CLIMATE CHANGE: THE CHINA PROBLEM

MICHAEL P. VANDENBERGH*

ABSTRACT

The central problem confronting climate change scholars and policymakers is how to create incentives for China and the United States to make prompt, large emissions reductions. China recently surpassed the United States as the largest greenhouse gas emitter, and its projected future emissions far outstrip those of any other nation. Although the United States has been the largest emitter for years, China's emissions have enabled critics in the United States to argue that domestic reductions will be ineffective and will transfer jobs to China. These two aspects of the China Problem, Chinese emissions and their influence on the political process in the United States, result in a mutually supportive but ultimately destructive dance between the two countries. This Article argues that a post-Kyoto international agreement and other measures are necessary but will not create sufficient incentives to induce China, and ultimately the United States, to act. Instead, the Article draws on the fact that the United States and Europe account for 41% of Chinese exports to propose a novel means of changing both countries' incentives. The article suggests that private or public schemes in the United States and Europe to disclose

* Professor of Law, Co-Director, Regulatory Program, and Director, Climate Change Research Network, Vanderbilt University Law School. This paper was supported by funds from Vanderbilt Law School and the Vanderbilt Center for the Study of Religion and Culture. I would like to thank Jim Bacchus, Linda Breggin, Mark Cohen, David Dana, Jeffrey Dunoff, Jonathan Gilligan, Theresa Glennon, Matthew Kotchen, David Mandel, Matthew Ogonowski, Jeffrey Smith, Tom Solomon, Kevin Stack, Robert Sussman, W. Kip Viscusi, David Zaring, Todd Zywicki, and the workshop participants at the University of Chicago Law School, the Georgetown University Law Center, the University of Kentucky College of Law, the Temple University Beasley School of Law, the University of Southern California Law School, and Vanderbilt University Law School, as well as the participants at the Michigan State University Environmental Crime and Natural Resources Sustainability Conference. Kevin Bonin, Antoinette Capaccio, Trevor Cloak, Nick Halmos, Maggie Johnson, Sarah Luppen, Nathan Moore, Paul Padgett, Katie Patterson, Smith Podris, and Chris Powell provided excellent research assistance.

product carbon emissions and corporate carbon footprints can create consumer and other pressure that will induce firms to impose supply-chain requirements on Chinese and other suppliers. This form of global private governance can create market-based incentives for China and the United States to reduce emissions directly and to make credible emissions-reduction commitments in the post-Kyoto era.

I. INTRODUCTION

"Our general stance is that China will not commit to any quantified emissions reduction targets, but that does not mean we will not assume responsibilities in responding to climate change."

– Ma Kai, head of Chinese National Development and Reform Commission, June 4, 2007[1]

"This is a challenge that requires a 100 percent effort; ours, and the rest of the world's. The world's second-largest emitter of greenhouse gases is China. Yet, China was entirely exempted from the requirements of the Kyoto Protocol."

– President George W. Bush, June 11, 2001[2]

"[T]he United States should not be a signatory to any protocol . . . which would . . . mandate new commitments to limit or reduce greenhouse gas emissions . . . unless the protocol or other agreement also mandates new specific scheduled commitments to limit or reduce greenhouse gas emissions for Developing Country Parties within the same compliance period . . . ."

– U.S. Senate Resolution 98, 1997[3]

In England, a leading grocery store recently sold small trays of baby asparagus, baby carrots, and other minivegetables neatly tied in bundles with a chive. The chives were grown in England and flown to Nairobi, Kenya, where workers tied them around the minivegetables and placed them in plastic trays also flown in from outside Nairobi. The minivegetable bundles were then shrink-wrapped and flown back to grocery stores in England, where customers purchased them oblivious to their 8500 mile

1. Jim Yardley & Andrew C. Revkin, *China Issues Plan on Global Warming, Rejecting Mandatory Caps on Greenhouse Gases*, N.Y. TIMES, June 5, 2007, at A12 (quoting Ma Kai, head of Chinese National Development and Reform Commission).

2. Press Release, White House Office of the Press Sec'y, President Bush Discusses Global Climate Change (June 11, 2001), *available at* http://www.whitehouse.gov/news/releases/2001/06/20010611-2.html.

3. S. Res. 98, 105th Cong. (1997).

journey.[4]

The largest potato chip producer in England buys potatoes by weight.[5] Farmers respond to the incentive to sell heavy potatoes by keeping the potatoes in humidified warehouses, using large amounts of energy and emitting large amounts of carbon dioxide in the process.[6] The moist, heavy potatoes are then transported, again using large amounts of energy.[7] When the potatoes arrive at the potato chip producer, the producer uses yet more energy during the potato-cooking process to remove the water that was carefully retained by the farmers.[8]

This Article examines how overcoming the types of consumer and firm information shortcomings at the root of these examples may resolve the most fundamental problem facing the public international system: how to create sufficient incentives to induce China, the United States, and other nations to reduce greenhouse gas emissions.[9] The coercive command-and-control approaches that dominated the first twenty years of domestic environmental law in the United States are not available at the global level. International trade rules render many trade sanctions and subsidies unavailable. The cap-and-trade measures that have dominated domestic environmental law in recent years require participation by most if not all of the principal players. The limited gains that will be achieved even by successful implementation of the Kyoto Protocol demonstrate the need to

4. FELICITY LAWRENCE, NOT ON THE LABEL: WHAT REALLY GOES INTO THE FOOD ON YOUR PLATE 87 (2004) (describing baby vegetable trays sold at Marks & Spencer).

5. *See* CARBON TRUST, CARBON FOOTPRINTS IN THE SUPPLY CHAIN: THE NEXT STEP FOR BUSINESS 11, 13 fig.8 (2006), *available at* http://www.carbontrust.co.uk/publications/publicationdetail.htm?metaNoCache=1&productid=CTC616&metaNoCache=1 (noting a case study of water content of potatoes supplied to Walkers). *See also* Sarah Murray, Op-Ed., *The Deep-Fried Truth*, N.Y. TIMES, Dec. 14, 2007, at A41 (noting that the humid conditions in which potatoes are stored, sold and transported to potato chip manufacturers contributes more to the manufacturer's carbon footprint than does distribution from the manufacturer).

6. *See* Murray, *supra* note 5.

7. CARBON TRUST, *supra* note 5, at 13 fig.8. A gallon of water weighs roughly eight and one-third pounds. *See* Charles Fishman, *Message in a Bottle*, FAST COMPANY, July/Aug. 2007, at 111, 112, *available at* http://www.fastcompany.com/magazine/117/features-message-in-a-bottle.html. Fishman notes that each year thousands of gallons of bottled water are shipped from Fiji, where water is scarce, to the United States, where it is plentiful. *Id.* at 113.

8. CARBON TRUST, *supra* note 5, at 13.

9. *See, e.g.*, SCOTT BARRETT, WHY COOPERATE?: THE INCENTIVE TO SUPPLY GLOBAL PUBLIC GOODS 93, 162–64 (2007) [hereinafter BARRETT, WHY COOPERATE?] (noting the need for and difficulty of creating incentives, and proposing uniform technology specifications to promote diffusion of low-carbon technologies); Cass R. Sunstein, *The Complex Climate Change Incentives of China and the United States* 3, 22 (Univ. of Chicago, John M. Olin Law & Econ. Working Paper No. 352, 2007) [hereinafter Sunstein, *Complex Climate Change*] (describing the need for incentives for the United States and China to restrict their greenhouse gas emissions).

bring the largest emitters to the table.[10]

To evaluate the incentives for China and the United States, this Article begins by examining China's unwillingness to commit to and implement greenhouse gas emission reductions, which this Article refers to as the China Problem.[11] Although the issue could just as easily be characterized as the "China-U.S. Problem," the greatest threat over the long term is the projected growth in China's emissions.[12] Despite taking a number of measures to reduce emissions,[13] China recently passed the United States as the largest emitter of greenhouse gases in the world,[14] and China's emissions are projected to increase at a more rapid rate than those of any other major emitter over the next several decades.[15] Current Chinese emissions are sufficiently large that it may not be possible to reduce the risk of catastrophic climate change without reductions from China.[16] In fact, China's projected emissions are so large that, when added to the greenhouse gases already in the atmosphere, Chinese emissions alone may be sufficient to trigger catastrophic climate change even if all other countries approach near-zero emissions levels.[17] At the same time, China's

10. *See* WILLIAM D. NORDHAUS & JOSEPH BOYER, WARMING THE WORLD: ECONOMIC MODELS OF GLOBAL WARMING 152 (2000) (concluding that the Kyoto Protocol would only reduce expected warming by 0.03 degrees Celsius by 2100).

11. China and the United States, the two largest emitters, not only have declined to commit to reductions but have attempted to undermine the efforts of other governments to date. *See infra* notes 88–90 and 113–15 and accompanying text.

12. The United States has emitted more carbon dioxide in the aggregate than China, but it is far easier to reduce emissions than to remove carbon dioxide from the atmosphere. Reducing prospective Chinese emissions is thus a more promising strategy for reducing the threat of global warming than capturing and sequestering existing U.S. emissions from the atmosphere. *See generally* Sunstein, *Complex Climate Change*, *supra* note 9 (examining the incentives of the United States and China).

13. For a review of the steps China has taken to reduce greenhouse gas emissions, see CTR. FOR CLEAN AIR POLICY, GREENHOUSE GAS MITIGATION IN BRAZIL, CHINA AND INDIA: SCENARIOS AND OPPORTUNITIES THROUGH 2025, CONCLUSIONS AND RECOMMENDATIONS 8–12 (2006), *available at* http://www.ccap.org/international/Conclusions-Developing%20Country.pdf. The review concludes that China has achieved a level of reduction that is "equal to or better than the level of reduction projected to be achieved by the U.S. under its voluntary emissions intensity target . . . ." *Id.* at 7.

14. *Gas Exchange: CO2 Emissions 1990–2006*, 447 NATURE 1038, 1038 (2007) [hereinafter *Gas Exchange*]. *See also* Joseph Kahn & Jim Yardley, *As China Roars, Pollution Reaches Deadly Extremes*, N.Y. TIMES, Aug. 26, 2007, at A1 (noting that the International Energy Agency had indicated that China could pass the United States as the largest emitter by the end of 2007).

15. *See* ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, INTERNATIONAL ENERGY OUTLOOK 2006, at 93 tbl.A10 (2006), *available at* http://www.eia.doe.gov/oiaf/ieo/pdf/ieoreftab_10.pdf.

16. *See infra* notes 48–53 and accompanying text.

17. Estimates suggest that carbon dioxide emissions should be reduced to only 20%–40% of current levels to avoid doubling atmospheric concentrations in order to reduce the risk of catastrophic climate change. *See infra* note 51 and accompanying text. China, however, currently comprises more than 20% of global carbon dioxide emissions and is on course to approach 40%. *See infra* notes 36–44 and accompanying text. In the absence of major reductions between now and 2050, China alone may

massive coal reserves, low per capita income, and the delayed effects of climate change provide incentives for China to maintain recent emissions trends.[18]

The second aspect of the China Problem is a political problem in the United States that is exacerbated by China's position on greenhouse gas emissions. If we assume that it is in the interest of the United States to reduce its emissions,[19] China's position on emissions contributes to the inability of the political process in the United States to pursue the national interest. China's position not only undermines the value to the United States of reducing emissions, but it also provides opponents of emissions reductions with powerful rhetorical tools. Opponents can point to economic competition from China as well as the futility of reducing emissions in the face of Chinese increases. Opponents also can resist unilateral domestic efforts because of the need for leverage in international negotiations[20] while never actually placing substantial pressure on China to reduce its emissions.[21] The political aspects of the China Problem are evident from statements made by sources as divergent as President George W. Bush,[22] the U.S. Senate,[23] and the dissent by Chief Justice John Roberts in the recent *Massachusetts v. Environmental Protection Agency* decision by the U.S. Supreme Court.[24] In turn, the unwillingness of the United States to

cause global carbon dioxide emissions to exceed the target 20%–40% of current emissions.

18. *See infra* notes 54–90 and accompanying text.

19. This is a contestable but reasonable assumption. *See infra* notes 92–103 and accompanying text.

20. *See infra* notes 107–08 and accompanying text.

21. *See, e.g.*, John M. Broder, *At Meeting About Global Warming, Bush Does Not Specify Goals*, N.Y. TIMES, Sept. 29, 2007, at A7 (noting that President Bush rejected "mandatory targets for capping carbon dioxide emissions" for all countries at a September 28, 2007 meeting among China and other major emitting countries).

22. *See* Press Release, White House Office of the Press Sec'y, President Bush and Australian Prime Minister Howard Discuss U.S.–Australian Trade Cooperation Treaty in Joint Press Availability (Sept. 4, 2007), *available at* http://www.whitehouse.gov/news/releases/2007/09/20070904-10.html (noting that President George W. Bush stated on September 5, 2007 that "in order for there to be an effective climate change policy, China needs to be at the table"). *See also infra* notes 104–07 and accompanying text.

23. S. Res. 98, 105th Cong. (1997); 143 CONG. REC. S5623 (daily ed. June 12, 1997) (statement of Sen. Byrd); Press Release, U.S. Senate Comm. on Energy & Natural Res., Domenici Statement on White House Global Climate Change Initiative (May 31, 2007), *available at* http://energy.senate.gov/public/index.cfm?FuseAction=PressReleases.Detail&PressRelease_id=f1d7f0e2-7017-479f-8d11-7b05a89f2dc6&Month=5&Year=2007&Party=1 ("It is my belief that this problem cannot be solved by the U.S. itself. We must engage China, India, and other developing nations to be active partners with us. If we don't do so, we could place our nation at an economic disadvantage and our efforts would likely be ineffective at reducing emissions.").

24. Massachusetts v. EPA, 127 S. Ct. 1438, 1469–70 (2007) (Roberts, C.J., dissenting) (agreeing with the EPA that China's emissions levels present a standing problem).

commit to mandatory reductions buttresses China's position.[25]

The complex *pas de deux* between China and the United States benefits opponents of near-term reductions in both countries. Yet if the concerns about catastrophic climate change are well-founded, this dance is in neither the global interest nor the interest of the United States.[26] Even China, although it stands to benefit tremendously from the economic growth that is generating its increased emissions, may face substantial net costs if catastrophic climate change occurs.[27]

Recent treatments of this topic by academicians, policymakers, and the media have suggested that national governments take a variety of steps to shift China's incentives, including subsidizing China through excess allowances in a post-Kyoto global carbon trading scheme, subsidizing Chinese adoption of less carbon-intensive[28] energy production, facilitating the development and adoption of new technologies, and acting unilaterally in the hope that China will reciprocate.[29] This Article suggests that it may

25. *See* Dean Scott, *Senators Cite Growing Support for Cap; European Officials Call for U.S. Leadership*, 186 Daily Env't Rep. (BNA) A-7, A-8 (Sept. 26, 2007) (noting that Danish Minister for the Environment Connie Hedegaard stated in a meeting with U.S. senators that "China, India, and other developing countries will not do anything [without] U.S. leadership"). More recently, the Bush Administration has announced a policy of leveling off U.S. greenhouse gas emissions, but the leveling off would not occur until 2025 and the commitment will only be included in an international agreement if other major emitting countries such as China also agree to limits. *See* Press Release, White House Office of the Press Sec'y, President Bush Discusses Climate Change (Apr. 16, 2008), *available at* http://www.whitehouse.gov/news/releases/2008/04/20080416-6.html.

