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Making Change in a New Currency: Incentives and the Carbon Economy

John M. Volkman*

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With dust settling on the science of climate change, controlling greenhouse gas emissions has assumed a deep sense of urgency. If there were hedges in prior Intergovernmental Panel on Climate Change assessments, there are none now: “Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.”¹ The economist who heads the Panel advises: “What we do in the next two to three years will determine our future. This is the defining moment.”² Many Americans agree that the problem is serious³ and a growing number of states are engaging climate policy,⁴ impatient with the lack

* General Counsel, Energy Trust of Oregon, Portland, Oregon, BA, Colorado College (1969), JD, University of Colorado (1973). This paper is based on a speech to the 31st Annual Public Land Law Conference, “Rocky Mountain Energy Leadership: Strategies for a New Energy Future,” Missoula, Montana, Sept. 24-26, 2007. I dedicate the paper to my late uncle, Squidge Lee, who dedicated a large part of his life to another global problem, strategic arms control. See note 96 and <http://www.arlingtoncemetery.net/jmlee.htm>.

1. International Panel on Climate Change, Working Group 1, *The Physical Science Basis of Climate Change, Summary for Policy Makers* 5, http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Print_SPM.pdf (2007).

2. Rajendra Pachauri, *U.N. Chief Seeks More Leadership on Climate Change*, New York Times 2, at ¶ 12 (Nov. 18, 2007) (available at <http://www.nytimes.com/2007/11/18/science/earth/18climatenew.html?ex=1353042000&en=6ed09cd70fdc2414&ei=5088&partner=rssnyt&emc=rss>). See also the summary of scientific testimony in *Green Mt. Chrysler Plymouth Dodge v. Crombie*, 508 F. Supp. 2d 295 (2007).

3. The Yale Center for Environmental Law and Policy’s *Environmental Poll: March 2007* put the number of Americans who call the problem “serious” at 83%. Yale Center for Environmental Policy, *Environmental Poll: March 2007*, <http://research.yale.edu/envirocenter/index.php?page=yale-environmental-poll> (Mar. 12, 2007).

4. As of April 2007, seven Northeast and Atlantic states had joined the Regional Greenhouse Gas Initiative (see <http://www.rggi.org>), agreeing to develop cap-and-trade systems such that beginning in 2009, emissions of CO₂ from power plants in the region would be capped at approximately current levels until 2015. The states would then begin reducing emissions incrementally over a four-year period

of federal movement. There are still skeptics,⁵ but even the Bush Administration, forced by the courts to reconsider its approach to greenhouse gas emissions in several settings,⁶ concedes that the problem is real.

Pressure is also building in Congress,⁷ and much of it is toward “incentive” rather than command-and-control approaches to greenhouse gas reduction. Incentive systems such as carbon taxes, emissions permit trading, and other devices impose mandatory limits or levy charges on greenhouse gas emissions.⁸ Although these systems are mandatory, they allow regulated firms flexibility and incentives for compliance.

to achieve a 10 percent reduction by 2019. California’s “Global Warming Solutions Act of 2006,” Cal. Assembly 32, 2006 Session (Aug. 31, 2006), requires that the state’s greenhouse gas emissions be reduced to 1990 levels by 2020, and gives the California Air Resources Board responsibility for figuring out how to do so. In 2007, the Oregon legislature adopted House Bill 3543 (Or. H. 3543, 74th Leg. (July 9, 2007)), committing the state to stop the growth of greenhouse gas emissions by 2010, reduce emissions to 10 percent below 1990 levels by 2020, and 75 percent below 1990 levels by 2050. Six western states (Arizona, California, New Mexico, Oregon, Utah and Washington) and two Canadian provinces (British Columbia and Manitoba) have joined the Western Regional Climate Action Initiative which, on August 22, 2007, agreed to reduce greenhouse gas emissions 15 percent below 2005 levels by 2020. Western Climate Initiative, *Statement of Regional Goals*, <http://www.westernclimateinitiative.org/ewebeditpro/items/O104F13006.pdf> (Aug. 22, 2007).

5. The skeptics are now less inclined to argue that global warming is not occurring, or that humans aren’t contributing to it. Bjørn Lomborg, for example, concedes these points, but argues that the problem is exaggerated and does not warrant the cost of curtailing greenhouse gas emissions. Bjørn Lomborg, *Cool It: The Skeptical Environmentalist’s Guide to Global Warming* (Alfred A. Knopf 2007). In his interview with Lomborg, satirist Stephen Colbert summarized Lomborg’s view as: Sure, it’s happening, but “it’s no big deal.” The Colbert Report, *Bjørn Lomborg*, http://www.comedycentral.com/motherload/player.jhtml?ml_video=102497&ml_collection=&ml_gateway=&ml_gateway_id=&ml_comedian=&ml_runtime=&ml_context=show&ml_origin_url=%2Fmotherload%2Findex.jhtml%3Fml_video%3D102497&ml_playlist=&lnk=&is_large=true (Sept. 11, 2007).

6. In addition to *Green Mountain*, 508 F. Supp. 2d 295, see *Mass. v. Envtl. Protection Agency*, 127 S. Ct. 1438 (2007), and *Ctr. for Biological Diversity v. Natl. Hwy. Traffic Safety Administration*, 508 F. 3d 508 (9th Cir. Nov. 15, 2007). In directing the EPA to reconsider its refusal to regulate carbon emissions, the court in *Massachusetts* noted that “[t]he harms associated with climate change are serious and well recognized,” potentially including “a precipitate rise in sea levels by the end of the century,” “irreversible changes to natural ecosystems,” “a significant reduction in water storage in winter snowpack in mountainous regions,” and an “increase in the spread of disease.” 127 S. Ct. at 1455-56. In response to the opinion, the President issued an executive order calling for inter-agency cooperation to protect the environment from greenhouse gas emissions (GHG). Exec. Or. 13432, 72 Fed. Reg. 27, 717 (May 14, 2007). Additionally, EPA announced that it will undertake rulemaking regarding GHG emissions from new vehicles. The White House, *Briefing by Conference Call on the President’s Announcement on CAFÉ and Alternative Fuel Standards*, <http://www.whitehouse.gov/news/releases/2007/05/20070514-6.html> (May 14, 2007).

7. For a summary of bills in Congress, see Pew Center, *Climate Action in Congress*, http://www.pewclimate.org/what_s_being_done/in_the_congress (accessed April 29, 2008).

8. Voluntary approaches like those advanced by the current Administration include government production incentives, clean energy bonds, property and sales tax incentives and credits, time-of-use rate structures, etc., which reward but don’t require action. The Western Governors Association report reviews non-mandatory incentive approaches for energy. The Western Governors Assn., *Clean and Diversified Energy Comm., Clean Energy, a Strong Economy and a Healthy Environment*, <http://www.westgov.org/wga/publicat/CDEAC06.pdf> (2006). Similarly, there are voluntary systems for “carbon credit” trading, essentially the only kind of greenhouse gas trading in the U.S., at least until domestic emissions trading systems are in place. See Peter Zaborowsky & Jeffrey Reamer, *Reality Check for the U.S., GHG Market*, http://www.evomarkets.com/assets/evobriefs/nw_1083009636.pdf (Apr. 26, 2004).

Based on U.S. insistence in the 1990s, a particular incentive approach called “cap and trade” has acquired broad support. Cap-and-trade systems establish a “currency” of emission allowances that can be traded in markets. Emissions allowance trading aims to reduce emissions more flexibly, at lower cost, and hopes to turn climate protection into a paying proposition for those who can do it well.

