simply buying their way out of responsibility.[273] There are also concerns that trading allows sources to invest in carbon sequestration projects with uncertain or only temporary benefits rather than actually reducing their emissions.

Projects aimed at reducing greenhouse gas emissions or increasing carbon sinks may create incentives for increased emissions/decreased sinks elsewhere. For example, if some sources shift away from using coal, that might deflate coal prices and stimulate increased use by others. Carbon sequestration may be pursued through investments in plantations that displace farmers and encourage them to move to other areas and cut down trees for croplands. One of the cheapest ways of generating greenhouse gas credits is to invest in the protection or expansion of carbon sinks, such as planting trees and no-till cultivation. However, this raises numerous problems, such as how to determine the baseline of carbon sequestration before a project is pursued, so that credits can be accurately calculated.

Effective enforcement that creates incentives for compliance is critical to the success of carbon trading. There are, however, conflicting

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269. *Id.*

270. *See* THE GREENHOUSE GAS PROTOCOL, *supra* note 235, at 12.

271. LORETI ET AL., *supra* note 230, at 27.

272. Isabel Rauch, *Developing a German and an International Emissions Trading System—Lessons from U.S. Experiences with the Acid Rain Program*, 11 FORDHAM ENVTL. L.J. 307, 456 (2000).

273. *See* BRYNER, *supra* note 17, at 22.

imperatives to be balanced. Simple rules, minimal transaction costs, and other factors lead to maximizing the volume of trading and the consequential benefits, while effective compliance and enforcement places limits and costs on the process. Sanctions for noncompliance must be developed. Who should bear responsibility for nonfulfillment of conditions—the buyer? The seller? The government? It may be possible to devise insurance schemes, funded by charges imposed on each transaction, that can be used to purchase credits to meet shortfalls. Such a system could incorporate extra credits to be used for such a purpose. Sanctions for failure to comply with conditions could include a prohibition on future trading and reduction of subsequent allowances by the number of credits in dispute. Credit generators could be required to demonstrate that real reductions have been produced before trading can occur, as is the case in other commodity markets, where producers must show that the product is available and certify its quality. This type of system would require strong political will to sanction parties that fail to meet their obligations.

III. ASSESSING CARBON TRADING

It is quite possible that some benefits may result from climate change, such as increased crop yield in some areas, increased timber yields in some regions, increased water availability in some water-scarce regions, reduced winter mortality in some areas, and reduced energy demand for space heating.[274]

Some may argue that not enough is known about the nature of climate change to take action now, and that current and future generations will be better served if governments and the private sector invest in more research and emphasize economic growth. As more wealth is generated, those financial resources will be available to fund whatever actions are eventually required and to mitigate the effects of adverse developments that may occur.

Nevertheless, there are several reasons why the prudent position is to pursue some preventative measures now. Uncertainties can cut both ways. They can result in even greater, more devastating impacts. Climate change may not be linear, gradual, and manageable. There may be climate tipping points where the next increment of climate change produces dramatic, nonlinear, disruptive, unforeseeable, and

274. WORKING GROUP II, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, SUMMARY FOR POLICYMAKERS, CLIMATE CHANGE 2001: IMPACTS, ADAPTATION, AND VULNERABILITY 6 (2001), *available at* http://www.ipcc.ch/pub/wg2SPMfinal.pdf (last visited Feb. 2, 2004).

unmanageable results. Recent studies, some of which have been commissioned by the George W. Bush administration, including the National Academy of Science's Committee on the Science of Climate Change, which issued a report in 2001 that generally endorsed the main conclusions of the UN-sponsored research on climate change,[275] and a December 2001 National Academy of Sciences report that concluded that climate changes could occur with startling speed,[276] provide compelling cases for precautionary action. Reducing the threat of climate change can also produce other economic, environmental, and equity benefits. Pollution prevention measures make economic sense, and investments in energy efficiency, conservation, cleaner fuels, and other actions that reduce wastes contribute to a dynamic, growing, efficient, and ecologically sustainable economy independent of climate stabilization goals.

For residents of the industrialized nations, climate change is an ethical issue. Those responsible for most greenhouse gases are not the same people who will suffer the consequences of climate change. Residents of industrialized nations are mostly responsible for the threat, and they have the resources to protect themselves from modest changes and disruptions. Developing countries lack the resources to protect their citizens against the effects of climate change. It is simply not tenable to argue that satisfying the continually growing demand by Americans for cheap energy must outweigh the need to contribute to global solutions for climate change.

Carbon trading is only part of an efficient and effective response to reducing the threat of climate change. Investments in energy and materials efficiency, conservation, pollution prevention, renewable energy, and more efficient resource use make sense for economic and environmental reasons apart from climate change, and demand for more efficient energy and industrial facilities will increase. Because greenhouse gases, once released, may stay in the atmosphere for a hundred years or longer, immediate precautionary action is prudent, along with a long-term risk reduction strategy. The longer we wait to reduce the threat of climate change, the larger the problem grows and the narrower our options become. The sooner we act, the more options we will have in the future. Carbon trading's promise to encourage the most cost-effective ways of reducing greenhouse gas emissions makes it a key

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275. *See* COMM. ON THE SCI. OF CLIMATE CHANGE NAT'L RESEARCH COUNCIL, CLIMATE CHANGE SCIENCE: AN ANALYSIS OF SOME KEY QUESTIONS (2001).

276. *See* COMM. ON ABRUPT CLIMATE CHANGE, NAT'L RESEARCH COUNCIL, ABRUPT CLIMATE CHANGE: INEVITABLE SURPRISES (2002).

element in generating political support for a cautious, precautionary policy concerning climate change.

Finally, carbon trading programs can produce valuable experience about how market-based systems can work to find the most cost-effective ways to reduce greenhouse gas emissions and help secure a stable climate. Beyond the benefits that accrue to more efficient operations, voluntary carbon trading programs can produce experience that can guide policy makers in designing future regulatory programs. Companies that established voluntary greenhouse gas reduction programs have found that establishing that goal has provided an additional incentive to identify and invest in improved efficiency and waste reduction. In many cases, emission reductions goals have been achieved while also reducing costs. In one sense, such voluntary programs have clearly been shown to work. However, unless every company adopts emission reduction goals very soon, we will not likely be able to achieve the emission reductions that scientists suggest are critical to reduce the threat of catastrophic climate change to a manageable level. Mandatory programs are inevitable, but voluntary programs can help generate support for the development of a regulatory program that, if well designed, will harness emissions trading to achieve the kind of emission reductions required to stabilize the climate, and produce valuable experience for designing such a program.