26. I assume that it is in the global interest to reduce greenhouse gas emissions by an amount necessary to reduce the risks of catastrophic climate change. *See* Michael P. Vandenbergh & Anne C. Steinemann, *The Carbon-Neutral Individual*, 82 N.Y.U. L. REV. 1673, 1679–85 (2007) (discussing the relationship between emissions and climate change, and the potential harms of global warming). *See also infra* notes 49–52 and accompanying text.

27. *See infra* notes 69–80 and accompanying text.

28. For brevity I use the terms "carbon" and "greenhouse gases" interchangeably, although I recognize that many greenhouse gases include more than just carbon, and some, such as nitrous oxide, do not include carbon.

29. *See, e.g.*, SCOTT BARRETT, ENVIRONMENT AND STATECRAFT: THE STRATEGY OF ENVIRONMENTAL TREATY-MAKING 16–18 (2003) [hereinafter BARRETT, ENVIRONMENT AND STATECRAFT] (examining strategic options); RICHARD B. STEWART & JONATHAN B. WIENER, RECONSTRUCTING CLIMATE POLICY: BEYOND KYOTO 102–04 (2003) (discussing the need for side payments from developed countries to major emitting developing countries to encourage the latter's participation in an emission reduction scheme); Eric A. Posner & Cass R. Sunstein, *Climate Change Justice* 9 n.53 (Univ. of Chicago, John M. Olin Law & Econ. Working Paper, Paper No. 354, 2007) (noting that unilateral action by the United States could spur action by other nations); Sunstein, *Complex Climate Change*, *supra* note 9, at 4, 5 (noting that "the best alternative is to convince either or both nations that they have a moral obligation to act to protect those nations that are most vulnerable" and that "unilateral action by the United States might well turn out to be feasible, through some combination of confusion, hope, and a sense of moral responsibility"). For a recent discussion of remedial options in the public media, see Thomas L. Friedman, *The Power of Green*, N.Y. TIMES, Apr.

be possible to shift China's incentives by stimulating the private provision of public goods, drawing on the global private governance literature to suggest how information provision in developed countries can generate market pressure that will increase China's incentives to reduce emissions. In particular, the information can induce private firms in the United States, Europe, and other developed countries to direct supply-chain contracting pressure toward their suppliers, including suppliers in developing countries. To the extent buyers demand lower carbon-intensity goods in new contracts, supply-chain contracting pressure can be coercive without being punitive. It also can provide private market subsidies to the extent corporate buyers are willing to pay a price premium for low-carbon goods or share information about efficiency enhancements and new technologies. The potential for influence is large: private firms in the United States and Europe account for roughly 41% of all Chinese exports[30] and 14%–28% of all Chinese carbon dioxide emissions.[31]

Supply-chain contracting pressure also can alter the political and economic incentives for the United States. New political incentives will arise from the absence of China as a willing coparticipant in the current embrace between emissions-reduction opponents in both countries. New economic incentives will arise from the application of the supply-chain contracting requirements not only to Chinese and other developing world exporters, but also to manufacturers in the United States and other developed countries, a feature that may be required in any event to avoid simply shifting high-emitting production from country to country.

This Article begins with an assessment of current and projected Chinese emissions. It then turns to an examination of the two principal aspects of the China Problem: China's position on current and future greenhouse gas emissions and the impact of the Chinese position on the political process in the United States. Regardless of the actual incentives faced by the two countries, both are functioning as if they lack incentives to

15, 2007, § 6 (Magazine), at 40.

30. *See* Gordon Fairclough, *Wal-Mart Sneezes, China Catches Cold*, WALL ST. J., May 29, 2007, at B1 (noting that approximately 20% of Chinese exports go to the United States); Joe McDonald, *China Says Inflation, Trade Surplus Up*, WASH. POST, Sept. 11, 2007, http://www.washingtonpost.com/wp-dyn/content/article/2007/09/11/AR2007091100721.html (reporting that China's August 2007 exports to Europe ($23 billion) were 20.7% of China's total exports ($111.3 billion)).

31. *See* Bin Shui & Robert C. Harriss, *The Role of CO2 Embodiment in US-China Trade*, 34 ENERGY POL'Y 4063, 4066 (2006) (estimating carbon dioxide emissions from Chinese exports to the United States were 7%–14%). The estimates for carbon dioxide emissions from Chinese exports to Europe were calculated assuming goods for export to Europe are comparable to goods for export to the United States, and thus carbon dioxide emissions for these goods are comparable.

make emissions reductions at the speed and magnitude necessary to reduce the risk of catastrophic climate change.

The Article then examines potential remedies. It suggests that the measures pursued to date, including excess allowances in international agreements, other forms of public subsidies, and trade sanctions may be necessary but face substantial hurdles. Subsidies in the form of allowances will need to be very large to change China's incentives and granting additional allowances of this magnitude may undermine efforts to achieve desired emissions reductions. Other types of subsidies from the United States and Europe are unlikely to be large enough to shift China's incentives significantly. Many unilateral trade measures will generate resistance from the World Trade Organization. Although these hurdles ultimately may be overcome, if they slow down global emissions reductions in the near term they will make it difficult, if not impossible, to achieve the necessary reductions.

This Article offers a novel approach that can create new incentives for prompt action by China and the United States. In short, the Article demonstrates that resolving the types of information shortcomings identified at the outset can stimulate private supply-chain contracting pressure for carbon emissions reductions and bypass many of the hurdles confronting other measures.[32] A number of methods are available to induce firms to adopt supply-chain contracting requirements, and this Article suggests private or public carbon-labeling schemes for consumer goods and corporate "carbon footprint" disclosure requirements.[33] These targeted information-disclosure measures can be adopted by public or private entities at little economic and political cost,[34] and given the increasing

32. The supply chain includes "the production and distribution network that encompasses the sourcing, manufacturing, transportation, commercialization, distribution, consumption, and disposal of goods, from the ore mine to the trash can." PETER PARRY, JOSEPH MARTHA & GEORGINA GRENON, BOOZ & CO., RESILIENCE REPORT: THE ENERGY-EFFICIENT SUPPLY CHAIN 1 (2007), *available at* http://www.strategy-business.com/media/file/resilience-07-08-09.pdf.

33. While all definitions of "carbon footprint" involve quantifying the greenhouse gas emissions of an individual or entity, a point of disagreement is "whether the carbon footprint needs to include indirect emissions embodied in upstream production processes or whether it is sufficient to look at just the direct, on-site emissions." THOMAS WIEDMANN & JAN MINX, ISA RESEARCH & CONSULTING, A DEFINITION OF "CARBON FOOTPRINT" 2 (2007), *available at* http://www.isa-research.co.uk/docs/ISA-UK_Report_07-01_carbon_footprint.pdf.

34. *See, e.g.*, David P. Baron, *Private Politics and Private Policy: A Theory of Boycotts* 2–3, 33 (Stan. Graduate Sch. Bus. Research Paper Series, Research Paper No. 1766, 2002), *available at* https://gsbapps.stanford.edu/researchpapers/library/RP1766.pdf (describing market pressure tactics of nongovernmental organizations and noting that market pressure can be a more effective international strategy than lobbying national government representatives). The incentives to disclose product and firm carbon emissions could arise from public regulatory requirements or private nongovernmental

consumer and corporate interest in climate change reductions, they could create widespread pressure on firms in the United States and Europe to require lower carbon-intensity from their suppliers. In fact, perhaps the most important information deficiency regarding climate change is the limited awareness by nongovernmental organizations ("NGOs") that they may have a greater impact on emissions from China and the United States if they focus efforts on using information disclosure to create market pressure that shifts the incentives of both nations rather than focusing almost exclusively on lobbying government policymakers who lack the incentives to regulate emissions.[35]

Supply-chain contracting requirements, thus, are a feasible, prompt means of creating incentives for China and the United States to reduce emissions. Supply-chain contracting pressure will not be a complete substitute for subsidies in international agreements and other traditional measures, but it may be necessary to stimulate the adoption and implementation of these measures. Although supply-chain contracting pressure alone will not bring China and the United States to the table, it may be an essential step if we are to resolve the greatest current challenge facing the international law regime.

organization schemes. Policymakers may face less resistance to information disclosure measures than to measures that require emissions reductions directly. *See* Michael P. Vandenbergh, *Order Without Social Norms: How Personal Norm Activation Can Protect the Environment*, 99 NW. U. L. REV. 1101, 1136 (2005) [hereinafter Vandenbergh, *Order Without Social Norms*]. Similarly, a wide range of experience suggests that private labeling and carbon footprinting is feasible. *See infra* notes 189–230 and accompanying text.

35. Empirical studies suggest that information disclosure has had important but limited effects on consumer and firm behavior over the last several decades. *See, e.g.*, *infra* notes 203, 242 and accompanying text. The consumer and corporate response to environmental information to date, however, may not predict the future effects of information regarding climate change. The relative importance of catastrophic climate change as compared to earlier environmental harms, the potential efficiencies that may be gained from many carbon reduction efforts, and recent changes in corporate behavior regarding carbon emissions all suggest reason for optimism. *See id.* It also is plausible that market pressure resulting from information disclosure will influence Chinese politics regarding carbon emissions, just as market pressure has influenced other aspects of the Chinese political system. *See, e.g.*, Karen Halverson, *China's WTO Accession: Economic, Legal, and Political Implications*, 27 B.C. INT'L & COMP. L. REV. 319, 337–38 (2004) (explaining how China's commitment to the General Agreement on Trade in Services will encourage reform of its banking system through market pressure); David Barboza, *China Moves to Refurbish a Damaged Global Image*, N.Y. TIMES, July 29, 2007, at A6 (reporting the execution of the head of the Chinese State Food and Drug Administration and other measures taken by China to guard against proposed trade sanctions following scandal regarding the safety of Chinese exports).

II. THE CHINA PROBLEM

A. CHINA'S EMISSIONS

Carbon dioxide is the most important of the greenhouse gases identified in the Kyoto Protocol, accounting for roughly 85% of the climate-forcing effect of all greenhouse gases.[36] For many years, the United States has been the largest emitter of carbon dioxide, but China has been gaining on the United States at a remarkable rate. For example, according to the Energy Information Administration ("EIA") of the U.S. Department of Energy, the United States accounted for 24.4% of the world's carbon dioxide emissions in 2000, as compared to 21.9% in 2004.[37] Overall, annual emissions from the United States did not decline during this period—instead, they increased by roughly 100 *million* tons—but the emissions from China increased by more than 1.5 *billion* tons, or more than 50%.[38]

In 2005, China released roughly 18% of the world's total of carbon dioxide, the United States released 20.5%, and the combined total from Russia, Germany, the United Kingdom, and the rest of Europe was 23%.[39] Although experts predicted that emissions from China would not exceed U.S. emissions until the end of the decade,[40] a recent report by the Netherlands Environment Assessment Agency concluded that China released 6220 million tons in 2006, passing the United States and its 5801 million tons as the largest emitter of greenhouse gases.[41]

Current Chinese emissions may be the largest in the world, but the

36. John Dernbach & Widener Univ. Law Sch. Seminar on Energy Efficiency, *Stabilizing and Then Reducing U.S. Energy Consumption: Legal and Policy Tools for Efficiency and Conservation*, 37 Envtl. L. Rep. (Envtl. Law Inst.) 10,003, at 10,010 n.76 (2007) (noting that in 2004 carbon dioxide accounted for 84.6% of the carbon dioxide equivalent contribution of all greenhouse gases). *See also* James Hansen & Makiko Sato, *Greenhouse Gas Growth Rates*, 101 PROC. NAT'L. ACAD. SCI. 16,109, at 16,111 (2004) (noting that the other greenhouse gases are nitrous oxide (5% of climate-forcing effect); methane (4%); the Montreal Protocol trace gases (for example, chlorofluorocarbons) and other trace gases (1%)).

37. *See* ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, ANNUAL ENERGY REVIEW 2005, at 335 tbl.11.19 (2006), *available at* http://tonto.eia.doe.gov/FTPROOT/multifuel/038405.pdf (demonstrating that the United States' carbon dioxide emissions increased at a slower rate from 2000 to 2004 than the rest of the world's emissions).

38. *Id.*

39. Paul Higgins, *So What's the Problem with China?*, CLIMATE POL'Y, Apr. 20, 2007, http://www.climatepolicy.org/?p=26#more-26.

40. Yardley & Revkin, *supra* note 1.

41. *Gas Exchange*, *supra* note 14. *See also* Kahn & Yardley, *supra* note 14 (noting that the International Energy Agency indicated in 2007 that China may pass the United States as the largest emitter that year).

projected future emissions are even more worrisome. The EIA predicts that China's emissions will grow at a remarkable 4.2% per year during the 1990 to 2030 period, a growth rate that is higher than any other major emitter.[42] The product of this growth rate will be an increase in carbon dioxide emissions from 2241 million tons in 1990 to a projected 10,716 million tons in 2030 (compared to a projected 1.3% annual growth rate from 1990–2030 for the United States and a 2030 total of 8115 million tons).[43] China is expected to release five times more carbon dioxide over the next twenty-five years than the Kyoto Protocol is projected to save.[44]

China's emissions are increasing at a rapid rate in large part because of new construction of coal-fired electric power plants. It added electric power plants with a generating capacity of 102 gigawatts in 2006, an amount equal to all of the electric power generating capacity in France, after adding an amount equal to all of Britain the year before.[45] On average, a new coal-fired electric plant large enough to serve a city the size of Dallas opens in China every seven to ten days.[46] Overall, China and other developing countries are projected to account for 85% of global energy growth between 2003 and 2020.[47]

The growing Chinese emissions have important implications for global efforts to reduce the risk of catastrophic climate change. Although differences emerge when turning to the optimal depth and speed of the reductions,[48] the widely held view is that emissions reductions that

42. ENERGY INFO. ADMIN., *supra* note 15, at 93 tbl.A10. In fact, a recent study suggests that the emissions growth from China may be increasing by 11% or more. *See* Maximilian Auffhammer & Richard T. Carson, *Forecasting the Path of China's CO2 Emissions Using Province Level Information*, 55 J. ENVTL. ECON. & MGMT. 229, 29 tbl. 4 (2008).

43. ENERGY INFO. ADMIN., *supra* note 15, at 93 tbl.A10.

44. Patrick Symmes, *The China Question: Leaping Tiger, Drowning River*, OUTSIDE ONLINE, Apr. 2007, http://outside.away.com/outside/destinations/200704/yangtze-river-china-2.html.

45. Kahn & Yardley, *supra* note 14.

46. Keith Bradsher & David Barboza, *Pollution from Chinese Coal Casts Shadow Around Globe*, N.Y. TIMES, June 11, 2006, §1, at 1. *See also* Editorial, *Taming Fossil Fuels*, N.Y. TIMES, Mar. 17, 2007, at A14 ("[T]he equivalent of one large coal-fired power plant is being built each week, using antiquated methods.").