The idea that environmental conditions like a stable climate have value that can be reflected in the price of goods and services is a long-sought dream of natural resource economists. However, converting environmental amenities to economic equivalents is controversial, and even if environmental values are quantified, commodity markets typically don’t account for them. In economic jargon, environmental damages are “externalities”⁹ that fall outside the market system, damages to common property for which no one pays compensation. Figuring out how to internalize these costs so that economic and environmental objectives are aligned is one of the basic problems of environmental policy.

Climate change is a little different because its *potential* costs are starting to be internalized. Concerns about climate change have become sufficiently clear that investors now consider it likely that carbon taxes or other charges will raise the cost of carbon-producing activities and factor this into investment decisions.¹⁰ Yet, by and large the economy is still running on oil, gas, and coal, and the distance between an economy that fully accounts for the costs of climate change and the economy we actually have is vast. Over the next few years, as the U.S. decides whether to make serious efforts to control greenhouse gas emissions, and the larger world decides on a post-2012 climate policy, we may find out how far incentive systems can bridge this gulf.

This paper: (1) provides background on incentive systems; (2) outlines key policy judgments in cap-and-trade systems; and (3) discusses gaps and complexities in the application of these systems in the power sector and internationally.

9. See Tom Tietenberg, *Environmental and Natural Resource Economics* 47 (4th ed., Harper Collins 1996); James Salzman & Barton H. Thompson, Jr., *Environmental Law and Policy* 17-18 (Jr. Foundation Press 2003).

10. “We have no Buys in Coal, and recommend switching into select Non-ferrous, Steel, and Gold names, or elsewhere in energy.” Citigroup Global Markets Equity Research, *Coal: Missing the Window*, http://www.pewclimate.org/companies_leading_the_way_belc/company_profiles (July 18, 2007); Robert J. Keating, et al., *Greenhouse Gas Emissions Trading: Emerging Markets and Opportunities for Colorado* 63, Univ. of Colo. Law School Energy & Envtl. Security Initiative (Mar. 15, 2007); Electric Power Research Institute, *Climate Policy Gets Down to Business*, EPRI Journal 19-20 (Summer 2006); Jeremy K. Leggett, *The Carbon War: Global Warming and the End of the Oil Era* 326-329 (Routledge 2001).

I. BACKGROUND ON INCENTIVE SYSTEMS; CHOOSING BETWEEN TAXES AND CAP-AND-TRADE

The modern era of air emissions control began with the Clean Air Act of 1970,¹¹ a flagship command-and-control program. The Clean Air Act established national air quality goals for six principal pollutants (“criteria” pollutants), required the Environmental Protection Agency (EPA) to set standards for classes of emissions sources, and called for states to work with the EPA to develop plans and enforcement mechanisms to reduce emissions. The command is in the goals and deadlines for cleaning up the nation’s air (within a decade or so), and the control is in specifying technologies and measures to achieve these goals.¹² Command-and-control leaves little to the imagination of regulated communities.

The Clean Air Act has reduced emissions of all the criteria pollutants, and in some cases the reductions have been dramatic.¹³ However, its success has been spotty, and it has come at a cost:¹⁴

- Command-and-control requires all firms of a given class to adopt the same control technologies, even if other solutions would be cheaper or more effective at individual sites.
- Command-and-control has encountered significant resistance, which plays out in Congress, administrative agencies, and courts, entailing major expense and delay.
- Regulators find it hard to keep up with shifts in science, technology, and consumer taste (e.g., sport-utility vehicles mooting increased mileage standards for cars).
- Regulations provide no incentive to go beyond bare compliance with regulatory limits, which are treated as ceilings rather than floors.¹⁵

The common assumption is that carbon dioxide (CO₂), the biggest contributor to the greenhouse effect, is such a pervasive by-product of industry,

11. 42 USC §§ 7401-7671(q) (2000). For background, see Salzman & Thompson, *supra* n. 9, at 77.

12. See Peter Berck & Gloria E. Helfand, *The Case of Markets versus Standards for Pollution Policy*, 45 Nat. Res. J. 345, 347 (2005); Salzman & Thompson, *supra* n. 9, at 77.

13. Walter A. Rosenbaum, *Environmental Politics and Policy* 189 (5th ed., CQ Press 2002).

14. For a fuller account of the shortcomings of command-and-control, see Walter A. Rosenbaum, *Environmental Politics and Policy* (6th ed., CQ Press 2005); Inho Choi, *Global Climate Change & the Use of Econ. Approaches: The Ideal Design Features of Domestic Greenhouse Gas Emissions Trading with an Analysis of the European Union’s CO₂ Emissions Trading Directive & the Climate Stewardship Act*, 45 Nat. Res. J. 865, 868-869 (2005). Among other things, the Clean Air Act puts the heaviest burdens on new facilities, which are likely to be cleaner than older facilities. *Id.* While the Act has reduced emissions from large sources, it has had much less success with small, dispersed sources that in the aggregate may cause more harm. *Id.* at 871.

15. David M. Driesen, *Is Emissions Trading an Economic Incentive Program? Replacing the Command and Control/Economic Incentive Dichotomy*, 55 Wash. & Lee L. Rev. 289, 305 (1998).

transportation and other enterprise that it would be hard to devise a practical command-and-control structure for it.¹⁶ Accordingly, early thinking about greenhouse gas control took a different tack. A carbon tax could raise the price of fuels and activities that produce CO₂ emissions and thereby reduce emissions. The tax system already reaches into every corner of the economy, so we would not need to invent an entirely new regulatory program. The tax revenue could be used to mitigate impacts on affected workers and businesses, as well as fund research into low-emission technologies.

Carbon taxes were adopted in various European countries in the 1990s, but ran into political problems and fell out of favor. A Btu tax proposed by President Clinton in the mid-1990s failed¹⁷ shortly before climate change negotiations began in Kyoto. The U.S. needed a politically viable alternative to a carbon tax.¹⁸

Around the same time, the EPA had begun a large-scale emissions trading program to control acid rain. The program, authorized by the 1990 Clean Air Act amendments, was designed to provide regulated firms with flexibility to find their own emissions reductions. The acid rain program:

- imposed a national cap on sulfur dioxide (SO₂) emissions of about nine million tons per year from electric generating plants, a 40% reduction from 1980 levels, in two phases: the largest emitters were capped in 1995, and the rest in 2000;
- distributed emissions allowances to the capped firms (one allowance per ton of SO₂), which in total equaled the required emission reductions;
- required capped firms to have enough allowances to cover their emissions for any reporting period, but allowed them to choose how to achieve the allowed level, either by reducing emissions on site, buying another firm's allow-

16. Choi, *supra* n. 14, at 878.

17. See Dawn Erlandson, *The BTU Tax Experience: What Happened and Why it Happened*, 12 Pace Envtl. L. Rev. 173 (1994). Erlandson's account is that the proposal was "brilliantly conceived in every way" and its early prospects were surprisingly favorable. It began to fall apart when the Clinton Administration carved out exemptions for political allies, which led to an "avalanche of [exemption] requests." When this happened, Republicans opposed the Btu tax as a partisan proposal, industry opposed it on grounds of cost, and key Democrats (Senator Boren in particular) opposed it for parochial reasons. The House nevertheless approved the Btu tax. But when the Senate substituted a 4.3-cent-per-gallon gas tax, mooting the Btu tax's deficit reduction, environmental and energy goals, the bill collapsed.

18. The Kyoto negotiations stemmed from the *United Nations Framework Convention on Climate Change*, to which the U.S. is a party. The Framework Convention's objective is "stabilization of greenhouse gas concentrations at a level that would prevent dangerous anthropogenic interference with the climate system." It encourages developed countries to stabilize the emissions at 1990 levels. The purpose of the Kyoto negotiations was to establish specific emissions limitations. United Nations, *United Nations Framework Convention on Climate Change*, Arts. 2, 4(2)(b), <http://unfccc.int/resource/docs/convkp/conveng.pdf> (May 29, 1992).

ances, or banking excess allowances for use in future reporting periods; and

- required the firms to install sophisticated emissions monitoring systems.