47. FLORIAN BRESSAND ET AL., MCKINSEY GLOBAL INST., CURBING GLOBAL ENERGY DEMAND GROWTH: THE ENERGY PRODUCTIVITY OPPORTUNITY 24 (2007). The growth in coal-fired power plants is not limited to China. *See* Andrew C. Revkin, *Money for India's "Ultra Mega" Coal Plants Approved*, N.Y. TIMES, Apr. 9, 2008, http://dotearth.blogs.nytimes.com/2008/04/09/money-for-indias-ultra-mega-coal-plants-approved (noting that the International Finance Corporation will provide financial backing for Indian plants that will emit twenty-three million tons per year of carbon dioxide).

48. Differences arise among economists. *Compare* WILLIAM NORDHAUS, THE CHALLENGE OF GLOBAL WARMING: ECONOMIC MODELS AND ENVIRONMENTAL POLICY (forthcoming) (manuscript at 19–21, *available at* http://nordhaus.econ.yale.edu/dice_mss_072407_all.pdf) (advocating for a small per-ton tax phased in gradually), *with* NICHOLAS STERN, THE ECONOMICS OF CLIMATE CHANGE 40,

substantially reduce the risk of catastrophic climate change are advisable on the global level.[49] An emerging consensus among scientists suggests that reducing the risk of catastrophic climate change will require that global atmospheric concentrations of carbon dioxide not exceed roughly double the levels that existed at the start of the industrial revolution (that is, avoiding an increase from roughly 280 parts per million in 1750 to a range of 450 to 550 parts per million).[50] In response, many scientists and policymakers have advocated leveling off greenhouse gas emissions in the next decade and reductions in the 60%–80% range by 2050.[51] Targets along these lines have been adopted or advocated by a number of foreign governments and corporations, as well as states, local governments, and corporations in the United States.[52] To provide a sense of the magnitude of

286 (2007) (advocating for a larger per-ton tax and more prompt adoption).

49. Even leading economists who have differed on the speed and depth of reductions have concluded that reductions of some sort are in the global interest. *See* NORDHAUS, *supra* note 48 (manuscript at 22); STERN, *supra* note 48, at 8; Kenneth J. Arrow, *Global Climate Change: A Challenge to Policy*, THE ECONOMISTS' VOICE, June 2007, at 1, 1, http://www.bepress.com/ev/vol4/iss3/art2 ("[B]oth futurity and uncertainty require significant discounting. However, even with that . . . we are much better off to act to reduce CO2 emissions substantially than to suffer and risk the consequences of failing to meet this challenge."). For a discussion of global and national incentives in the legal literature, see generally Posner & Sunstein, *supra* note 29 (noting that both the incentives and benefits for reducing greenhouse gas emissions vary from country to country).

50. STAFF OF H.R. COMM. ON ENERGY & COMMERCE, 110TH CONG., CLIMATE CHANGE LEGISLATION DESIGN WHITE PAPER: SCOPE OF A CAP-AND-TRADE PROGRAM 3 & n.1 (2007). *See also* Vandenbergh & Steinemann, *supra* note 26, at 1682, 1686–87 (discussing scientific literature on target atmospheric concentrations necessary to avoid catastrophic climate change). The Intergovernmental Panel on Climate Change concluded in May 2007 that stabilization of atmospheric concentrations of carbon dioxide at levels that are thought to reduce the risk of catastrophic climate change (445 to 535 parts per million) would result in a temperature change of less than 2 degrees Celsius or 3.6 degrees Fahrenheit and would cause the economy to grow at a 0.12% lower annual rate, or a total of 3% by 2030. WORKING GROUP III, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: MITIGATION OF CLIMATE CHANGE 12 tbl.SPM.4, 15 tbl.SPM.5, *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-spm.pdf. *See also id.* at 18 tbl.SPM.6 (extending the analysis to 2050).

51. Vandenbergh & Steinemann, *supra* note 26, at 1686–87 (discussing the targets advocated by policymakers and experts). For a debate on the necessity for immediate emissions reductions, compare Sunstein, *Complex Climate Change*, *supra* note 9, at 2 (concluding that among economists the "consensus is against" prompt aggressive reductions), with Brian C. O'Neill & Michael Oppenheimer, *Dangerous Climate Impacts and the Kyoto Protocol*, 296 SCIENCE 1971, 1972 (2002) (concluding that delaying achievement of the Kyoto target from 2010 to 2020 may require a "staggering" 8% reduction per year to begin before 2040 and that "such high rates of reduction may be prohibitively costly"), and Friedman, *The Power of Green*, *supra* note 29 (quoting Stephen Pacala, one of the heads of the Princeton Carbon Mitigation Initiative, for the proposition that to avoid doubling atmospheric concentrations of carbon dioxide "we have to get rid of 175 billion tons of carbon over the next 50 years . . . if we delay a decade or two, avoiding the doubling or more may well become impossible").

52. *See, e.g.*, Fla. Exec. Order No. 07-127 (July 13, 2007), *available at* http://www.flgov.com/pdfs/orders/07-127-emissions.pdf (setting a goal of 80% reductions in greenhouse gas emissions from

the challenge presented by achieving 60%–80% reductions by 2050, China today has per capita emissions that are roughly one-sixth that of the United States, but the 2050 target will require global per capita emissions to be far below current Chinese levels.[53]

B. CHINA'S INCENTIVES

China has enormous incentives to release large amounts of greenhouse gases.[54] China's booming economy is fueled by the export of manufactured goods.[55] Chinese manufacturing has a competitive advantage in large part because of low energy costs. These low energy costs arise in part because of huge coal reserves, which provide between two-thirds and three-quarters of the energy used by China.[56] Coal emits far more greenhouse gases than petroleum or other fossil fuels, and an even greater amount more than renewable sources of energy.[57] China burned 2.7 billion tons of coal in 2006, more than the combined total of the United States, Japan, and Europe.[58] In addition, with the construction of each new coal-fired electric plant, China has a greater investment in coal as an energy source and a reduced incentive to switch to other fuel sources. The growing prosperity of China has generated increased domestic demand for cars and other

1990 levels by 2050); U.S. CLIMATE ACTION P'SHIP, A CALL FOR ACTION 3–7, 12 (2007), *available at* http://us-cap.org/USCAPCallForAction.pdf (expressing a statement by more than a dozen major corporations and several environmental groups adopting goal of prompt near-term reductions and 60%–80% reductions from 1990 levels by 2050); MAYORS CLIMATE PROT. CTR., U.S. CONF. OF MAYORS, U.S. MAYORS CLIMATE PROTECTION AGREEMENT (2005), *available at* http://www.usmayors.org/climateprotection/documents/mcpAgreement.pdf (stating a number of goals geared toward reducing "global warming pollution").

53. *See* Posting of Paul Baer to CLIMATE POLICY, http://www.climatepolicy.org/?p=26#comment-226 (May 13, 2007, 01:43 EST) (stating in response to Higgins, *supra* note 39, that "[t]he problem of course is that emissions everywhere need to average about 0.5 tC per capita or less by 2050, and China is already over this level (about 1.2 tC per capita currently by best estimates)").

54. *See* STEWART & WIENER, *supra* note 29, at 15.

55. David Barboza, *China Says Its Economy Grew by 10.7% in 2006, with Little Inflation*, N.Y. TIMES, Jan. 26, 2007, at C3. *See also* Jianguo Liu & Jared Diamond, *China's Environment in a Globalizing World*, 435 NATURE 1179, 1184 (2005) ("Export trade is a major cause of China's increasing pollution . . . . Most of China's exports are primary goods or manufactured products that create heavy pollution and require intensive resource uses.").

56. *Compare* Kahn & Yardley, *supra* note 14 (stating that coal supplies two-thirds of China's energy), *with* Corliss Karasov, *On a Different Scale: Putting China's Environmental Crisis in Perspective*, 108 ENVTL. HEALTH PERSP. A452, A454 (2000) (stating that coal supplied three-quarters of China's energy in 2000).

57. *See* ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, LONG FORM FOR VOLUNTARY REPORTING OF GREENHOUSE GASES app. B at 47–48 (2006), *available at* http://www.eia.doe.gov/pub/oiaf/ 1605/ cdrom/pdf/FormEIA-1605_2005_Instructions.pdf.

58. Kahn & Yardley, *supra* note 14.

consumer goods,[59] but most of the current Chinese emissions relate to manufacturing for export. Furthermore, some benefits are expected to occur from climate change, such as an increase in the growth rates of some species of plants, which may increase agricultural production of some crops.[60]

China's incentives to continue emitting large amounts of carbon dioxide also are affected by arguments grounded in fairness. These arguments are likely to resonate among China's citizens and supporters around the world: although it is the largest current emitter of greenhouse gases, it is far from the largest in terms of per capita and aggregate historical emissions. Chinese per capita emissions are roughly one-sixth of those in the United States, as discussed above, and they are one-third of those in the European Union.[61] In addition, historical emissions are relevant because carbon dioxide remains in the atmosphere for fifty to two hundred years.[62] Since the start of the industrial revolution, China has emitted roughly 7.8% of the global total. The comparable figures from 1750 through 2005 are 27.8% for the United States, 7.5% for Russia, and 31.1% for the combined total of Germany, the United Kingdom, and the rest of Europe.[63]

From either the per capita or historical perspective, if the ability of the atmosphere to absorb greenhouse gases without triggering catastrophic climate change is a common resource, China has yet to consume its equal share.[64] Following this reasoning, China should be able to undercontrol to achieve economic prosperity while countries that emit more per capita today or emitted more historically should overcontrol. Regardless of the merits of this argument, it is likely to affect the incentives faced by China

59. *See, e.g.*, Friedman, *The Power of Green*, *supra* note 29 ("[I]f China keeps growing at 8 percent a year, by 2031 the per capita income of 1.45 billion Chinese will be the same as America's in 2004. China currently has only one car for every 100 people, but . . . if it copies American consumption, it will have three cars for every four people, or 1.1 billion vehicles. The total world fleet today is 800 million vehicles!").

60. The extent of the impacts on growth rates is likely to depend largely on the extent of the carbon dioxide fertilization effect. *See, e.g.*, LIN ERDA, ET AL., HM TREASURY, STERN REVIEW INTO THE ECONOMICS OF CLIMATE CHANGE, CLIMATE CHANGE IMPACTS AND ITS ECONOMICS IN CHINA 26–28 (2006), *available at* http://www.hm-treasury.gov.uk/media/8/1/stern_review_china_impacts.pdf.

61. *See* WORLD BANK, LITTLE GREEN DATA BOOK 2007, at 7 illus., 68, 225 (2007), *available at* http://siteresources.worldbank.org/INTEEI/936214-1146251511077/21329572/LGDB2007.pdf.

62. EcoBridge, Frequently Asked Questions about Global Warming, http://www.ecobridge.org/content/g_faq.htm#remain (last visited July 20, 2008).

63. Higgins, *supra* note 39, at fig.2.

64. *See* NAT'L DEV. & REFORM COMM'N, P.R.C., CHINA'S NATIONAL CLIMATE CHANGE PROGRAMME 58 (2007), *available at* http://www.ccchina.gov.cn/WebSite/CCChina/UpFile/File188.pdf.

and other developing countries.[65]

Although increases in per capita income have led to demands for improvements in environmental protection in many countries (sometimes referred to as the environmental Kuznets curve), this phenomenon does not appear to occur for greenhouse gas emissions.[66] In fact, some studies suggest that greenhouse gas emissions form a U-shaped or an N-shaped curve, spiking up as per capita income increases above some threshold.[67] Even if the Chinese population demands reduced greenhouse gas emissions when per capita income reaches the levels typically associated with demands for environmental protection in other industrializing countries, at current growth rates the emissions that will occur by that time may well exceed those that climate scientists suggest can occur without substantial risk of catastrophic climate change.[68] In other words, simply waiting for the Chinese to become sufficiently prosperous to demand environmental amenities, even if the process does occur as it has for other environmental pollutants, is not an option.

At the same time, China has a number of incentives to reduce greenhouse gas emissions that are easily overlooked in gloom-and-doom scenarios about the prospects for reducing the risk of catastrophic climate change. Reports by scientists and policymakers suggest that China will suffer substantial harm from climate change. If sea level rises occur to five meters (roughly seventeen feet), 11.3% of coastal China will be inundated.[69] The flooded area would include large parts of port cities such

65. For an analysis of corrective and redistributive justice issues, see generally Posner & Sunstein, *supra* note 29 (noting that both the incentives and benefits for reducing greenhouse gas emissions vary from country to country).

66. David I. Stern, *The Rise and Fall of the Environmental Kuznets Curve*, 32 WORLD DEV. 1419, 1420, 1423–24 (2004); Joseph E. Stiglitz, *The Ethical Economist*, FOREIGN AFFAIRS, Nov./Dec. 2005, at 128, 129 (book review) ("Many forms of pollution have gone down as richer countries have turned their mind to air-quality issues, but greenhouse gas emissions—with all the dangers they present for global warming—have continued to increase with economic growth, especially in the United States.").

67. *See, e.g.*, Marzio Galeotti, Alessandro Lanza & Francesco Pauli, *Reassessing the Environmental Kuznets Curve for CO2 Emissions: A Robustness Exercise*, 57 ECOLOGICAL ECON. 152, 162 (2006); Amy K. Richmond & Robert K. Kaufmann, *Energy Prices and Turning Points: The Relationship Between Income and Energy Use/Carbon Emissions*, 27 ENERGY J. 157, 178 (2006).

68. This conclusion is based on the assumption that China will increase its emissions at rates predicted by the U.S. Department of Energy. *See* ENERGY INFO. ADMIN., *supra* note 15, at 93 tbl.A10. *See also supra* note 38 and accompanying text (noting that China's emissions may be increasing at more than 11% per year).

69. Du Bilan & Zhang Jinwen, *Adaptation Strategy for Sea Level Rise in Vulnerable Areas Along China's Coast*, 19 ACTA OCEAONOLOGICA SINICA 1, 2 (2000) (P.R.C.). *See also* Gordon McGranahan, Deborah Balk & Bridget Anderson, *The Rising Tide: Assessing the Risks of Climate Change and Human Settlements in Low Elevation Coastal Zones*, 19 ENV'T & URBANIZATION 17, 21–

as Shanghai, Tianjin, and Guangzhou.[70] Although the Intergovernmental Panel on Climate Change ("IPCC") articulated a range of roughly one to two feet of sea level rise by 2100 in its 2007 Fourth Assessment Report, it also concluded that it could not fully model the effects of the melting of the Greenland ice cap.[71] Several leading climate scientists have suggested that a nontrivial risk exists that the Greenland ice cap could begin to disintegrate this century,[72] and if it does, the result will be sea level rises in the five meter range.[73]

In addition, James Hansen has noted that the last time global average temperatures were roughly five degrees Fahrenheit higher than today, or roughly equal to the IPCC's "best estimate" if carbon dioxide levels double, sea levels were eighty feet higher.[74] An increase of this magnitude would inundate a large percentage of the Chinese coast and would displace roughly 250 million people.[75] Even in the absence of catastrophic climate change, the dry north is expected to get drier and the wet south is expected to get wetter, with adverse consequences in both cases for agriculture, drinking water, and social strife.[76] To the extent climate change effects

22 (2007) (noting that 2% of the world's land, inhabited by more than six hundred million people, lies within ten meters of current sea levels).