The lesson of allowance trading in the acid rain program was that emissions could be reduced more and faster if regulated firms were allowed to use their creativity to find less costly ways to do it.¹⁹ By taking advantage of the fact that some firms could reduce emissions at much lower cost than others, the program cost an estimated 43-55% of a uniform emission standard.²⁰ Some analysts concluded that the acid rain program fostered consensus on program goals, reduced emissions more quickly than command-and-control, reduced requests for exemptions, avoided litigation, and produced better emissions data.²¹ A 2005 study predicted that by 2010, the acid rain program will have produced \$122 billion in annual benefits at a cost of \$3 billion per year, a 40-to-1 benefit-cost ratio.²²

Greenhouse gases may be even better candidates for trading than SO₂. Because greenhouse gases mix uniformly in the atmosphere, emissions reductions have much the same value in all parts of the globe, which helps broaden the trading market. Cost differences in different parts of the world are likely to be large, which increases flexibility in finding abatement options. Because greenhouse gases are long-lived, allowances can be traded over time periods.²³

In Kyoto, the U.S. strongly advocated an emissions trading system. U.S. negotiators hoped that emissions trading between nations would reduce domestic opposition to the international program because it would encourage abatement projects in developing countries.²⁴ The resulting Kyoto Protocol obligates parties to reduce their greenhouse gas emissions below 1990 emissions.²⁵ The European Union and others have developed cap-and-trade systems pursuant to the Kyoto Protocol, and have actively traded emissions allowances among themselves.²⁶

19. A. Denny Ellerman, Paul L. Joskow & David Harrison, Jr., *Emissions Trading in the U.S.* 12 (Pew Center 2003). See also Judith A. Layzer, *The Environmental Case: Translating Values into Policy* 393 (2d ed., CQ Press 2006).

20. Ellerman et al., *id.* at 15; Market Advisory Comm. to the Cal. Air Resources Board, *Recommendations for Designing a Greenhouse Gas Cap-and-Trade System for California* 8, http://www.climatechange.ca.gov/documents/2007-06-29_MAC_FINAL_REPORT.PDF (June, 1 2007).

21. Ellerman et al., *supra* n. 19, at 33-35.

22. Environmental Protection Agency, *Acid Rain Program 2004 Progress Report*, <http://www.epa.gov/airmarkets/progress/arp04.html> (last updated Feb. 2, 2007).

23. Ellerman et al., *supra* n. 19, at 40-41.

24. Layzer, *supra* n. 19, at 294-95.

25. Kyoto Protocol to the United Nations Framework Convention on Climate Change, U. N. Doc. FCC/CP/1997/L.7/Add.1, Art. 3.1, Annex B (Dec. 10, 1997).

26. The European Union system covers CO₂ emissions from large emitters in the power, heat generation, and selected energy-intensive industry sectors: combustion plants, oil refineries, coke ovens, iron and steel plants and factories making cement, glass, lime, bricks, ceramics, pulp and paper. More

Many economists still contend that carbon taxes would be a more efficient, cheaper, easier-to-administer, and effective way to reduce emissions than a cap-and-trade system, and the tax alternative is still a subject for debate as nations decide what to do after 2012, when the Kyoto Protocol lapses.²⁷ In addition to avoiding the need to create a new “carbon currency” and trading system, taxes create certainty about the annual cost of emissions reduction, provide consistent incentives to reduce emissions, and are not subject to the wild swings and manipulation seen in commodity markets. Some tax advocates think taxes are generally more transparent, easier to monitor across different countries, and less susceptible to manipulation or corruption compared to allowance trading systems.²⁸

Carbon taxes do avoid a “baseline” problem that affects cap-and-trade systems. The Kyoto Protocol picked 1990 emissions as the baseline against which emissions would be measured. A country like Russia, whose emissions dropped below 1990 levels because its economy cooled, would meet its Kyoto commitments without trying and be able to sell surplus emissions allowances.²⁹ A country whose economy heated up since the baseline period would have to do a great deal, possibly buying allowances from countries with slow economies. A tax system, in contrast, uses a zero-emissions baseline: any carbon emissions are taxed, regardless of whether a given economy runs hot or cold.³⁰

There are also considerations of principle. Taxes discourage pollution, whereas cap-and-trade appears to confer a “right” to pollute,³¹ and lets emitters buy their way out of their sins of emission.³² For some people, a

than 11,400 installations are included, accounting for about 45% of the CO₂ emissions in the EU, or about 30% of its overall greenhouse gas emissions. A 2005 analysis found that the system was likely to achieve only “minor steps” toward meeting Kyoto targets. Hans H. Kolshus & Asbjørn Torvanger, *Analysis of EU Member States' National Allocation Plans*, 30 Ctr. for Intl. Climate & Env'tl. Research Working Paper 2005-02, <http://www.cicero.uio.no/media/3982.pdf> (Dec. 2005).

27. See, Peter R. Orszag, *Approaches to Reducing Carbon Dioxide Emissions*, Congressional Budget Office Testimony before the House Committee on the Budget 4-5 (Nov. 1, 2007); William D. Nordhaus, *Life After Kyoto: Alternative Approaches to Global Warming Policies*, Nat. Bureau of Econ. Research Working Paper 11889, http://www.econ.yale.edu/~nordhaus/kyoto_long_2005.pdf (Dec. 9, 2005); Robert J. Shapiro, *Addressing the Risks of Climate Change: The Environmental Effectiveness and Economic Efficiency of Emissions Caps and Tradable Permits, Compared to Carbon Taxes*, <http://www.aci-citizenresearch.org/Shapiro.pdf> (Feb. 2007); Ian W.H. Parry, *Should We Abandon Cap and Trade in Favor of a CO₂ Tax?* 166 *Resources for the Future* 6, 10 (Summer 2007).

28. Shapiro, *supra* n. 27, at 8; Juliet Eilperin & Steven Mufson, *Tax on Carbon Emissions Gains Support*, *The Washington Post* A05 (April 1, 2007).

29. See Kyle W. Danish, *An Overview of the International Regime Addressing Climate Change*, 7 *Sustainable Dev. L. & Pol'y* 10, 12 (Winter 2007), <http://www.wcl.american.edu/org/sustainabledevelopment/2007/07winter.pdf?rd=1>.

30. Nordhaus, *supra* n. 27, at 13; Shapiro, *supra* n. 27, at 13-14.

31. Allowances create a conditional entitlement, not legal title per se, but they are still entitlements with weight. Tom Tietenberg, *The Tradable Permits Approach to Protecting the Commons: What Have We Learned?* 1, 7 <http://www.feem.it/NR/rdonlyres/0DE1C530-3142-4579-A880-E56B70D09A29/474/3602.pdf> (June 2002).

32. The British website CheatNeutral.com satirizes the moral problem with emissions trading: “When you cheat on your partner you add to the heartbreak, pain and jealousy in the atmosphere. CheatNeutral offsets your cheating by funding someone else to be faithful and NOT cheat. This neutral-

market-oriented approach to greenhouse gas abatement crosses a moral threshold, commoditizing the air we breathe, authorizing what should be discouraged.

However, cap-and-trade systems have advantages of their own. For one thing, they impose a direct limit on emissions, and limiting emissions is, after all, the point. We can only estimate the effect a tax might have on emissions by looking at how much demand would be reduced if the prices of the goods and services produced by emissions-producing activities were increased by a given tax.³³ This kind of prediction can be made with economic models, but it is a prediction and the practical reality may disprove it.³⁴ If a tax has surprisingly little effect on emissions, or dampens emissions only temporarily, we would have to adjust the tax. By setting an emissions cap, a cap-and-trade law can set the key policy objective and avoid the backing and filling that a tax could entail.

The second key advantage of cap-and-trade is political. Taxes are a tough sell, and the Btu tax history is a heavy burden to lug around.³⁵ Cap-and-trade systems don't involve a tax, and even though emissions caps may raise the price of energy, the costs are determined by markets, not legislators. And market trading creates winners (those who reduce emissions cheaply and/or play markets well), not just losers (those who pay taxes).

Politics permitting, the shortcomings of cap-and-trade might be minimized by careful design. Market fluctuations can be dampened with flexibility mechanisms such as allowance banking (allowing a capped entity to keep surplus allowances for use in future years), allowance set-asides (in which government reserves some allowances for sale at a set price), and other devices.³⁶ If all emission allowances are auctioned and the proceeds used for public purposes, cap-and-trade burdens undesirable activity (emis-

ises the pain and unhappy emotion and leaves you with a clear conscience." Cheatneutral, *Homepage*, <http://www.CheatNeutral.com> (last accessed Apr. 29, 2008).

33. See Choi, *supra* n. 14, at 900; Market Advisory Comm. to the Cal. Air Resources Board, *supra* n. 20, at 6; Roger C. Dower & Mary Beth Zimmerman, *The Right Climate for Carbon Taxes: Creating Economic Incentives to Protect the Environment*, 10-11 (World Resources Institute, Aug. 1, 1992).

34. "In practice, however, a tax system is extremely difficult to monitor and enforce. Governments would implement greenhouse gas taxes on top of existing distortions in their tax systems, making it hard to measure the practical effect of the new taxes." David G. Victor, *The Collapse of the Kyoto Protocol and the Struggle to Slow Global Warming* 19 (Princeton U. Press 2001).

35. Emissions taxes "have been and remain politically impossible to implement in the United States." Alan Sanstad, W. Michael Hanemann & Maximillian Auffhammer, *End-Use Energy Efficiency in a 'Post-Carbon' California Economy: Policy Issues and Research Frontiers*, Managing Greenhouse Gas Emissions in California 6-9, http://calclimate.berkeley.edu/managing_GHG_in_CA.html (Jan. 2006).

36. Dallas Burtraw, Alexander E. Farrell, Lawrence H. Goulder & Carla Peterman, *Lessons for a Cap-and-Trade Program*, Managing Greenhouse Gas Emissions in California 5-7, 5-13, 5-14, 5-15 (The Cal. Climate Change Ctr. at UC Berkeley, Jan. 2006).

sions) and benefits desirable activity, mollifying those of us who chafe at granting rights to pollute.³⁷

Cap-and-trade and tax approaches share some drawbacks. Once adopted, a tax would be difficult to change, but so could cap-and-trade rules. Cap-and-trade rules are likely to be complex, but so are tax rules. Gaming and corruption are risks in any incentive program, whether it involves taxes, cap-and-trade, or something else.

Finally, consider that the U.S. insisted on cap-and-trade in Kyoto. It would be awkward, now that the rest of the world has acted on the U.S. suggestion, for the U.S. to insist on a tax approach. Unless the European Union and others are persuaded by their experience to draw back from cap-and-trade, it is hard to imagine that a U.S.-proposed tax approach would have much credibility.

II. THREE KEY POLICY JUDGMENTS IN CAP-AND-TRADE³⁸

A. *Setting an Emissions Cap*

One of the advantages of cap-and-trade – the ability to impose a specific emissions limit – is an advantage only if there is political will to adopt one.

The scientific basis for a cap is reasonably well developed. Over the past 150 years, CO₂ concentrations have risen from about 280 parts per million to about 380 parts per million.³⁹ Business-as-usual is expected to increase emissions more than half again by 2030.⁴⁰ The International Panel on Climate Change suggests that emissions need to be reduced world-wide from current levels by 50% to 85% by 2050.⁴¹ With such a reduction, per capita annual carbon emissions in the U.S. would still be much higher than the world average, but temperatures increases would be limited to a couple of degrees Centigrade.⁴²

An emissions cap will follow a slow/stop/reverse pattern: first slow the increase in emissions, then stop, and then reduce emissions to an end-

37. See Nat. Commn. on Energy Policy staff paper, *Allocating Allowances in a Greenhouse Gas Trading System* 9, http://www.energycommission.org/files/contentFiles/Allocating_Allowances_in_a_Greenhouse_Gas_Trading_System_45f71a5fb536b.pdf (Mar. 2007).

38. There are many more program “design” issues than are discussed in this paper. For a longer list, see Sergey Paltsev, John M. Reilly, Henry D Jacoby, Angelo C. Guregel, Gilbert E. Metcalf, Andrei P. Sokolov, & Jennifer F. Holak, *Assessment of U. S. Cap-and-Trade Proposals*, MIT Joint Program on the Science and Policy of Global Change § 2, p. 3-7 (April 2007).

39. Jane A. Leggett, *CRS Report for Congress, Climate Change: Science and Policy Implications*, 1 (Jan. 25, 2007).

40. Nat. Commn. on Energy Policy, *Energy Policy Recommendations to the President and the 110th Congress* 11-12, http://www.bipartisanpolicy.org/files/news/contentFiles/NCEP-Recom-final-single_4773e92b6f5c2.pdf (April 2007); International Energy Agency *Energy Bulletin*, <http://www.energybulletin.net/22042.html> (Nov. 7, 2006).

41. International Panel on Climate Change, Fourth Assessment Report, Working Group III, *Mitigation of Climate Change, Summary for Policy Makers*, <http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-spm.pdf> (2007).

42. *Id.*

point.⁴³ The pace and end-point are where the controversy lies. In 2005, the Northeast states agreed to stabilize CO₂ emissions from the region's power plants at 2005 levels by 2015, and reduce them by 10 percent in 2018.⁴⁴ California law requires the state's greenhouse gas emissions to be reduced to 1990 levels by 2020.⁴⁵ Governor Schwarzenegger has issued an executive order providing shorter- and longer-term checkpoints: 2000 emissions levels by 2010 and 80 percent below 1990 levels by 2050.⁴⁶ Oregon aims to reduce emissions in absolute terms (not just in terms of emissions intensity) by 2010; ten percent below 1990 levels by 2020; and 75 percent below 1990 levels by 2050.⁴⁷ The governments of the Western Climate Initiative have agreed to establish a regional goal to reduce greenhouse gas emissions in the West to 15 percent below 2005 levels by 2020 (about 1990 emission levels).⁴⁸

Proposals in Congress are similarly diverse. In the Senate, the Lieberman-Warner bill⁴⁹ would cap electric generation, industrial, and transportation emissions at 2005 levels in 2012; 15% below 2005 levels by 2020; and 70% below 2005 levels by 2050. An earlier Kerry-Snowe bill, S. 485, would reduce covered emissions to at least 62% below 1990 levels in 2050.⁵⁰ The Bingaman-Specter bill, S. 1766, would reduce covered emissions to 60% below 2006 levels in 2050.⁵¹ In the House, Representatives Dingell and Boucher have issued a white paper on climate legislation saying that the U.S. should reduce its greenhouse gases by 60-80 percent by 2050, but the paper provides no specific baseline against which to measure reductions.⁵² The Bush Administration would reduce emissions *intensity* by 18 percent by 2012, with no absolute reduction.⁵³ Analysts are still examin-

43. See Nat. Commn. on Energy Policy, *supra* n. 40, at 11; Karen Palmer & Dallas Burtraw, *Electricity, Renewables & Climate Change: Searching for a Cost-Effective Policy 2* (Resources for the Future, May 2004).