70. *See* Bilan & Jinwen, *supra* note 69, at 3 fig.1.

71. Vandenbergh & Steinemann, *supra* note 26, at 1683–84 (discussing IPCC report assumptions and conclusions about Greenland and West Antarctica by James Hansen and others).

72. *Id.* at 1683. *See also* WORKING GROUP II, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY 17 (2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-spm.pdf. Research published after the release of the 2007 IPCC report has raised concerns that sea level rises may exceed the high end of the range identified by the IPCC. *See* Marc Kaufman, *Escalating Ice Loss Found in Antarctica; Sheets Melting in an Area Once Thought to Be Unaffected by Global Warming*, WASH. POST, Jan. 14, 2008, at A1 ("The new finding comes days after the head of the Intergovernmental Panel on Climate Change said the group's next report should look at the 'frightening' possibility that ice sheets in Greenland and Antarctica could melt rapidly at the same time.").

73. *See* James E. Hansen, *Can We Still Avoid Dangerous Human-Made Climate Change?*, 73 SOC. RESEARCH 949, 957 (2006) [hereinafter Hansen, *Can We Still Avoid?*). *See also* O'Neill & Oppenheimer, *supra* note 51, at 1971 (discussing the effect of disintegration of the West Antarctic Ice Sheet). For an economic analysis of climate-change-related low probability, high consequence events, see generally Martin L. Weitzman, *Structural Uncertainty and the Value of Statistical Life in the Economics of Catastrophic Climate Change* (AEI-Brookings Joint Ctr. for Regulatory Studies, Working Paper No. 07-11, 2007), *available at* http://aei-brookings.org/admin/authorpdfs/redirect-safely.php?fname=../pdffiles/WP07-11_topost110607.pdf (noting the importance of accounting for low probability/high consequence events in cost-benefit analyses of climate change). For a discussion of catastrophic climate change in the legal literature, see Sunstein, *Complex Climate Change*, *supra* note 9, at 22–24.

74. Jim Hansen, *The Threat to the Planet*, N.Y. REV. BOOKS, July 13, 2006, at 12, 13 [hereinafter Hansen, *Threat*]. *See also infra* note 99 and accompanying text.

75. Hansen, *supra* note 74, at 13.

76. *See* NAT'L DEV. & REFORM COMM'N, *supra* note 64, at 17–19.

occur in China, they also will occur in its trading partners, causing economic harms that will reduce the demand for Chinese goods.

A second incentive for China to reduce greenhouse gas emissions is that cobenefits will arise from the reduction of other pollutants, particularly if greenhouse gas emissions reductions are achieved through a shift away from coal-fired energy production.[77] The human health and environmental harms arising from energy production in China are sufficiently great that these cobenefits may amount to billions of dollars per year. In fact, recent studies suggest that 400,000 to 750,000 Chinese die from air pollution every year.[78] A "Green G.D.P." study conducted for the Chinese government in 2004 concluded that environmental harms, even using low values for human lives and excluding ecological effects altogether, would have reduced the Chinese growth rate from 10% to 7%, and there are suggestions that fully accounting for the human and ecological harms of pollution in China might generate a negative growth rate.[79] The Chinese government did not commission another Green G.D.P. study.[80]

China also faces domestic unrest because of environmental and human health harms caused by pollutants other than greenhouse gases.[81] International pressure arising from domestic environmental conditions also is influential. The recent furor over air quality for the 2008 Olympic Games and the dramatic near-term response by the Chinese government demonstrate that China has incentives to be perceived as a cooperative global player.[82]

77. For an overview of the cobenefits of Chinese greenhouse gas reduction efforts, see Kong Chiu, Collin Green & Katherine Sibold, *Air Quality and Greenhouse Gas Co-Benefits of Integrated Strategies in China*, 6 SINOSPHERE 40, 41–42, 46 (2003), *available at* http://www.epa.gov/ies/pdf/general/sinospherearticle.pdf.

78. Elizabeth C. Economy, *The Great Leap Backward? The Costs of China's Environmental Crisis*, FOREIGN AFF., Sept.–Oct. 2007, at 38, 47. *See also* Kahn & Yardley, *supra* note 14 ("Ambient air pollution alone is blamed for hundreds of thousands of deaths each year.").

79. Kahn & Yardley, *supra* note 14 ("[T]he early results were so sobering . . . that the project was banished to China's ivory tower this spring and stripped of official influence."). *See also* HE KEBIN & PAN XIAO CHUAN, ENERGY OPTIONS AND HEALTH BENEFITS FOR CHINA NATIONAL STUDY 18 (2003) (estimating overall economic cost to China from air pollution to be as high as 7.1% of GNP), http://epa.gov/ies/pdf/china_natl_assess/ies_china.pdf; Friedman, *The Power of Green*, *supra* note 29 (noting that according to one Chinese newspaper, in 2004 environmental harms cost China $64 billion, or 3.05% of its GDP, although "[s]ome experts believe the real number is closer to 10 percent").

80. Kahn & Yardley, *supra* note 14.

81. *See* WORLD BANK, COST OF POLLUTION IN CHINA 33–57 (2007), *available at* http://siteresources.worldbank.org/INTEAPREGTOPENVIRONMENT/Resources/China_Cost_of_Pollution.pdf (discussing the health and economic impacts of water pollution); Kahn & Yardley, *supra* note 14 ("Officials blame fetid air and water for thousands of episodes of social unrest.").

82. *See* Liu & Diamond, *supra* note 55, at 1185 (noting that China's interest in joining the WTO and hosting the Olympic Games has spurred pollution reduction measures); Kahn & Yardley, *supra*

Given the near-term economic benefits and lengthy delay before the more severe harms of climate change are likely to occur, whether it is in the economic interest of China to reduce emissions turns largely on the discount rate and the value assigned to low-probability, high-consequence events such as the breakup of the Greenland ice sheet.[83] If long-term harms are discounted at any significant rate, the near-term incentives to rely on coal-fired power for economic growth appear likely to dominate over the long-term incentives to reduce emissions.[84] Even though catastrophic climate change could flood large areas of the Chinese coast, disrupt agriculture, and cause social dislocation, the Chinese are likely to perceive, based on current studies, that there is uncertainty associated with the extent and timing of the most severe climate change effects and that the most important adverse effects are unlikely to occur until the 2030 to 2050 period or later.[85]

In addition, although the cobenefits arising from reducing other related forms of pollution may amount to avoiding the premature deaths of several hundred thousand people per year and a reduction of several percentage points in annual gross domestic product ("GDP"), the Chinese economic and political sectors may be unwilling or unable to adopt and enforce even those standards that would be cost beneficial in the near term.[86] The economic gains from the export of goods made with low-cost,

note 14 ("Beijing is frantically searching for a magic formula, a meteorological deus ex machina, to clear its skies for the 2008 Olympics."). *See also* Thomas L. Friedman, *Red China or Green?*, N.Y. TIMES, June 30, 2006, at A23 (noting increasing Chinese sensitivity to domestic environmental problems arising from manufacturing goods for export).

83. *Compare* NORDHAUS, *supra* note 48, at 117–20, *with* STERN, *supra* note 48, at 76–78, 122. *See also* Martin L. Weitzman, *A Review of* The Stern Review on the Economics of Climate Change, 45 J. ECON. LITERATURE 703, 723–24 (2007) (concluding that it is important to "confront[] the issue of what to do about catastrophe insurance against the possibility of thick-tailed rare disasters"); Inez Fung, Remarks at the China-U.S. Climate Change Forum, What's at Risk? Climate Model Predictions and Physical and Biological Impacts (May 23, 2006), *available at* http://webcast.berkeley.edu/event_details.php?webcastid=15770 (examining impacts of climate change on China); Chen Yiyu et al., *Assessment of Climate and Environment Changes in China (II): Impacts, Adaptation and Mitigation of Climate and Environment Changes*, 2 ADVANCES CLIMATE CHANGE RES. 6, 8–10 (Supp. 1 2006) (P.R.C.) (same).

84. For a recent discussion of climate-change-related temporal traps and social traps in the legal literature, see generally Jeffrey J. Rachlinski, *The Psychology of Global Climate Change*, 2000 U. ILL. L. REV. 299 (2000) ("[T]he threat of global climate change creates such a social trap, a morass that, because of its psychological characteristics, society is unlikely to resolve through conventional approaches.").

85. *See, e.g.*, ERDA ET AL., *supra* note 60, at 8–9 tbl.3 (noting that the agricultural sector will have negative impacts by 2020, but predicting all regions to be in "balance" in terms of water supply until 2050, and noting predicted impacts at time intervals of 2020, 2050, and 2080).

86. Economy, *supra* note 78, at 50–53 (discussing the difficulty of inducing local officials to increase the priority given to climate change and other environmental concerns); Kahn & Yardley,

coal-based energy sources will be tremendous. The cobenefits of reducing greenhouse gas emissions, particularly through reduced reliance on coal-fired energy sources, are large, but for the next several decades are unlikely to outweigh the economic benefits of heavy coal use for Chinese leaders.[87]

In the last decade, China's actions have been consistent with this analysis. It has continued to invest in low-cost, high-emitting coal-fired electric generation and has not opted for high-efficiency turbines or carbon sequestration. It has rejected national greenhouse gas reduction limits.[88] It also has led the movement among developing countries to oppose the inclusion of mandatory limits for developing countries in the Kyoto Protocol[89] and in post-Kyoto negotiations.[90]

C. THE AMERICA PROBLEM

China's large and growing greenhouse gas emissions and position on mandatory targets also affects the political process in the United States. The opposition of the U.S. government to mandatory targets in international agreements and to limits on domestic emissions[91] is

supra note 14 ("For the Communist Party, the political calculus is daunting. Reining in economic growth to alleviate pollution may seem logical, but the country's authoritarian system is addicted to fast growth. Delivering prosperity placates the public, provides spoils for well-connected officials and forestalls demands for political change. A major slowdown could incite social unrest, alienate business interests and threaten the party's rule.").

87. *Cf.* Charles J. Vörösmarty et al., *Global Water Resources: Vulnerability from Climate Change and Population Growth*, 289 SCIENCE 284, 287 (2000) (concluding that water availability in China will be dominated by population growth and economic development more than climate change for the next several decades).

88. Steven Mufson, *In Battle for U.S. Carbon Caps, Eyes and Efforts Focus on China*, WASH. POST, June 6, 2007, at D1 ("China's own climate-change plan issued Monday was seen as only a modest step forward. Though the plan backed ambitious targets for fuel efficiency and the use of renewable energy, it did not back greenhouse-gas targets."); Daniel Pruzin, *China "Will Not Accept" Emissions Limits; Government Adviser Cites Insufficient Data*, 38 Env't Rep. (BNA) 1515 (July 13, 2007) (reporting that "[a] senior adviser to the Chinese government said July 6 that China would not accept binding greenhouse gas emissions limits under the Kyoto Protocol or subsequent climate change agreements . . ."). *See also* NAT'L DEV. & REFORM COMM'N, *supra* note 64, at 58.

89. *Cf.* RANEE K.L. PANJABI, THE EARTH SUMMIT AT RIO: POLITICS, ECONOMICS, AND THE ENVIRONMENT 37–38 (1997) (noting that the Chinese suggestion that "[n]o country should encroach on another under the pretext of environmental protection" was reflected in the Stockholm Declaration in 1972).

90. *See* Pruzin, *supra* note 88 (reporting comments by a senior adviser to the Chinese government that China, as a developing country, should not set "quantitative emissions targets"); *G-77 Developing Countries Issue Proposal Calling for Emissions Targets Following 2012*, Int'l Env't Daily (BNA) (Dec. 6, 2005) (reporting that at the Eleventh Conference of the Parties in 2005, while China and the other G-77 developing countries proposed emissions targets for themselves, they did not set any specific targets, nor would the reductions begin until 2012).

91. *See supra* notes 21–24 and accompanying text.

problematic if the United States' interest is to reduce the risk of catastrophic climate change. By failing to commit to emissions reductions, the United States signals to other countries that they are dupes if they do so. By failing to reduce its own emissions, the United States contributes to rising atmospheric concentrations of greenhouse gases. Failing to commit to and implement reductions thus increases the likelihood of catastrophic climate change.

The interests of the United States are the subject of substantial debate in the economic and legal literature.[92] The United States faces many of the same incentives as China, including huge reserves of coal, which accounts for 37% of domestic carbon dioxide emissions.[93] The United States also will be better able to adapt to the effects of climate change than many developing nations.[94] As a result, some have argued that substantial reductions are not in the economic interest of the United States.[95] Other estimates, however, imply that more aggressive reductions are in the economic interest of the United States.[96] Arguments grounded in intragenerational concerns, particularly concerning the poor in India, Africa, and other developing regions who may suffer the most in the near term, also support an obligation on the part of the United States to bear substantial costs to reduce greenhouse gas emissions.[97]

A concern about harm to future generations also may motivate current action, particularly because events such as major sea level increases may cause harms that are irreparable and not subject to substantial adaptation.[98]

92. *See generally* BARRETT, WHY COOPERATE?, *supra* note 9; Posner & Sunstein, *supra* note 29; Sunstein, *Complex Climate Change*, *supra* note 9.

93. MASS. INST. OF TECH., THE FUTURE OF COAL: OPTIONS FOR A CARBON-CONSTRAINED WORLD 7 tbl.2.4 (2007), *available at* http://web.mit.edu/coal/The_Future_of_Coal.pdf.

94. *E.g.*, STERN, *supra* note 48, at 139.

95. *See* NORDHAUS & BOYER, *supra* note 10, at 91 tbl.4.10 (suggesting that a temperature increase of 2.5 degrees Celsius will have less than a 0.5% impact on U.S. GDP). *But see* NORDHAUS, *supra* note 48, at 137–38 (noting that participation by the United States in a global emissions reductions agreement is justified). In 2007, the IPCC concluded that temperature increases above 2 degrees Celsius (3.6 degrees Fahrenheit) raise the risk of substantial ecosystem change. WORKING GROUP II, *supra* note 72, at 14–15.

96. STEWART & WIENER, *supra* note 29, at 49–51. *See also generally* RICHARD A. POSNER, CATASTROPHE: RISK AND RESPONSE (2004) (examining potential harms of catastrophic climate change). In addition, action by the United States may increase the pressure on China and others to follow. *See* Sunstein, *Complex Climate Change*, *supra* note 9, at 34.

97. For example, India and Africa have contributed little to greenhouse gas emissions to date, yet the harms to India and Africa may be severe and their ability to adapt limited. *See* Sunstein, *Complex Climate Change*, *supra* note 9, at 4, 12 ("[T]he best alternative is to convince either or both [the United States and China] that they have a moral obligation to act to protect those nations that are most vulnerable.").