44. See Regional Greenhouse, Gas Initiative (RGGI) *Memorandum of Understanding in Brief*, http://www.rggi.org/docs/mou_brief_12_20_05.pdf (Dec. 20, 2005).

45. The Global Warming Solutions Act of 2006, Cal. Assembly 32, 2006 Session (Aug. 31, 2006).

46. Cal. Exec. Or. S-3-05 (June 1, 2005) (available at <http://www.dot.ca.gov/hq/energy/ExecOrderS-3-05.htm>).

47. Or. H. 3543, 74th Leg. (July 9, 2007) (available at <http://www.leg.state.or.us/cgi-bin/searchMeas.pl>).

48. Western Climate Initiative, *Statement of Regional Goal*, <http://www.westernclimateinitiative.org/ewebeditpro/items/O104F13006.pdf> (Aug. 22, 2007).

49. Sen. 2191, 111th Cong. (October 18, 2007) (available at http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_bills&docid=f:s2191is.txt.pdf (October 18, 2007)).

50. See John Larsen, *Global Warming Legislation in the 110th Congress*, http://www.wri.org/climate/topic_content.cfm?cid=4265 (Feb. 1, 2007).

51. The non-partisan National Commission on Energy Policy, on which the Bingaman-Specter bill is modeled, proposes a "first step" policy: stabilize emissions at 2006 levels by 2020, and reduce them by 15 percent below 2006 levels by 2030. Nat. Commn. on Energy Policy, *supra* n. 40, at 11-12.

52. See House Committee on Energy and Commerce, *Climate Change Legislation Design White Paper: Scope of a Cap-and-Trade Program*, http://energycommerce.house.gov/Climate_Change/White_Paper.100307.pdf (Oct. 3, 2007).

53. See Larsen, *supra* n. 50; World Resources Institute, *A Comparison of Legislative Climate Change Targets in the 110th Congress*, <http://pdf.wri.org/usclimatetargets.pdf> (Sept. 17, 2007).

ing the effects of these proposals,⁵⁴ the congressional prospect is unclear, and the 2008 presidential candidates are clarifying their positions.

The argument for a less restrictive cap and/or a ceiling price on emissions allowances is based on a combination of economics, risk management and political acceptability. There are unknowns about climate change and climate policy: what kinds of systems will be adopted in the U.S. and other parts of the world; enforcement mechanisms, especially at the international level; whether the costs of climate change and of emissions reduction are much higher or lower than anticipated; and other issues. Given these uncertainties, it makes sense to take more modest steps initially and adjust as we go.⁵⁵

Strictly from the perspective of cap-and-trade mechanics, setting a high cap (i.e., one that allows more emissions) would reduce demand for emissions allowances and undermine an allowance market. To achieve greenhouse gas objectives, a cap must make allowances sufficiently scarce to drive a market.⁵⁶ The point was illustrated in the European Community cap-and-trade system's pilot stage, where each nation set its own cap, and more allowances were distributed than actual emissions. When the over-allocation became apparent, the allowance market crashed, prices dropped from 30 euros (€) per ton in the program's first year to about 1€ per ton in March 2007.⁵⁷

B. Breadth, Complexity, and Transparency

The more sectors and gases that are involved in a trading system, the greater the potential effects on emissions, the less likely it is that emissions will simply shift to other sectors (a problem called "leakage" in greenhouse gas policy-speak), the more robust the market, and the more cost-effective emissions reductions are likely to be.⁵⁸

In concept, a carbon trading system could be quite broad. Climate change is an economy-wide problem, with three sectors producing most of the emissions: electric generation (roughly 40% of U.S. CO₂ emissions and a third of greenhouse gas emissions); the transportation sector (about a third of CO₂ and 28% of greenhouse gas emissions); and the industrial sector (about 14% of CO₂ and 19% of greenhouse gases). Agricultural (7% of

54. Compare the Environmental Protection Agency, *Analysis of Senate Bill S.1766 in the 110th Congress, the Low Carbon Economy Act of 2007*, <http://www.epa.gov/climatechange/economicanalysis.html>, with World Resources Institute, http://www.wri.org/newsroom/newsrelease_text.cfm?nid=398 (Oct. 1, 2007).

55. See Joseph E. Aldy, Peter R. Orszag & Joseph E. Stiglitz, *Climate Change: An Agenda for Global Collective Action*, 24-26 http://www.sbgo.com/Papers/Aldy-Orszag-Stiglitz_5.pdf (Oct. 2001).

56. See Market Advisory Comm. to the Cal. Air Resources Board, *supra* n. 20, 15.

57. Keating et al., *supra* n. 10, at 18.

58. Market Advisory Comm. to the Cal. Air Resources Board, *supra* n. 20, at 22; Catherine Boemare & Philippe Quirion, *Implementing Greenhouse Gas Trading in Europe: Lessons from Economic Literature and International Experiences*, 43 *Ecological Applications* 213 (2002).

greenhouse gases), commercial (3% of CO₂, 6% of greenhouse gases) and residential sectors make up the rest (6% of CO₂, 5% of greenhouse gases).⁵⁹

However, the larger the system, the greater the complexity, problems of transparency, and likelihood of political resistance. The trade-offs between scope, complexity, transparency and politics can be managed to some degree by carefully choosing the point at which emissions allowances are distributed. Because there are fewer entities at the “upstream” end of the supply chain (e.g., the well-head, mine-mouth or port of entry), distributing allowances upstream may minimize complexity. If allowances are distributed further downstream (e.g., everyone who drives a car or pushes a lawnmower), there will be many more entities involved and the system may be impossible to monitor.

Monitoring is a key consideration in establishing a system’s scope. If an emissions source cannot be meaningfully monitored, skilled market-players may be able to game the system, making profits while no one is quite sure what is happening to greenhouse gas emissions. There is little value in including sectors that can’t be monitored at acceptable cost. Upstream-oriented systems may be monitored more effectively and at lower (still not insignificant⁶⁰) cost.

There is no single solution to the trade-offs between scope, complexity, and transparency. In a regulated industry like the electric industry, it may be more feasible to distribute allowances upstream, e.g., to utilities and energy service providers. However, it is harder to say where “upstream” is in the industrial sector because there are so many different industries emitting so many gases. Transportation and industry sectors may require hybrid systems with elements of trading, command-and-control, and taxes.⁶¹

C. Distributing Allowances Fairly

Economists say that in terms of achieving emissions goals, it makes no difference how emission allowances are allocated. No matter who gets them initially, emissions allowances will migrate through trading to the most cost-efficient place.⁶² However, initial allocation makes a big difference in terms of equity and the cost of reducing emissions, and the process is politically fraught.⁶³

59. U.S. Environmental Protection Agency, *U.S. Greenhouse Gas Inventory Reports: 1990-2005*, USEPA # 430-R-7-002, Executive Summary tables ES-3 and ES-4 (April 2007).

60. Monitoring can be expensive. The acid rain monitoring program uses a “continuous emissions monitoring system,” which added about 7% to compliance costs during phase I of the program. Ellerman et al., *supra* n. 19, at 16-17.

61. See Market Advisory Comm. to the Cal. Air Resources Board, *supra* n. 20, at 34; Robert R. Norhaus & Kyle W. Danish, *Designing a Mandatory Greenhouse Gas Reduction Program for the U.S.* 34-35, <http://www.pewclimate.org/docUploads/USGas.pdf> (2003).

62. Tom Tietenberg, *supra* n. 31, at 3.

63. Nat. Commn. on Energy Policy staff paper, *supra* n. 37, at 3.

There are two primary allocation methods: free allocation (i.e., grandfathering) and auctioning. Free allocation distributes allowances on the basis of past activity; e.g., output, emissions, or fuel input. In an auction system, firms bid to purchase allowances.⁶⁴

In the trial phase of the European emissions trading market, allowances were grandfathered on the theory that free allocation was necessary to compensate firms for the cost of reducing emissions, and besides, it was the path of least political resistance. These factors overcame other objections to free allocation (e.g., that new firms seeking entry into a market would be disadvantaged because they would have to pay for allowances).

The 2005-2007 European trading experience demonstrated a fallacy in the idea that free allocation was needed to compensate capped firms. Allowances are like currency: once they are distributed, the recipient can sell them, use them to meet an emissions cap, or hold them for future use. If an allowance is sold, the capped firm must find other ways to reduce emissions, the cost of which will, if possible, be passed on to customers. If an allowance is used to meet an emissions cap, the capped firm will, if possible, raise its price to customers to reflect the allowance's expended value. In other words, to the extent they can, capped firms will pass on the cost of emissions reduction to consumers. If the allowance was free in the first place, capped firms are not compensated, they receive a windfall.⁶⁵ By one estimate, capped firms in Europe in 2005 secured windfalls of about \$1 billion in this fashion.⁶⁶

Auction systems, in which everyone bids for allowances, are far more efficient.⁶⁷ Auctions allow new and existing firms to compete for allowances on an even footing, avoid the risk of windfall profits, and generate revenue that can be used to address economic or policy concerns. Revenues can be used to mitigate impacts on industry sectors that actually merit compensation, reduce other taxes, fund research and development of low-emissions technology, and other purposes. The National Commission on Energy Policy concluded that a roughly even split between grandfathered and auctioned permits would more than compensate industry for potential dislocation and generate significant revenues to address policy objectives.⁶⁸ Some allowances can be distributed free to unfairly-burdened industry sectors.⁶⁹

64. *Id.* at 4.

65. *Id.* at vii-viii. If these observations seem counter-intuitive, see also *Id.* at 11.

66. H. Fairfield, *When Carbon is Currency*, New York Times (May 6, 2007) (available at http://www.nytimes.com/2007/05/06/business/yourmoney/06emit2.html?_r=1&oref=slogin).

67. Nat. Commn. on Energy Policy staff paper, *supra* n. 37, at ix.

68. *Id.* at 17.

69. *Id.* at ix.

III. GAPS AND LIMITATIONS OF CAP-AND-TRADE

Angus Duncan, an Oregon climate policy leader, once remarked that there is no integrated “field theory” that explains how cap-and-trade should fit with other policy devices to reach climate policy objectives.⁷⁰ We are not exactly blind, but we are still on the steep part of the learning curve, feeling our way around an elephantine problem with a unclear sense of how different solutions add up to a whole. We think that cap-and-trade worked in the acid rain context, but we don’t know how well it will transfer to greenhouse gases at a global scale. At this point, with the benefit of a couple of years’ experience with the European Union system, we have seen a large amount of trading activity and some missteps in trading systems. This section illustrates how some of this has played out, and how systems can be designed or supplemented to avoid pitfalls.

A. *Cap-and-Trade in the Power Sector*

Over the next 40-50 years, the challenge for the power sector is to transition from what the Electric Power Research Institute describes as “a global energy system that is 85% CO₂-emitting today to one that is predominantly non-emitting.”⁷¹ Several factors make this otherwise daunting challenge seem plausible. For example, power generation is thought to be one of the most straightforward sectors in which to reduce emissions. It is a large source of carbon emissions. The industry is regulated, relatively free from economic competition, and has a manageable number of emissions sources.⁷²

The power sector also has one of the few trump cards in climate policy: the availability of a large and evolving amount of energy efficiency.⁷³ Energy efficiency can meet energy needs with zero emissions. Because efficiency often costs less than building new generating facilities, it is not only an effective way to reduce emissions, it can actually save money in the power sector. In effect, it is a way to finance greenhouse gas reductions in the power sector.⁷⁴

70. Field theories use mathematical quantities to describe how conditions at any point in space will affect matter or another field. The most famous example of a grand field theory was Einstein’s attempt to explain how quantum physics, which deals with fundamental particles, fits with laws that apply to large-scale physical phenomena. See Walter Issacson, *Einstein: His Life and Universe* 13-14, 316-317 (Simon & Schuster 2007).

71. Electric Power Research Inst., *Turning on Energy Efficiency*, EPRI Journal 9 (Summer 2006).

72. Regulatory Assistance Project, *Carbon Caps and the Power Industry: Recent State Activity and the Design Issues for Regulators*, Issues letter 1, <http://www.raonline.org/Pubs/Sept2006.pdf> (Sept. 2006).

73. “[E]nergy efficiency in buildings, transport and manufacturing industries account for more than half of this potential [to reduce emissions in 2010-2020 time period].” International Panel on Climate Change, Fourth Assessment Report, Working Group III, *supra* n. 41, at 5.

74. See William R. Prindle, Anna Monis Shipley & R. Neal Elliott, *Energy Efficiency’s Role in a Carbon Cap-and-trade System: Modeling Results from the Regional Greenhouse Gas Initiative*, Ameri-

It is tempting to assume that because cap-and-trade systems are supposed to push capped firms to the cheapest low-emissions resource, capped firms will seek energy efficiency first. However, this is not necessarily a good assumption because of changes in the nature of the electric industry in recent years. Assume a greenhouse gas cap is imposed on power generators, which was the case in the acid rain program. When the acid rain program was designed in the early 1990s, energy utilities were vertically integrated, i.e., utilities controlled energy generation, transmission and distribution. Since then, significant parts of the energy industry have been restructured.

Generation is now dominated by independent power producers; utilities handle distribution. Independent generators sell to utilities in large wholesale markets, where the market determines energy prices. In turn, utilities sell energy to consumers subject to state regulation.⁷⁵ For a number of reasons, generators are unlikely to use energy efficiency to meet emissions reduction requirements. Generators have no relationship with ultimate energy consumers, no obvious way to induce consumers to use less energy and, of course, they make money by selling energy rather than convincing people to use less. Because generators' prices are regulated only by what the market will bear, they will incline to generation-oriented options such as building low-emission generation facilities, using low-carbon fuel, buying allowances, and pass the cost on to utilities and consumers. These are not bad options, but they entirely miss the benefits of energy efficiency. To capture these benefits, a cap-and-trade system needs a way to link the capped entity (generators or utilities) and the potential source of energy efficiency (the end-user).

Moreover, the costs that generators pass on to utilities and consumers may be more or less than the actual cost of emissions reduction because of another feature of the energy industry. In some regions, energy prices are determined by competitive markets. Market administrators request bids from generators for sufficient energy to meet load at different times. Generators price their offers based on fuel cost, plant efficiency and, in a cap-and-trade world, the cost of reducing emissions. The market administrator accepts as many bids as needed to meet demand and pays the highest bid price for all the generation it buys for that time period.⁷⁶ Energy prices in these markets are based on the highest rate that is bid into the market at a given time. An efficient, low-emissions generator is paid the same price for energy as an inefficient, high-emissions generator who must pay a lot for emissions reduction, and consumers end up paying more for emissions re-

can Council for an Energy-Efficient Economy Report No. E064 (May 2006); Market Advisory Comm. to the Cal. Air Resources Board, *supra* n. 20, at 46-47.

75. Nat. Commn. on Energy Policy staff paper, *supra* n. 37, at viii; Regulatory Assistance Project, *supra* n. 72, at 4; Michael Gillenwater & Clare Breidenich, *Internalizing Carbon Costs in Electricity Markets: Using Certificates in a Load-Based Emissions Trading Scheme*, 4 (Aug. 2007) (available at http://www.princeton.edu/~mgillenw/Load%20based%20cap%20paper-formatted%20_final.pdf).