98. For a discussion of types of catastrophic climate change that have been identified in scientific

For example, as discussed above, at least one leading climate scientist has suggested that sea levels ultimately could increase by as much as twenty-five meters (eighty feet) if global average temperatures increase by five degrees Fahrenheit.[99] Whether temperatures will increase by five degrees Fahrenheit and whether sea levels will increase twenty-five meters cannot be known at this point. Furthermore, even if sea levels ultimately increase to these levels, the increases will occur over a period of many decades and centuries, not in the near future.[100] If sea levels do increase to this extent, however, many of the major coastal cities in the United States, and nearly all of Florida, will be inundated.[101] Although adaptation efforts will be effective against some of the harms arising from climate change, it is unrealistic to assume that meaningful adaptation will be possible for increases of this magnitude, whether by developed or developing countries, and whether by gradual or abrupt increases.[102] If elevated sea levels cause harms that last for hundreds or thousands of generations, at some point the intergenerational issue becomes compelling.[103]

literature as potentially irreparable and not subject to adaptation, see Vandenbergh & Steinemann, *supra* note 26, at 1683–85 (noting the possibility of substantial sea level increases, ocean acidification, and food chain disruption). For a recent discussion of intergenerational issues in legal literature, see generally Symposium, *Intergenerational Equity and Discounting*, 74 U. CHI. L. REV. 1 (2007).

99. The "best estimate" of the IPCC is that if carbon dioxide levels double, which they are on track to do before 2100, global average temperatures will be roughly five degrees Fahrenheit higher. WORKING GROUP I, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS 12, 13 (2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf. James Hansen has noted that global average temperatures were five degrees Fahrenheit higher three million years ago and that sea levels were roughly eighty feet (twenty-five meters) higher at that time. Hansen, *Threat*, *supra* note 74, at 13; Hansen, *Can We Still Avoid?*, *supra* note 73, at 952, 957. *See also* James Hansen, *Defusing the Global Warming Time Bomb*, SCI. AM., Mar. 2004, at 68, 71 illus. (demonstrating the correlation between greenhouse gases, temperature, and sea level over the past four hundred thousand years).

100. *See* Hansen, *Threat*, *supra* note 74, at 13. *See also* WORKING GROUP I, *supra* note 99, at 13 & tbl.SPM.3, 14 (discussing ice sheet collapse and sea levels).

101. Hansen, *Threat*, *supra* note 74, at 13.

102. I focus here on rising sea levels, but ocean acidification and several other climate-change-related phenomena may present similar types of catastrophic, irreversible risks that are not subject to adaptation on any meaningful level. *See* O'Neill & Oppenheimer, *supra* note 51, at 1971–72; Vandenbergh & Steinemann, *supra* note 26, at 1685 n.44 (discussing adaptation). For a discussion of abrupt, catastrophic climate change, see POSNER, *supra* note 96, at 253–54.

103. For a recent examination of the viewpoints on intergenerational discounting, compare W. Kip Viscusi, *Rational Discounting for Regulatory Analysis*, 74 U. CHI. L. REV. 209 (2007) (arguing that intergenerational costs and benefits should be discounted based on the same methodology as are current generation costs and benefits), with Douglas A. Kysar, *Discounting . . . on Stilts*, 74 U. CHI. L. REV. 119 (2007) (arguing that "the use of discounting in the intergenerational context [does] not withstand scrutiny"). If wealth increases, developed nations are able to adapt, and climate change harms are not irreversible, then an argument can be made that the preferable approach is to transfer wealth directly to the poor today rather than to do so indirectly through the form of emissions reductions. *See* Posner & Sunstein, *supra* note 29, at 5 (observing that a payment to the poor now would be preferable to

Despite these arguments in favor of emissions reductions, the United States certainly is behaving as if it is not in its interest to adopt or implement any emissions-reduction targets, and the existence of the large and growing Chinese emissions alters both the actual interests of the United States and the rhetoric used in the debate. In particular, it bolsters the arguments of emissions-reduction opponents.[104] Opponents can point to China as a reason not to adopt mandatory limits, while at the same time refusing to push China to adopt these limits.[105] The use of China in the logic and rhetoric about domestic climate-change regulation has occurred in all three branches of the federal government.

The Bush Administration pointed to the failure of China to agree to emissions targets in the Kyoto Protocol as a reason that the United States formally indicated its intention not to join.[106] Two years later, the Environmental Protection Agency ("EPA") pointed to emissions from China and other developing countries as a reason not to regulate greenhouse gas emissions from motor vehicles in the United States, arguing that unilateral action by the United States would undermine its ability to use the promise of action to leverage Chinese emissions reductions.[107] At

emissions reductions, which would function as a payment to the poor in the future). Posner and Sunstein nevertheless conclude that the United States should participate in an international agreement even if its domestic economic costs exceed its benefits. *Id.* at 5–6.

104. *See infra* notes 106–19 and accompanying text.

105. *See infra* note 109 and accompanying text.

106. Press Release, White House Office of the Press Sec'y, *supra* note 2 ("The world's second-largest emitter of greenhouse gases is China. Yet, China was entirely exempted from the requirements of the Kyoto Protocol."); Jim Connaughton Hosts Ask the White House (Oct. 22, 2004), http://www.whitehouse.gov/ ask/print/20041022.html ("This Administration decided not to participate in the Kyoto Treaty on climate change because its implementation would have meant the loss of nearly $400 billion in U.S. GDP, and up to 4.9 million lost American jobs, many of which would be exported overseas to developing countries with lower environmental standards, hurting our economic competitiveness. . . . But that also means that the greenhouse gas emissions and air pollution also go there, and in many instances go up—so we would not achieve anything to address the issue of reducing emissions globally.").

107. Control of Emissions from New Highway Vehicles and Engines, 68 Fed. Reg. 52,922, at 52,931 (Sept. 8, 2003) ("Unilateral EPA regulation of motor vehicle GHG emissions could also weaken U.S. efforts to persuade key developing countries to reduce the GHG intensity of their economies. Considering the large populations and growing economies of some developing countries, increases in their GHG emissions could quickly overwhelm the effects of GHG reduction measures in developed countries. Any potential benefit of EPA regulation could be lost to the extent other nations decided to let their emissions significantly increase in view of U.S. emission reductions."). The EPA also has declined to adopt more stringent mercury emissions standards for electric utilities in part because of the risk posed by mercury from Pacific tuna that ultimately arises from Chinese coal burning. *Cf.* Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units, 69 Fed. Reg. 4652, 4652, 4658, 4670 (proposed Jan. 30, 2004) (noting that the United States accounts for only 3% of anthropogenic mercury emissions).

the same time, the Administration has neither committed the United States to mandatory reductions,[108] nor substantially pressured China to do so.[109]

Instead, in 2002 the Administration set a national policy for the United States of achieving an 18% reduction in the greenhouse gas intensity of the economy between 2002 and 2012.[110] This standard approximates the greenhouse gas intensity reductions that occurred in the 1990s.[111] The standard will allow aggregate greenhouse gas emissions to increase by 12% during this period if economic growth increases at a 3% rate, a goal also articulated by the Administration.[112] The Administration also initially opposed other countries' attempts to use the G-8 and post-Kyoto developments to begin the process of setting binding commitments for greenhouse gas emissions.[113] Even though the United States led a recent series of meetings that included China and other major emitters, in his closing remarks the President expressly rejected adoption of binding commitments for emissions reductions by the participants.[114] Only in 2008 did the Administration announce a goal of leveling off United States greenhouse gas emissions by 2025, and it conditioned inclusion of the goal in an international agreement on participation by China and other major emitters.[115]

Congressional opponents of mandatory emissions targets from both

108. *See* Editorial, *Climate Week*, N.Y. TIMES, Sept. 22, 2007, at A14 (noting that the Bush Administration stated its opposition to binding targets in favor of "'aspirational' goals" when announcing a summit on climate change.).

109. *See* Broder, *supra* note 21 (noting recent rejection by President Bush of mandatory targets for all countries).

110. Press Release, White House Office of the Press Sec'y, President Announces Clear Skies & Global Climate Change Initiatives (Feb. 14, 2002), *available at* http://www.whitehouse.gov/news/releases/2002/02/20020214-5.html.

111. Robert R. Nordhaus & Kyle W. Danish, *Assessing the Options for Designing a Mandatory U.S. Greenhouse Gas Reduction Program*, 32 B.C. ENVTL. AFF. L. REV. 97, 101 (2005).

112. Sarah Krakoff, Essay, *Arnold Schwarzenegger and Our Common Future*, 53 BUFF. L. REV. 925, 931 (2005) ("[W]e could reach President[] [Bush's] goal of being GHG intensity-free, and simultaneously continue indefinitely to increase our total GHG emissions.").

113. *See, e.g.*, Tom Regan, *Document: US Wants Climate Statement "Watered Down,"* CHRISTIAN SCI. MONITOR, June 20, 2005, http://www.csmonitor.com/2005/0620/dailyUpdate.html (noting attempt to block G-8 statement advocating stringent measures). The administration has also opposed emissions reductions by state governments in the United States. *See, e.g.*, Justin Hyde, *Bush Called on to Halt Lobbying; Effort Against Fuel Rules Is Covert, Critic Says*, DETROIT FREE PRESS, Sept. 25, 2007, at B1 (noting an effort to persuade various states to lobby against an EPA waiver necessary for California to implement tougher motor vehicle greenhouse gas emissions standards).

114. Broder, *supra* note 21 (noting the rejection of country-specific "mandatory targets for capping carbon dioxide emissions"). *See also* Dean Scott, *Bush Announces September Climate Meeting to Set Post-2012 Emissions Reduction Goal*, 38 Env't Rep. (BNA) 1712 (Aug. 10, 2007) (noting opposition to mandatory targets expressed at time of meeting announcement).

115. *See* Press Release, White House Office of the Press Sec'y, *supra* note 25.

parties also have focused on the role of China. A number of Senators pointed to China as a reason to oppose an agreement in advance of Kyoto,[116] and a Senate resolution that passed with a 98-0 vote prior to Kyoto advised the Clinton Administration not to commit to binding limits if China and other developing countries failed to do so.[117] More recent comments by congressional opponents of domestic emissions reductions have continued to point to China.[118] Justice Roberts also referenced China in his dissent to the decision reversing and remanding the EPA determination in *Massachusetts v. Environmental Protection Agency*.[119]

The political debate in the United States reflects and informs public opinion. Recent polling suggests that the public expresses high levels of concern about climate change in the abstract, but also rejects remedial measures that include taxes or higher energy prices by large margins, and it ranks action to reduce greenhouse gas emissions below at least half a dozen other concerns, including high gasoline prices.[120] In short, if we assume that it is in the interest of the United States to reduce greenhouse gas emissions, the China Problem poses a substantial barrier to achieving that goal.[121]

116. *See, e.g.*, 143 CONG. REC. S5623 (daily ed. June 12, 1997) (statement of Sen. Byrd).

117. S. Res. 98, 105th Cong. (1997).

118. *E.g.*, Press Release, U.S. Senate Comm. on Energy & Natural Res., *supra* note 23 and accompanying text.

119. Massachusetts v. EPA, 127 S. Ct. 1438 at 1469 (Roberts, C.J., dissenting).

120. *See* Kirk Johnson, *We Agreed to Agree, and Forgot to Notice*, N.Y. TIMES, Jan. 6, 2008, § 4, at 1 ("In a *New York Times*-CBS News poll last April, 43 percent of the respondents who thought the weather had become stranger lately volunteered that global warming was the probable cause, up from only 5 percent a decade ago. But asked in the same survey whether they'd support an increase in gasoline taxes if that might help fight the climate problem, a resounding 58 percent said no."); HART/NEWHOUSE, NBC NEWS/WALL STREET JOURNAL SURVEY, STUDY #6083 (2008), *available at* http://msnbcmedia.msn.com/i/msnbc/sections/news/080611_NBC-WSJ_Released.pdf. *See also* Karlyn Bowman, *How Hot Is Global Warming? A Review of the Polls*, ENVTL. POL'Y OUTLOOK, July 2007, at 1, *available at* http://www.aei.org/publications/pubID.26519/pub_detail.asp.

121. The opposition to emissions reductions has occurred at the same time that the United States has outsourced much of its most greenhouse-gas-intensive production. The United States increased imports by 128% between 1997 and 2004, and the imports often included the types of goods that require the most energy to produce. *See* Rhitu Chatterjee, *Outsourcing U.S. Greenhouse-Gas Emissions*, 41 ENVTL. SCI. & TECH. 4834, 4834 (2007) (citing Christopher Weber of Carnegie Mellon University). Although consumption increased in the United States during this period, emissions of greenhouse gases did not increase proportionately. *Id.* Instead, it appears as though carbon-intensive production moved to China and other developing countries, enabling the United States to outsource emissions, placating the public by keeping down the price of consumer goods. *See id.* So long as the carbon footprint of the United States accounts only for direct emissions and not for the emissions from the production of imported goods, the outsourcing is not transparent.

III. THE LIMITS OF TRADITIONAL INSTRUMENTS

The challenge facing policymakers is to develop incentives for China and the United States to adopt and implement greenhouse gas emissions reduction targets. Part III examines the traditional instruments that have been the subject of much of the recent debate. A mix of these instruments may be necessary to induce movement by the two countries, but a variety of intrinsic barriers have rendered them insufficient to date.

The options widely discussed in the legal literature include a group of instruments that require that the parties have independent incentives to comply or that assume the existence of some coercive authority. Examples include emissions limitations, taxes, and cap-and-trade schemes, all of which require some form of international agreement and governmental involvement in law formation, monitoring, and enforcement. A second group of "beneficiary pays" instruments avoids the problem of the absence of a coercive authority by assuming that change will occur through subsidies.[122]

A. INTERNATIONAL AGREEMENTS

The lack of a global government makes a direct coercion approach difficult if not impossible. It is conceivable that the post-Kyoto process will yield an agreement that will be adopted by the vast majority of major emitters, including the United States and China. The agreement could include a range of command-and-control provisions (for example, a requirement that coal-fired utilities use combined-cycle turbines and be fitted with carbon-sequestration technology), a global carbon tax, a global cap-and-trade scheme, or other remedies that require some form of government adoption and enforcement.

Adoption and enforcement of emissions-reduction commitments through a multilateral agreement, however, confronts a collective-action problem.[123] China, the United States, and other countries have incentives to act in ways that are individually rational but collectively deficient for the world as a whole.[124] The incentives for China and the United States to

122. Jonathan Baert Wiener, *Global Environmental Regulation: Instrument Choice in Legal Context*, 108 YALE L.J. 677, 752–53 (1999) (examining "polluter pays" and "beneficiary pays" options). *See also* STEWART & WIENER, *supra* note 29, at 74–75.

123. BARRETT, ENVIRONMENT AND STATECRAFT, *supra* note 29, at 16–17. *See also generally* Cass R. Sunstein, *Of Montreal and Kyoto: A Tale of Two Protocols*, 31 HARV. ENVTL. L. REV. 1 (2007) (concluding that a principal reason for the success of the Montreal Protocol and "mixed picture" of the Kyoto Protocol was determined by the United States' decision to join the former and reject the latter).