76. Regulatory Assistance Project, *supra* n. 72, at 4-5.

ductions than the reductions actually cost. In contrast, in parts of the country where energy prices to consumers are regulated rather than determined by markets, generators may be unable to pass on the full cost of emissions-reduction to consumers. In these areas, emissions may be subsidized by the regulatory system.

In short, cap-and-trade systems are unlikely to capture energy efficiency if the cap is imposed on generation unless a specific mechanism is built into the system; and even if the cap is imposed on load-serving entities rather than generation, a cap-and-trade system may be inefficient. It needs to be designed carefully to ensure that consumers pay no more or less than the actual cost of emissions reduction.

Two responses to these phenomena have emerged in the states. The Regional Greenhouse Gas Initiative imposes caps on generators, but requires at least 25 percent of allowances to be auctioned (several of the Northeast states require all allowances to be auctioned).⁷⁷ Auction revenues are to be used to finance energy efficiency, lower other taxes, or invest in other public-purposes. In this way, the program should capture the benefit of energy efficiency and reduce the risk of windfall profits to generators. It is not clear, however, how this model avoids paying a premium for emissions reductions due to the markets' tendency to set energy prices at the highest bid price.

California, in contrast, aims its emissions cap at a different point in the supply chain. Instead of capping generators, it focuses lower in the supply chain, on energy purchasers such as utilities, called "load-serving entities." Load-serving entities may buy energy from low-emission generators, buy allowances from other load-serving entities, or offer incentives to their customers to save energy. This approach captures energy efficiency. Because load-serving entities have the ability to buy energy from low-emission generators, and because state regulators may not permit load-serving entities to recover artificially high emissions reduction costs, the cost of emissions control will be lower.

The specific point is that cap-and-trade systems won't necessarily reach energy efficiency and won't minimize the cost of reducing emissions unless they are specifically designed to do so. The more general point is that it is risky in any sector – energy, transportation, industrial or others – to assume cap-and-trade systems will automatically realize their hoped-for advantages. They need to be designed carefully with the characteristics of those particular sectors clearly in mind.

77. See Nat. Commn. on Energy Policy staff paper, *supra* n. 37, at 15; Regulatory Assistance Project *supra* n. 72, at 2; Gillenwater & Breidenich, *supra* n. 75, at 2.

B. *Supplementing Cap-and-Trade with Other Initiatives*

Because of these complexities, because the scale of the climate change problem is so large, and because experience with cap-and-trade and greenhouse gas emissions is limited, commentators emphasize the need to supplement cap-and-trade with other, more targeted initiatives. It is unclear, for example, whether cap-and-trade will do enough to spur the development of innovative technologies and systems. This is a problem the economic literature terms “innovation market failure,” in which markets seek low-cost, available solutions, not fundamental technological innovation.⁷⁸ Opinions are divided about whether the acid rain program pushed innovation. As one commentator said:

[T]here is no hard evidence that emissions trading works simply because it can either harness market power or induce technological innovation. . . . In the case of sulfur dioxide (SO₂) allowance trading, utilities have been able to comply with the applicable emissions limit by switching to low-sulfur western coal or by installing scrubbers, without incurring significant additional costs.⁷⁹

Even if cap-and-trade does much better at this in the greenhouse gas context than its skeptics suppose, there is sense in managing this risk by supplementing cap-and-trade with programs and incentives aimed specifically at research and development of next-generation technologies.⁸⁰

The point, moreover, is broader. We hope that well-designed cap-and-trade systems will optimize energy efficiency and lead to an outpouring of innovation. But to some degree we are rolling dice in a high-stakes game. Targeted investment in research and development, tighter energy codes, energy conservation programs,⁸¹ tax credits, renewable portfolio stan-

78. The problem in which markets lead to short-term gains rather than fundamental innovation is known in the economic literature as “innovation market failure.” See Market Advisory Comm. to the Cal. Air Resources Board, *supra* n. 20, at 14. See Carolyn Fischer & Richard Newell, *Environmental and Technology Policies for Climate Mitigation*, Resources for the Future Discussion Paper RFF DP 04-05, 2 (April 2004, revised February 2007) (available at <http://ideas.repec.org/p/rff/dpaper/dp-04-05.html#download>).

79. Choi, *supra* n. 14, at 886-887. See also Berck & Helfand, *supra* n. 12; David M. Driesen, *Sustainable Development and Market Liberalism's Shotgun Wedding: Emissions Trading Under the Kyoto Protocol* 43-44, <http://www.law.syr.edu/Pdfs/0sustainbeyonfinal2007.pdf> (Mar. 22, 2007).

80. Burtraw et. al, *supra* n. 36, at § 4.1. Energy companies in particular tend to avoid investing in long-term technology development because of the lack of short-term payoff. Federal spending on energy research and development in 2006 was less than half what it was in 1980. Andrew C. Revkin, *Budgets Falling in Race to Fight Global Warming*, N.Y. Times (Oct. 30, 2006) (available at <http://www.nytimes.com/2006/10/30/business/worldbusiness/30energy.html?ei=5090&en=3be47b59ce9137c1&ex=1319864400&adxnnl=1&partner=rssuserland&emc=rss&adxnnlx=1204034413-0D5/JzBJiah8RSU9TFfQ>).

81. Sanstad et al., *supra* n. 35, at 6-6.

dards,⁸² regulatory reform, and other strategies are prudent ways to hedge these risks.⁸³

C. *How Will It Work Globally?*

Climate protection has to work globally if it is to work at all,⁸⁴ and so it is important to consider how a U.S. incentive system would mesh with efforts in other nations. At the same time, however, there is uncertainty about how the international system will look after the Kyoto Protocol expires in 2012. We don't know precisely what approach will be taken after that, but we do know that not every country is enamored of markets, willing to cap emissions, or levy carbon taxes.⁸⁵ How should U.S. climate policy designers deal with these uncertainties?

One of the central dilemmas involves developing countries. When the Kyoto Protocol was negotiated, developing nations found emissions caps unacceptable because of concerns that caps would freeze developing nations' economies at persistent levels of underdevelopment. On the other hand, developed nations, particularly the U.S., wanted to avoid the risk that they would reduce emissions, impinging on their own economies, only to see climate objectives undone by increasing and unrestricted emissions from developing countries. This is the international version of the problem in which emissions "leak" from participating entities to non-participating entities.⁸⁶ Based on this concern, in 1997 the U.S. Senate passed a resolution directing the government not to enter into any agreement that would limit or reduce U.S. greenhouse gas emissions without also limiting developing countries.⁸⁷

82. Palmer et al., *supra* n. 43, at 2.

83. "The literature in general gives no preference for any particular policy instrument. Market based instruments may be cost-effective in many cases, especially where capacity to administer them is developed. Energy efficiency standards and performance regulations are widely used, and may be effective in many countries, and sometimes precede market based instruments. Voluntary agreements have recently been used more frequently, sometimes preceding the introduction of more stringent measures. Information campaigns, environmental labeling, and green marketing, alone or in combination with incentive subsidies, are increasingly emphasized to inform and shape consumer or producer behaviour. Government and/or privately supported research and development is important in advancing the long-term application and transfer of mitigation technologies beyond the current market or economic potential." Intergovernmental Panel on Climate Change, Fourth Assessment Report, Working Group III, *supra* n. 41, at 12.

84. The U.S. is still the world's largest greenhouse gas producer, but it is about to be overtaken by China, which is expected to increase its greenhouse gas emissions by another 65-80% by 2020. Pew Center on Global Climate Change, *Climate Change Mitigation Measures in the People's Republic of China*, International Brief 1, 1 (April, 2007).