124. Scholars differ on whether the China-U.S. relationship is a prisoner's dilemma. *Compare*

agree to and implement a costly set of emissions-reduction requirements in the near term are uncertain at best.[125] In the absence of adequate incentives by China and the United States, the prospects for an adequate new multilateral agreement are dim. The post-Kyoto process does not appear to be developing fast enough among a sufficient number of major emitters to avoid a doubling of atmospheric concentrations of carbon dioxide from preindustrial levels.

B. SUBSIDIES

If instruments that rely on public coercive methods are not successful in achieving emissions reductions of the magnitude and in the time necessary to reduce the risk of catastrophic climate change, policymakers could turn to a beneficiary pays model.[126] The Clean Development Mechanism ("CDM") provisions of the Kyoto Protocol already serve this function.[127] The CDM process allows developed country signatories to achieve their Kyoto emissions targets by subsidizing activities in the developing world. The subsidies occur through a complex process of review and approval of offsets, yet critics in recent years have identified a number of situations in which the emissions avoided were dubious or nonexistent.[128] Although these criticisms need not be fatal to the CDM effort, they do demonstrate that these types of subsidies require substantial oversight to avoid abuse. In any event, these subsidies to date have not been sufficient to induce China or other developing nations to agree to and implement greenhouse gas emissions reductions.

Many proponents of a post-Kyoto agreement have argued that China and other developing nations should be provided with a subsidy in the form of additional emissions allowances.[129] For example, the allowance

Sunstein, *Complex Climate Change*, *supra* note 9, at 5, 18 (noting that a prisoner's dilemma does not exist because the United States and China will not benefit significantly from cooperation), *with* Stephen M. Gardiner, *The Real Tragedy of the Commons*, 30 PHIL. & PUB. AFF. 387, 406–16 (2001) (noting that the problem can be viewed as a prisoner's dilemma or a battle of the sexes). The remedy proposed in this Article functions without regard to whether a prisoner's dilemma exists.

125. *See* STEWART & WIENER, *supra* note 29, at 10 (noting that the United States' costs of emissions control may be high and may have been as much as 80% of the costs for all industrialized nations to comply with the Kyoto Protocol); Gardiner, *supra* note 124, at 388 & n.3 (referencing incentives relating to global climate change).

126. *See, e.g.*, STEWART & WIENER, *supra* note 29, at 102–04 (discussing side payments).

127. *See* Kyoto Protocol to the United Nations Framework Convention on Climate Change art. 12, Dec. 11, 1997, 37 I.L.M. 22 (creating the CDM program).

128. *See, e.g.*, Michael Wara, Commentary, *Is the Global Carbon Market Working?*, 445 NATURE 595, 595–96 (2007).

129. *E.g.*, CTR. FOR CLEAN AIR POLICY, GREENHOUSE GAS MITIGATION IN BRAZIL, CHINA AND INDIA: SCENARIOS AND OPPORTUNITIES THROUGH 2025 iv (2006) (suggesting a scenario in which

allocation could enable China to increase emissions in the near term and reduce emissions more gradually than developed countries. Although a subsidy in the form of additional emissions allowances may be a necessary inducement, the number of allowances will need to be very large to overcome China's near-term economic incentives. If the number of the allowances is large, however, they will enable correspondingly large increases in global carbon dioxide emissions unless offset by reductions in allowance allocations to other countries. It is not clear that sufficient allowances can be provided to shift China's incentives without undermining support for the cap-and-trade scheme in the subsidizing countries or allowing emissions to exceed the target levels necessary to reduce the risk of catastrophic climate change.[130] The subsidy-through-allowances approach also could be extended to the United States, but this approach is subject to the same problems.

In addition to emissions allocations in multilateral international agreements, national or subnational governments that have incentives to bear substantial costs could enter into bilateral agreements that provide for side payments to China and the United States to create incentives for emissions reductions.[131] Normative objections to paying the United States, given its prosperity, are likely to make this option unfeasible for the foreseeable future.[132] Payments to China may face somewhat less normative resistance given the per capita and historical arguments discussed above, but the history of small foreign aid payments by many developed nations casts doubt on the prospects for this approach.[133]

One of the most frequently discussed forms of side payments involves technology transfer and subsidization. The countries that stand to benefit the most from an international agreement could provide China with the access and the funds to acquire more efficient turbines or new carbon sequestration technologies as they are developed. This is the "China price"

China is allowed to increase total emissions through 2020 while the United States levels off emissions and the European Union reduces emissions to 30% below 1990 levels).

130. *See id.* (noting the need to keep total emissions below levels that will generate 450 ppm atmospheric concentrations of carbon dioxide).

131. *Cf.* BARRETT, ENVIRONMENT AND STATECRAFT, *supra* note 29 at 346–49 (noting that assistance from the Global Environment Facility was essential to getting developing nations to comply with the Montreal Protocol).

132. For a discussion of the various types of side payments as well as corrective and distributive justice issues associated with side payments, see Posner & Sunstein, *supra* note 29, at 3–6 & n.14; Sunstein, *Complex Climate Change*, *supra* note 9, at 29–30.

133. Sunstein, *Complex Climate Change*, *supra* note 9, at 20, 27–30 (noting different forms of side payments and some history of small foreign aid payments).

strategy that Thomas Friedman has advocated.[134] In Friedman's view, policies should be directed at developing and transferring low-cost alternative energy sources to China that can provide energy to Chinese manufacturers at or below the cost of coal-fired electric utilities.[135]

Although a strategy based on technology transfer and subsidies may be an important part of the total mix of incentives, technology transfer on the scale necessary may not be viable because it will not address the U.S. domestic-political aspect of the China Problem: it will not mollify critics who ground their objections in concerns about enhancing the economic strength of China.[136] To make a substantial dent in China's emissions, the wealth transfers between China and the developed nations would have to be massive. Opponents of emissions reductions in the United States who point to China's economic growth as a reason the United States should not expend significant amounts to control its domestic emissions are likely to object to a nation-to-nation subsidy of any substantial magnitude. Technology transfer efforts that create goodwill and demonstrate some responsiveness on climate change may garner support among skeptics, but efforts of the magnitude necessary to provide meaningful levels of energy at less than the China price also would increase the economic competitiveness of China.[137] These incentives may explain why technology transfer programs to date have been widely publicized but funded at low levels.[138] In addition, it is not clear that alternative technologies exist that would generate large amounts of energy in China at costs that taxpayers in the United States would be willing to pay and in the time horizons necessary.[139]

134. Friedman, *The Power of Green*, *supra* note 29 (describing the "China price" as "basically the price China pays for coal-fired electricity today").

135. *Id.* The Bush Administration's Asia-Pacific Partnership on Clean Development and Climate can be seen as an effort to subsidize the development of alternative energy sources in China, India, and other Asian countries. *See* Press Release, White House Office of the Press Sec'y, Fact Sheet: The Asia-Pacific Partnership on Clean Development and Climate (Jan. 11, 2006), *available at* http://www.whitehouse.gov/news/releases/2006/01/print/20060111-8.html.

136. Jim Connaughton hosts Ask the White House, *supra* note 106 (Chairman of White House Council on Environmental Quality discussing concern about loss of jobs to developing countries).

137. *See id.*

138. *See* Press Release, White House Office of the Press Sec'y, *supra* note 135 (noting in 2006 that the Administration would propose $52 million in funding to support the Asia-Pacific Partnership).

139. The framing of these costs may be very important. Consumers may be more willing to pay higher prices for goods via supply-chain contracting or the increased prices that will arise from cap-and-trade schemes than they will be willing to pay for higher taxes. *See* Johnson, *supra* note 120 (demonstrating Americans' distaste for taxes even when levied to remediate climate change, an issue about which they express a high level of concern); Michael P. Vandenbergh, *The New Wal-Mart Effect: The Role of Private Contracting in Global Governance*, 54 UCLA L. REV. 913, 966 (2007) [hereinafter Vandenbergh, *New Wal-Mart Effect*] (exploring the possibility that consumers may be willing to pay for

Technology subsidies at these levels thus are likely to carry the same rhetorical weight as unilateral emissions reductions and with the same effect: domestic opposition in the United States.[140] Similarly, if the technology-subsidy efforts are viewed by the public in the United States as a form of foreign aid, history suggests that funding will be limited.[141] In the absence of meaningful participation by the United States, it is difficult to comprehend how other developed nations could provide technology or other subsidies to China at levels sufficient to shift its incentives. And, in the absence of a shift in China's position, the United States may continue to oppose emissions limits.

C. TRADE SANCTIONS

A number of countries have considered unilateral trade measures to induce other countries to reduce greenhouse gas emissions.[142] These potential trade measures have included a fee designed to account for the global warming effects of air travel and tariffs on imports from nations that did not adopt Kyoto.[143] In addition, the leading cap-and-trade legislation in the U.S Senate includes a provision that would require the purchase of allowances for imported goods from countries not meeting certain emissions-reductions standards.[144] Many forms of trade sanctions will face World Trade Organization ("WTO") hurdles, however.[145] Even measures that do not comprise explicit trade sanctions may be subject to successful challenges in the WTO dispute settlement body if, for example, the

environmental control costs).

140. *See supra* notes 103–16 and accompanying text.

141. *See* Posner & Sunstein *supra* note 29, at 19 & n.99 (discussing foreign aid contributions).

142. Joost Pauwelyn, *U.S. Federal Climate Policy and Competitiveness Concerns: The Limits and Options of International Trade Law* 5–8 (Nicholas Inst. for Envtl. Pol. Solutions, Duke U., Working Paper No. 07-02, 2007).

143. *See id.* at 8 & nn.17–18; Rick Mitchell, *Dutch Airline Organization, Airport Group Sue Government Over Environmental Tax*, Int'l Envt. Daily (BNA), at 1 (Feb. 25, 2008).

144. America's Climate Security Act of 2007, S. 2191, 110th Cong. § 6006 (as referred to the S. Comm. on Env't & Pub. Works, Oct. 18, 2007).

145. Steve Charnovitz, *The WTO's Environmental Progress*, 10 J. INT'L ECON. L. 685, 689 (2007); Steve Charnovitz, *Environmentalism Confronts GATT Rules*, 27 J. WORLD TRADE 37, 40 (1993) [hereinafter Charnovitz, *Environmentalism*]. *See also* JEFFREY L. DUNOFF, STEVEN R. RATNER & DAVID WIPPMAN, INTERNATIONAL LAW: NORMS, ACTORS, PROCESS 846–59 (2d ed. 2006) (discussing past U.S. trade restrictions that have been attacked under WTO rules). The National Foreign Trade Council has noted that a provision of S. 2191 that addresses allowance requirements for U.S. imports may violate national treatment under General Agreement on Tariffs and Trade (GATT) Article III. NAT'L FOREIGN TRADE COUNCIL, WTO-COMPATIBILITY OF FOUR CATEGORIES OF U.S. CLIMATE CHANGE POLICY 2–3, 21–24 (2007), *available at* http://www.nftc.org/default/trade/wto/Climate%20Change%20Paper.pdf.

measures are determined to be technical barriers to trade ("TBT").[146] In theory, the nations that formed the WTO could adopt reforms that allow or even encourage aggressive climate change actions by member nations, but international collective action regarding the WTO presents many of the same incentive problems as do other forms of multilateral international action. Although trade measures of some type ultimately may be a part of the global response to climate change, the prospects are limited for putting effective trade sanctions in place in the near future.

IV. SUPPLY-CHAIN CONTRACTING

Rather than relying only on traditional instruments with limited prospects for success or abandoning the goal of reducing China's emissions, the better approach is to add new instruments to the mix that may tip the balance of incentives and induce China, and ultimately the United States, to make meaningful reductions. The emerging private global-governance literature suggests a particularly promising alternative instrument: private supply-chain contracting.[147] A focused strategy directed at inducing importers of goods in developed countries to impose carbon reduction requirements on suppliers may provide additional incentives for prompt, substantial reductions by China, the United States, and other countries.

Supply-chain contracting pressure may create negative incentives for Chinese firms through increased pressure by buyers to shift production to less carbon-intensive manufacturers, in some cases in other countries.[148] This is the obverse of the China price: rather than lowering the cost of low-carbon alternative energy sources, the contracting pressure may reduce the demand for high-carbon Chinese goods.[149] A risk exists that if firms in developed countries exert too much pressure without also offering to pay higher prices, the Chinese government will retaliate in other ways,

146. *E.g.*, NAT'L FOREIGN TRADE COUNCIL, *supra* note 145, at 2 ("Government-administered eco-labeling schemes in H.R. 6 may violate Article II of the WTO Agreement on Technical Barriers to Trade for constituting measures that are 'more trade-restrictive than necessary' to protect the environment, even if this objective is 'legitimate.'"). *See also* Charnovitz, *Environmentalism*, *supra* note 145, at 40. The WTO Appellate Body and subsequent compliance panel discussions examine the ability of states to protect the environment under the GATT. *See* Appellate Body Report, *United States—Import Prohibition of Certain Shrimp and Shrimp Products: Recourse to Article 21.5 of the DSU by Malaysia*, ¶ 54, WT/DS58/AB/RW (Oct. 22, 2001); Panel Report, *United States—Import Prohibition of Certain Shrimp and Shrimp Products*, ¶¶ 152–53, WT/DS58/R (May 15, 1998).

147. *See infra* notes 152–61 and accompanying text.

148. *See* Vandenbergh, *New Wal-Mart Effect*, *supra* note 139, at 918 n.14 (discussing the low-price strategy that has generated controversy regarding Wal-Mart and other large firms).

149. *See supra* notes 134–39 and accompanying text.

undermining the supply-chain contracting effort. For example, a Chinese official recently described importers' demands that China improve its environmental conditions while selling inexpensive goods as "eco-colonialism."[150]

Positive incentives also may arise for Chinese firms, however. Consumers in developed countries may be willing to pay a price premium and buyers may identify efficiencies that they share with suppliers. In this way, supply-chain contracting could function as a private subsidy that is more efficient, raises fewer symbolic issues, and is more politically viable than payments from one national government to another.[151]

Section IV.A identifies the elements of supply-chain contracting requirements that will be necessary if the approach is to have the desired effect, and Section IV.B examines how supply-chain contracting requirements may influence national positions on emissions reductions. Section IV.C then demonstrates the extent to which supply-chain contracting requirements for greenhouse gases already are in place around the globe.

A. ELEMENTS

In recent years, scholars have recognized that domestic and global governance involves a complex mix of public and private institutions.[152] The supply-chain contracting approach contemplated here involves firms in the United States and other developed countries insisting on greenhouse gas emissions restrictions in supply-chain contracting with sellers of goods in China and other developing countries.[153] In addition, to avoid simply

150. Economy, *supra* note 78, at 55.

151. *See infra* notes 240–44 and accompanying text.