85. David M. Driesen, *Choosing Environmental Instruments in a Transnational Context*, 27 *Ecology L. Q.* 1 (2000).

86. Joseph Aldy, Scott Barrett & Robert Stavins, *Thirteen Plus One: A Comparison of Global Climate Policy Architectures*, 2, [http://ksgnotes1.harvard.edu/Research/wpaper.nsf/rwp/RWP03-012/\\$File/rwp03_012_stavins.pdf](http://ksgnotes1.harvard.edu/Research/wpaper.nsf/rwp/RWP03-012/$File/rwp03_012_stavins.pdf) (Mar. 2003).

87. Sen. Res. 98, 105th Cong. (July 25, 1997); 143 Cong. Rec. S8138 (daily ed. July 25, 1997).

The Kyoto Protocol attempts to manage this dilemma by authorizing trading between capped (developed) and uncapped (developing) countries⁸⁸ through what is called the Clean Development Mechanism (“CDM”). CDM trading involves specific emissions reduction projects in developing countries, which a developing country can fund and use as credit toward its Kyoto emissions commitment. CDM has several advantages. First, if a capped entity can acquire emissions reduction credits anywhere on the planet, the trading market will involve more and cheaper emissions reduction options. Overall, this should lower the cost of reducing emissions. Second, CDM trading allows uncapped nations to profit from emissions reduction. In effect, CDM trading creates small caps that may grow: each project caps a particular facility, area or sector; the prospect of a profit acts as an incentive to expand the capped area to include more projects.⁸⁹ The Kyoto designers hoped that over time, CDM trading would bring more nations into a cap-and-trade allowance trading system, which requires a national commitment to emissions caps.

The disadvantage of CDM trading is that the process is much more complex and unpredictable than allowance trading. In CDM trading, a project’s potential emissions reductions have to be estimated in advance, and then verified against baselines. Credit projects must also satisfy “additionality” criteria by showing that the emissions reduction would not have occurred absent CDM credit.⁹⁰ These processes and requirements help ensure that projects represent real emissions reductions, but they also can be burdensome and their results can be hard to predict.⁹¹ There has been some volume of CDM trading (mostly by China, which has generated around 40 percent of CDM credits so far, mostly involving greenhouse gases other than carbon), but the process is problematic.⁹² Thus, it is not yet clear

88. Axel Michaelowa, *The Kyoto Protocol and its Flexibility Mechanisms*, International Society for Ecological Economics Internet Encyclopedia of Ecological Economics, www.ecoeco.org/pdf/Kyotoandflex.pdf (Feb. 2003).

89. “Each project constitutes an incremental extension of the emission caps and the incentives will be strong to extend the caps to include related facilities, a whole sector, or even a country. The greater the scope of the caps, the less leakage (i.e., shifting emissions from capped to uncapped sources), and the less costly it will be to establish credible baselines.” Ellerman, *supra* n. 19, at 43.

90. “Additionality is a criterion that says GHG reductions should only be recognized for project activities that would not have ‘happened anyway.’ While there is general agreement that additionality is important, its meaning and application remain open to interpretation.” World Resources Inst. & World Business Council for Sustainable Dev., *The Greenhouse Gas Protocol: GHG Protocol for Project Accounting* 8 (2004).

91. Investors are flocking to the growing market in emissions allowances, but it’s not for the faint of heart. *Reducing Gains: There’s Plenty of Money to Be Made in the Fight Against Global Warming, but the Risks Can Be as Big as the Potential Profits* R6, Wall St. J. (Aug. 27, 2007) (quoting John Mackle, Chief Financial Officer of MGM International). See also Axel Michaelowa, *supra* n. 88. The same can be said of the various voluntary carbon offset programs. See Clean Air, Cool Planet, *A Consumers’ Guide to Retail Carbon Offset Providers* (Dec. 2006) (available at <http://www.cleanair-coolplanet.org/ConsumersGuidetoCarbonOffsets.pdf>).

92. Danish, *supra* n. 29, at 49-50 (available at http://www.vnf.com/assets/attachments/KWD-ABA_Climate_Law07.pdf).

whether CDM trading does much to address concerns about emissions leakage.

Moreover, CDM trading is admittedly a small patch on the international problem. The larger question is how a sufficient group of nations can coordinate climate protection policies when their circumstances are so disparate, mutual trust is so low, and the problem overlaps many of the entrenched economic, security, and equity issues that divide north and south, east and west, developed and developing countries. Does it truly take all nations to participate? Is the Kyoto approach – capping developed nations but not undeveloped nations – viable? Do developing nations really have the political and administrative infrastructure to implement the types of incentive approaches that engross the developed nations?

With the end of Kyoto only a few years off, some things seem clear. First, the trading scheme developed in the European Union and elsewhere has a certain momentum, and the Kyoto process that underlies it has developed a considerable body of rules, procedures and mechanisms to coordinate policy internationally.⁹³ There are other options, certainly.⁹⁴ But wholly reinventing climate policy and walking away from this infrastructure would be a fateful step, gambling that something else is needed and will work better. Second, any significant progress in climate change policy will take active U.S. engagement. This is in part what is at stake in the current congressional efforts over climate legislation. A convincing U.S. program would be the clearest demonstration that the dust on the scientific debate has settled and we are ready to get to work. Finally, regardless of which direction climate policy takes, climate protection needs to be regarded as a long-term project. If cap-and-trade is the chosen path, we can't expect to get it exactly right in the early going. The problem and the potential solutions are too complex to expect early, sweeping success. If and when the U.S. does engage, it needs to be with the expectation that addressing these issues is a long-term problem of science, national politics, and international diplomacy.

IV. CONCLUSION

Incentive approaches are playing an important role in the climate change policy debate in the U.S. and globally. The basic variables in these systems are reasonably well studied, and with the benefit of experience based on the European trading system's trial phase, it is easier to see how much the details of policy design can work. Done well, a cap-and-trade approach can help wring inefficiency out of the economy and accomplish climate objectives at much lower cost. Climate change policy design appears to be sufficiently mature to come up with a good initial design. Testing the proposi-

93. *Id.* at 50-52.

94. Aldy et al., *supra* n. 86, at 18-19.

tion will require the U.S. and other nations to make the political judgments that a proof will take.

There is no point in pretending that developing a credible U.S. climate policy will be easy or that the solutions are obvious. We are standing on the high board and it is a long way down. At the same time, if anyone needed a reminder, the introductory section of the Supreme Court's opinion in *Massachusetts v. EPA*⁹⁵ documents how long we have been debating climate policy. For better or worse, we have the benefit of this history: high confidence in the science, experience from emissions trading systems in other parts of the world, many years of analysis and debate over incentive approaches, and a new degree of political consensus that something needs to be done.

No matter how difficult the political judgments, many factors justify the effort. This is a problem that will only worsen with time and neglect, and the risks of inaction are large. Even modest success will help move us toward a more sustainable fuel supply, a transition that must come sooner or later, and a more efficient economy. And for the U.S. above all, this is an important problem to confront in a candid and constructive spirit. As Squidge Lee said 28 years ago about the prospect of taking on another critical global problem:

[W]hether such a program were to fail or succeed, it would be good for this country that we had made the effort. It would be good for our view of ourselves and our confidence, now in disarray, that we still follow our best national impulses; it would be good for the world's view of us if we publicly dedicate ourselves to [this] large-scale effort⁹⁶

95. *Massachusetts*, 127 S. Ct. 1438.

96. Adm. John M. Lee, *An Opening 'Window' for Arms Control*, 58 Foreign Affairs 121, 140 (1979).