152. *See, e.g.*, BENJAMIN CASHORE, GRAEME AULD & DEANNA NEWSOM, GOVERNING THROUGH MARKETS: FOREST CERTIFICATION AND THE EMERGENCE OF NON-STATE AUTHORITY 5 (2004); Daniel C. Esty, *Good Governance at the Supranational Scale: Globalizing Administrative Law*, 115 YALE L.J. 1490 (2006) (advocating the use of administrative law principles and tools to increase support for global governance institutions); Jody Freeman, *Collaborative Governance in the Administrative State*, 45 UCLA L. REV. 1 (1997) (noting domestic public-private collaborative activities); Jody Freeman, *The Private Role in Public Governance*, 75 N.Y.U. L. REV. 543 (2000) (examining public-private hybrids and standard-setting); Benedict Kingsbury, Nico Krisch & Richard B. Stewart, *The Emergence of Global Administrative Law*, 68 LAW & CONTEMP. PROBS. 15, 23 (2005) ("cautiously" suggesting that conceptions of the global regulatory regime should be extended to include private standard setting organizations that carry out regulatory functions).

153. For an empirical study of recent environmental supply-chain activity and its implications for global governance, see Vandenbergh, *New Wal-Mart Effect*, *supra* note 139, at 921–70. *See also* Michael P. Vandenbergh, *The Private Life of Public Law*, 105 COLUM. L. REV. 2029, 2074 (2005) (examining the governmental functions performed by private-private contracting).

shifting high-carbon production to developed countries, buyers will need to apply the supply-chain contracting requirements to sellers in the United States and other developed countries as well. Applying the supply-chain contracting requirements to all domestic and foreign suppliers also may reduce the risk of an adverse ruling from the WTO in the event the WTO concludes that it has jurisdiction.

The greenhouse gas restrictions could occur in any of several forms, such as limits on the carbon intensity of the contracted-for good (for example, total emissions in carbon-equivalents per unit of production) or on the total greenhouse gas emissions arising from the contractual relationship between the manufacturer and importer over a specified time period.[154] Emissions restrictions could be imposed through vendor or product eligibility requirements or through express terms in supply contracts.

Standard setting could be facilitated by use of private or public-private standard-setting organizations along the lines of the International Standardization Organization, the Forest Stewardship Council, or the Marine Stewardship Council.[155] An extensive literature has documented the growth of private standard-setting organizations and examined their efficacy and accountability.[156] Although private standard-setting organizations face shortcomings on both fronts, in some global commons settings and in countries with little effective government these organizations may be essentially the only entities performing governmental functions.

Monitoring and enforcement of greenhouse gas provisions in supply-chain contracts will be difficult. At the same time, adoption of the supply-

154. In theory, the contract requirements could be based on a national greenhouse gas emissions total or per capita average, but the absence of control over those totals would make manufacturers reluctant to commit to them.

155. *See generally* Aseem Prakash & Matthew Potoski, *Collective Action Through Voluntary Environmental Programs: A Club Theory Perspective*, 35 POL'Y STUD. J. 773 (2007) (exploring the effectiveness of voluntary environmental programs among private organizations); Aseem Prakash & Matthew Potoski, *Racing to the Bottom? Trade, Environmental Governance, and ISO 14001*, 50 AM. J. POL. SCI. 350 (2006) (discussing ISO 14001, a commonly employed environmental regulation that suggests private organizations should aspire to exceed the environmental regulations their counties require); Erika N. Sasser et al., *Direct Targeting as an NGO Political Strategy: Examining Private Authority Regimes in the Forestry Sector*, BUS. & POL., Dec. 2006, at 1 (2006), http://www.bepress.com/cgi/viewcontent.cgi?article=1163&context=bap (discussing the Forest Stewardship Council).

156. *See generally, e.g.*, Errol Meidinger, *The Administrative Law of Global Private-Public Regulation: The Case of Forestry*, 17 EUR. J. INT'L L. 47 (2006) (examining collective private forestry standards).

chain contracting approach by a number of major buyers may create large market incentives even if not all buyers impose requirements and not all sellers comply with the requirements that are imposed. In some global-commons settings and countries, private monitoring and enforcement may be as good as or better than the public enforcement that would occur with public regulatory requirements, if any exist. To the extent government regulatory compliance is the benchmark, substantial compliance with environmental regulatory requirements often hovers in the 75% range in developed countries, and developing countries often experience lower rates of compliance with such requirements.[157]

In addition, recent experience with labor and other environmental terms in supply-chain contracts has shown that monitoring and enforcement does occur.[158] Examples from a variety of developing countries demonstrate the variety of different ways in which monitoring and enforcement of low-carbon provisions in supply-chain contracts could occur. For instance, firms that have imposed labor and environmental supply-chain contract requirements have retained hundreds of employees to inspect suppliers in some cases, and others have relied on an emerging number of consulting firms that provide assurance services.[159] Firms also have been subject to independent monitoring by standard-setting organizations and by NGO advocacy groups.[160] Perhaps most importantly, studies suggest that private standards with private enforcement have had substantial effects on suppliers' behavior in China and other developing countries.[161]

B. EFFECTS

Widespread adoption of supply-chain contracting requirements by

157. *See, e.g.*, Wesley A. Magat & W. Kip Viscusi, *Effectiveness of the EPA's Regulatory Enforcement: The Case of Industrial Effluent Standards*, 33 J.L. & ECON. 331, 343 (1990) (noting compliance rates with major clean water requirements in the United States); Petra Christmann & Glen Taylor, *Globalization and the Environment: Determinants of Firm Self-Regulation in China*, 32 J. INT'L BUS. STUD. 439, 441 (2001) (noting monitoring and enforcement issues in developing countries).

158. *See* Christmann & Taylor, *supra* note 157, at 452 (concluding that firm adoption of environmental management standards in China correlates with exports).

159. *See* Margaret M. Blair, Cynthia A. Williams & Li-Wen Lin, *Assurance Services as a Substitute for Law in Global Commerce* 4, 23 (Vanderbilt Univ. Law Sch., Law & Economics Working Paper No. 07-06, 2007) (documenting growth of private assurance providers).

160. *See id.* at 22–23.

161. *See, e.g.*, Christmann & Taylor, *supra* note 157, at 449–52 (examining adoption of environmental management systems and environmental performance of firms in China). *See also generally* Aseem Prakash & Matthew Potoski, *Investing Up: FDI and the Cross-Country Diffusion of ISO 14001 Management Systems*, 51 INT'L STUD. Q. 723 (2007) (examining the relationship of foreign direct investment and firm adoption of environmental management standards).

firms in the United States, Europe, and other developed countries could have substantial effects on the incentives faced by China, and ultimately the United States. The United States imports goods accounting for a significant portion of China's GDP,[162] and Europe imports goods accounting for another substantial amount.[163] As stated at the outset, the manufacture of goods for export to the United States and Europe also accounts for roughly 14%–28% of all Chinese carbon dioxide emissions.[164] Single companies such as Wal-Mart, with its imports from China of roughly $18 billion per year, also are remarkably influential.[165]

Supply-chain contracting requirements may influence China's incentives in several ways. First, they may accelerate the extent to which government and private managers identify efficiencies. The potential for efficiency gains in China are tremendous,[166] as much of the recent Chinese economic growth has occurred through the development of inefficient industries that use prodigious quantities of energy and balance remarkable inefficiency with low energy and labor costs.[167] These industries include the aluminum smelting industry, which is a major user of electricity and uses more energy than the entire Chinese commercial sector, as well as the steel industry (using 20% more energy per ton of steel produced than the international average) and the cement industry (using 45% more).[168] Inefficiencies also arise from the profusion of township and village enterprises ("TVEs"). These TVEs average only six employees per enterprise, but they produce half of China's exports, and their small size and other characteristics lead them to contribute disproportionately to emissions.[169] In many cases, the inefficiencies in manufacturing are the product of massive government subsidies[170] that may look less advisable if exporting industries are subject to supply-chain contracting pressure. Although the Chinese economy is becoming more energy efficient, China has not met recent targets for energy intensity (energy use per unit of

162. McDonald, *supra* note 30 (noting that China exported $20.9 billion in goods to the United States).

163. *Id.* (reporting that China's August 2007 exports to Europe were 20.7% of its total exports).

164. *See supra* note 31.

165. Fairclough, *supra* note 30. *See also* Vandenbergh, *New Wal-Mart Effect*, *supra* note 139, at 927.

166. Economy, *supra* note 78, at 57 (stating that "vast gains" in environmental protection efforts can be achieved by bringing the efficiency of Chinese industry up to world standards).

167. *See id.* at 40.

168. Kahn & Yardley, *supra* note 14 (citing a World Bank report).

169. Liu & Diamond, *supra* note 55, at 1180–81.

170. Kahn & Yardley, *supra* note 14 (noting adoption of tax incentives and government subsidies in a Chinese 1997 economic program).

GDP), and inefficiencies stretch across many industrial sectors.[171]

Second, supply-chain pressures will increase Chinese manufacturers' incentives to opt for less carbon-intensive energy sources where they are available. Where alternatives are not available, the manufacturers will have greater incentives to pressure local and national government officials to invest in less carbon-intensive energy sources. The pressure may lead China to generate less electricity from coal and more from other sources, to generate energy from coal more efficiently,[172] or, if the technology is available, to sequester carbon dioxide generated from burning coal.[173] The means by which these pressures will be transmitted through the economic and political systems in China are beyond the scope of this Article, but the response of China to economic pressure in other realms suggests a reasonable likelihood that supply-chain contracting will have substantial effects on governmental decisionmaking at many levels.[174] The claim is not that China will promptly adopt and implement stringent emissions targets or be able to shift promptly to alternative sources of energy, but that China will have additional incentives to do so, and that the additional incentives, on top of others mentioned above, will induce China to act.

C. PREVALENCE

Firm environmental behavior in the last several years confirms that incentives already exist for some firms to impose greenhouse gas requirements on supply-chain contractors and that doing so can generate impressive reductions. For example, some initial activities are already underway in China to increase efficiency through supply-chain networks.[175] Wal-Mart has responded to a range of incentives by taking the first steps toward imposing supply-chain requirements in China, beginning with a scorecard system to assess suppliers.[176] Specific energy efficiency or

171. *See* Economy, *supra* note 78, at 40 (noting that goods production in China uses seven times as much energy as Japan and three times as much energy as India).

172. *See* Kahn & Yardley, *supra* note 14 (noting that the Chinese typically have opted not to build plants with combined-cycle turbines, which are more efficient but also more costly to build than traditional power plants).

173. *See* HOWARD HERZOG & JAMES KATZER, THE FUTURE OF COAL IN A GREENHOUSE GAS CONSTRAINED WORLD 3–5 & tbl.5 (2004), http://sequestration.mit.edu/pdf/GHGT8_Herzog_Katzer.pdf (concluding that with current technology, greenhouse gas sequestration from coal-fired utilities in the United States would increase the cost by approximately 40% and reduce electricity output by 20%).

174. Market pressure has influenced other aspects of the Chinese political system. *See, e.g.*, Halverson, *supra* note 35, at 323–33; Barboza, *supra* note 35.

175. *See, e.g.*, Economy, *supra* note 78, at 58 (citing pilot program providing financing for factories' efficiency upgrades).

176. *See* Press Release, Wal-Mart, Wal-Mart Buyers Put Packaging Scorecard into Practice (Jan.

greenhouse gas requirements are not a part of the program at this point, but Wal-Mart is taking emissions into account by scoring potential Chinese suppliers "greenhouse gas emissions" and "emissions related to the distance packaging materials are transported."[177] With ten thousand Chinese suppliers and $18 billion in annual imports from China, Wal-Mart alone may have a substantial influence.[178] General Motors and the World Environment Center also have conducted a joint pilot project to improve the environmental performance and to reduce carbon emissions from eight of General Motors' suppliers in China.[179]

Other companies in the United States have imposed greenhouse gas emissions requirements on their domestic and foreign suppliers, including Timberland,[180] Pepsi,[181] and possibly Ford.[182] Additionally, the growing interest in firms' supply-chain emissions has spawned an expanding market for consultants offering advice and products relating to carbon footprint analysis and supply-chain emissions reductions.[183] The potential gains from supply chains sometimes arise from surprising places. For example, Timberland calculated its carbon footprint and found that a large share of its emissions were arising not from the production, shipment, and retailing

31, 2008), *available at* http://walmartstores.com/FactsNews/NewsRoom/7911.aspx.

177. Wal-Mart plans to initiate its scorecard program next year. *Id.*

178. *See* Fairclough, *supra* note 30 (stating in the title that when "Wal-Mart Sneezes, China Catches Cold"); Sarah Schafer, *A Welcome to Wal-Mart*, NEWSWEEK (Pacific ed.), Dec. 20, 2004, at 30, *available at* http://www.newsweek.com/id/56097 ("Chinese suppliers say Wal-Mart is already having a transformative effect on everything from supply chains, to distribution networks, to customer service. The company has a network of 10,000 suppliers for its China operation, most of which are small and not part of its global supply chain. Thus, the spread of Wal-Mart stores is raising efficiency standards for a growing number of Chinese suppliers . . . .").

179. *GM, WEC Report on Green Supply Chain Project*, ENVTL. LEADER, Aug. 3, 2007, http://www.environmentalleader.com/2007/08/03/gm-wec-report-on-green-supply-chainproject (describing energy savings as "significant" from actions such as changes to lighting in Chinese factories); Press Release, World Env't Ctr., General Motors and World Environment Center Report Significant Results in China "Green Supply Chain Project," July 31, 2007, *available at* http://www.wec.org/news/general-motors-and-world-environment-center-report-significant-results-in-china-201cgreen-supply-chain-project201d.

180. Amy Cortese, *Friends of Nature? Let's See Those Shoes*, N.Y. TIMES, Mar. 6, 2007, at H5.

181. *See* 2007 ENERGY STAR Award Recipients, http://www.energystar.gov/index.cfm?c=industry.bus_award_recipients_2007 (last visited July 27, 2008) ("PepsiCo worked 'upstream' to reduce the embedded energy of inputs to its business by requesting that suppliers establish energy goals, demonstrate energy management activities, and join the ENERGY STAR partnership.").

182. *See id.* (noting that as to Ford, "[k]ey strategies for moving energy management ahead included . . .working with suppliers to address the embedded energy burden upstream of the company"). It is unclear whether "working with" included imposing efficiency requirements on suppliers.

183. *E.g.*, *IBM Helps Clients Calculate and Cut Carbon Footprints*, ENVTL. LEADER, Aug. 24, 2007, http://www.environmentalleader.com/2007/08/24/ibm-helps-clients-calculate-cut-carbon-footprints.

of its shoes, but from the methane emitted by the cows that supply the shoe leather.[184] Timberland is exploring whether a change in the use of raw materials will reduce the methane emissions.[185] Numerous other U.S. firms have imposed environmental requirements other than greenhouse gas restrictions on their suppliers, and many additional firms in the United States and abroad impose labor and other nonenvironmental social welfare standards on suppliers.[186]

Firms in other countries also have imposed greenhouse gas or energy-use requirements on their suppliers. For example, Ericsson has required its suppliers to minimize energy use in electronic-component manufacturing.[187] Tesco and Marks & Spencer in the United Kingdom also have imposed efficiency or greenhouse gas emissions reduction requirements on their suppliers.[188]

The question, then, is what might induce additional firms in the United States, Europe, and other developed countries that import goods from China to impose greenhouse gas emission reduction requirements on their suppliers? The next Part examines this issue.

V. THE ROLE OF INFORMATION

The federal government could simply require that firms impose supply-chain contracting requirements on their foreign and domestic suppliers, but the likely inefficiencies and lack of political viability make this option unattractive.[189] The minivegetable and potato examples at the outset of this Article suggest a more efficient and viable option based on the observation that individuals and firms often have remarkably little information about the greenhouse gas emissions and energy use associated with many products. Although these are only anecdotal examples, numerous others exist. On the consumer front, thousands of gallons of water are shipped from Fiji to the United States each year, with customers

184. *See* Cortese, *supra* note 180; Jad Mouawad, *The Greener Guys*, N.Y. TIMES, May 30, 2006, at C1.

185. *See* Mouawad, *supra* note 184.

186. Vandenbergh, *New Wal-Mart Effect*, *supra* note 139, at 933, 950–56.

187. *See* Ericsson, Supplier Environmental Requirements, http://www.ericsson.com/ericsson/corporate_responsibility/suppliers/doc/supplier_req_brochure.pdf (last visited July 27, 2008); Ericsson, Code of Conduct, http://www.ericsson.com/ericsson/corporate_responsibility/doc/codeofconduct.pdf (last visited July 27, 2008).

188. PARRY ET AL., *supra* note 32, at 1–2 (noting that Tesco recently stated that it will reduce its carbon footprint by 50% in the next fifteen years).

189. An example of federal regulation of the actions of firms abroad is the Foreign Corrupt Practices Act, 15 U.S.C. §§ 78m–ff (2000).

only dimly aware of the associated carbon emissions.[190] On the firm front, Wal-Mart recently discovered that it could save $25 million per year by adopting a firm-wide policy against idling delivery trucks.[191] UPS discovered it could save a substantial amount by restricting delivery trucks from making left turns in the New York metropolitan area.[192] Firms ultimately may have discovered these efficiencies on their own without climate change-based prodding, but inducing firms to gather information about emissions may truncate the time that otherwise would be required to identify efficiencies throughout the supply chain.

Although firm-level efficiencies alone are unlikely to motivate sufficient levels of firm behavior, information about emissions also may have a second effect: it may enable individuals to act on preferences for emissions reductions through their consumer and civic behavior. Information disclosure thus may facilitate the application of legal, economic, and social pressure on firms, whether from government regulators, consumers, NGOs, investors, or employees.[193] This Part proposes two measures designed to require the collection and disclosure of the types of information that could induce firms to adopt supply-chain contracting requirements: corporate carbon footprints and product carbon labeling.

A. NEW FIRM INCENTIVES

Carbon footprint and product-labeling schemes could be developed and enforced by public or private entities.[194] Government-mandated schemes may be more widely adopted and better enforced than private schemes, but they also may be more vulnerable to a WTO challenge.[195]

190. *See* Fishman, *supra* note 7.

191. William J. Holstein, *Saving the Earth, and Saving Money*, N.Y. TIMES, Aug. 13, 2006, § 3, at 9.

192. Joel Lovell, *Left-Hand-Turn Elimination*, N.Y. TIMES, Dec. 9, 2007, § 6 (Magazine), at 80.

193. *See* Neil A. Gunningham, Dorothy Thornton & Robert A. Kagan, *Motivating Management: Corporate Compliance in Environmental Protection*, 27 LAW & POL'Y 289, 300–07 (2005); Neil Gunningham, Robert A. Kagan & Dorothy Thornton, *Social License and Environmental Protection: Why Businesses Go Beyond Compliance*, 29 LAW & SOC. INQUIRY 307, 308–10 (2004) [hereinafter Gunningham et al., *Social License*]; Bradley C. Karkkainen, *Information as Environmental Regulation: TRI and Performance Benchmarking, Precursor to a New Paradigm?*, 89 GEO. L.J. 257 (2001) (discussing the Toxic Release Inventory and other forms of informational regulation as "pioneering the systematic use of performance monitoring and benchmarking as regulatory tools").

194. *See* Vandenbergh, *New Wal-Mart Effect*, *supra* note 139, at 919–24. NGO-driven private governance raises numerous questions, including questions about the accountability of NGOs. *See, e.g.*, Peter J. Spiro, *New Global Potentates: Nongovernmental Organizations and the "Unregulated" Marketplace*, 18 CARDOZO L. REV. 957, 963–67 (1996).

195. Government labeling schemes may be more vulnerable to a WTO challenge than private

Although the federal government has shown little interest to date in expanding beyond the EPA Energy Star labeling program for appliances, the governments of some of the most populous states already have adopted carbon labeling schemes for some products.[196] Similarly, several states have begun to require that firms calculate and report their emissions, and several federal legislative initiatives are under consideration.[197]

NGOs could stimulate the development of carbon labeling and corporate carbon footprints by directing lobbying efforts toward government or private firms.[198] NGO efforts to date have been directed principally at the development of domestic regulatory measures, such as efficiency standards and cap-and-trade schemes, but the analysis in this Article suggests that a concerted effort regarding certain types of information-disclosure schemes may yield greater emissions reductions over the long run. The potential for influencing China, and ultimately the United States, through supply-chain contracting suggests that these information disclosure efforts may be worthy of substantial commitments of NGO and government resources.

1. Corporate Carbon Footprints

A viable means of stimulating supply-chain carbon requirements is the calculation and disclosure of corporate carbon footprints. These footprints identify the greenhouse gas emissions, generally in carbon dioxide-equivalents, associated with a firm.[199] The model for firm-based disclosure of greenhouse gas emissions is the public disclosure of toxic chemical releases from industrial facilities, which has been widely hailed as a successful means of inducing firms to improve their environmental performance.[200]

The principal federal disclosure program is the Toxics Release

schemes. *See* Pauwelyn, *supra* note 142, at 12–14.

196. *See, e.g.*, CAL. HEALTH & SAFETY CODE § 43200.1 (Deering 2007) (mandating global warming index label for cars beginning in the 2009 model year); N.Y. ENVTL. CONSERV. LAW § 19-1103 (Consol. 2007) (mandating global warming index label for cars beginning in 2010 model year). *See also* discussion *infra* at notes 220–22.

197. *See infra* notes 204–05.

198. *See, e.g.*, David P. Baron, *Competing for the Public Through the News Media*, 14 J. ECON. & MGMT. STRATEGY 339, 341–42 (2005) (noting public and private targets of the Sierra Club's efforts to raise average fuel economy standards).

199. Corporate carbon footprints are distinct but based on the same concept as personal carbon footprints. For a recent study of the carbon calculators used to calculate personal carbon footprints, see generally J. Paul Padgett et al., *A Comparison of Carbon Calculators*, 28 ENVTL. IMPACT ASSESSMENT REV. 106 (2008).

200. *See* Karkkainen, *supra* note 193, at 259–61.

Inventory ("TRI"), which was established soon after the 1984 Bhopal disaster.[201] The statutory and regulatory provisions creating the TRI require large industrial facilities to disclose their toxic chemical releases on an annual basis.[202] The TRI provisions only require reporting of releases from industrial facilities, not from suppliers or customers. Empirical studies have concluded that firms identified in TRI data releases as being among the highest emitters in their industrial sectors experienced an abnormal negative effect on firm stock value and subsequently reduced emissions more than those who were among the lowest emitters, even where emissions reductions were not mandated by law.[203] In short, despite the lack of any emissions-reductions requirements, TRI information disclosures appear to have created incentives for firms to reduce emissions.

If appropriately configured, a greenhouse gas emissions-disclosure scheme modeled on TRI could create incentives for U.S. firms to reduce their direct emissions and to adopt supply-chain contracting requirements to reduce emissions from suppliers. Several states have adopted requirements for facility-specific disclosure of greenhouse gas emissions, often in carbon dioxide equivalents.[204] Federal legislators have introduced bills with similar requirements.[205] Many of these greenhouse gas emissions

201. *See id.* at 259.

202. For a discussion of TRI reporting requirements, see Vandenbergh, *Order Without Social Norms*, *supra* note 34, at 1140–41.

203. Shameek Konar & Mark A. Cohen, *Why Do Firms Pollute (and Reduce) Toxic Emissions?* 6–7 (2000), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=922491. *See also* Winston Harrington, *Enforcement Leverage when Penalties Are Restricted*, 37 J. PUB. ECON. 29, 49 (1988) (noting high compliance where costs are low even in cases in which penalties are unlikely to be levied and suggesting that the threat of bad publicity may also incentivize firms to comply in the absence of penalties). For a review of the empirical literature on the Toxics Release Inventory, see generally Mark A. Cohen, *Empirical Research on the Deterrent Effect of Environmental Monitoring and Enforcement*, 30 Envtl. L. Rep. (Envtl. Law Inst.) 10,245 (2000). *See also* Cary Coglianese & Jennifer Nash, *Management-Based Strategies: An Emerging Approach to Environmental Protection*, *in* LEVERAGING THE PRIVATE SECTOR: MANAGEMENT-BASED STRATEGIES FOR IMPROVING ENVIRONMENTAL PERFORMANCE 3, 9–10 (Cary Coglianese & Jennifer Nash eds., 2006) (discussing state analogues to TRI).

204. *E.g.*, California Global Warming Solutions Act of 2006, Cal. Health & Safety Code § 38530(a) (Deering 2007) (requiring the California State Air Resources Board to finalize a reporting program for firm greenhouse gas emissions by the end of 2007); Regional Greenhouse Gas Initiative, About RGGI, http://www.rggi.org/about.htm (last visited July 27, 2008).

205. *See* National Greenhouse Gas Registry Act of 2007, S. 1387, 110th Cong. (2007) (amending the Emergency Planning and Community Right-to-Know Act to include greenhouse gases under the TRI reporting requirements); Greenhouse Gas Accountability Act of 2007, H.R. 2651, 110th Cong. (2007) (requiring all publicly traded companies and "significant emitters" of greenhouse gases to report to the EPA and for the agency to make the data available in a publicly searchable format). *See also* Consolidated Appropriations Act, 2008, Pub. L. No. 110-161, 121 Stat. 1844, 2128 (2008) (directing the EPA to publish a rule requiring all sectors of the economy to report their greenhouse gas

reporting requirements appear to be designed to provide baseline data for the imposition of state, regional, or federal cap-and-trade schemes,[206] but they also may generate pressure on firms through TRI-type public disclosure of emissions.

Nevertheless, these reporting requirements reflect several limitations of the TRI design. They apply only to large industrial facilities, and also do not require regulated facilities to report the emissions from suppliers or customers. As a result, although these greenhouse gas disclosure programs may generate pressure to reduce facility-specific greenhouse gas emissions, they are unlikely to generate pressure to reduce emissions from the supply chain or from the use of the goods produced at the regulated facilities. In the absence of pressure on suppliers and customers, firms will have incentives to reduce reported facility-specific emissions not by reducing total emissions from the life cycle of the product, but by shifting high-emitting production to suppliers or by making goods that are less carbon intensive to make but more carbon intensive to use.

To induce pressure for supply-chain contracting, firms should be induced to include emissions from suppliers in their footprint.[207] In addition, any carbon footprint disclosure requirements modeled on the TRI program should apply not only to facilities but also to firms, and the types of firms should include not only manufacturers but also large retailers. Many of the firms that have committed to reducing greenhouse gas emissions and have calculated their carbon footprints thus far have excluded suppliers from their footprint analyses, and leading global and domestic private carbon-reporting standards do not require inclusion of suppliers in estimates of a firm's carbon footprint.[208] The inclusion of

emissions).

206. *See, e.g.*, Climate Stewardship Act of 2003, S. 139, 108th Cong. (2003); Regional Greenhouse Gas Initiative, Memorandum of Understanding, Dec. 20, 2005, http://www.rggi.org/docs/mou_final_12_20_05.pdf.

207. *See* WIEDMANN & MINX, *supra* note 33, at 2 (noting that a point of disagreement regarding definitions of carbon footprints is "whether the carbon footprint needs to include indirect emissions embodied in upstream production processes or whether it is sufficient to look at just the direct, on-site emissions"). Several entities are accounting for customer-produced carbon dioxide emissions. *See* Press Release, Middlebury College, Middlebury College Ski Facility Takes Carbon Neutrality to New Heights (Oct. 30, 2006), *available at* http://www.middlebury.edu/about/pubaff/news_releases/2006/news632977987165870677.htm. Others are encouraging suppliers to measure their own carbon footprints. *See* Ylan Q. Mui, *Wal-Mart Aims to Enlist Suppliers in Green Mission*, WASH. POST, Sept. 25, 2007, at D02 (describing Wal-Mart's efforts in asking "suppliers to measure their carbon footprint and find ways to reduce it").

208. *See, e.g.*, GLOBAL REPORTING INITIATIVE, SUSTAINABILITY REPORTING GUIDELINES 17, 26, 33 (2006), *available at* http://www.globalreporting.org/NR/rdonlyres/ED9E9B36-AB54-4DE1-BFF2-5F735235CA44/0/G3_GuidelinesENU.pdf (advancing sustainability performance indicators with

supplier emissions in corporate carbon footprints on a widespread basis thus may require government, consumer, NGO, or other pressure.[209] That pressure, in turn, will arise only if policymakers, NGOs, and individuals recognize the potentially central role that low-carbon supply-chain contracting can play in addressing the climate problem at the global level.

Ideally the footprint requirements not only should include supplier emissions, but also emissions from the consumption of the goods produced or sold.[210] Doing so will reduce the risk that retailers will have incentives to opt for products that are manufactured with fewer emissions than comparable products but emit more during use.[211] For example, nothing will be gained if retailers are induced to sell a lawnmower that generates one ton less greenhouse gases during production than an alternative, yet emits two tons more during its useful life. Some of the pressure to reduce emissions from consumption rather than just manufacturing and selling can be addressed by including consumer emissions in product labels, as

regard to suppliers in the economic (EC6) and human rights (HR2) realms, but asserting that, while "operational information such as emissions data can be reliably compiled from entities under the control of an organization, [they] may not be available for a joint venture or a supplier"); THE CLIMATE REGISTRY, GENERAL REPORTING PROTOCOL FOR THE VOLUNTARY REPORTING PROGRAM 34 (2008), *available at* http://www.theclimateregistry.org/downloads/GRP.pdf (describing as "optional" the reporting of all upstream emissions); CARBON DISCLOSURE PROJECT, CARBON DISCLOSURE PROJECT (CDP5) GREENHOUSE GAS EMISSIONS QUESTIONNAIRE, http://www.cdproject.net/admin/cdp5reportingguidance.asp (noting that supplier emissions are included in Scope 3, and only in the Scope 1 and Scope 2 levels is reporting required).

209. Firms that have committed to carbon neutrality often have undertaken a carbon footprint analysis. *See* BUS. FOR SOCIAL RESPONSIBILITY, WHO'S GOING "CARBON NEUTRAL"? (2007), http://www.bsr.org/reports/BSR_Carbon-Neutral-Chart.pdf (listing fifteen firms that have achieved carbon neutrality and thirteen that have made a commitment to achieve carbon neutrality, each providing supportable claims). Many firms in the United States have calculated their carbon footprint. *E.g.*, Press Release, The Conference Board, "Carbon Footprint" Gaining Business Attention (Oct. 18, 2006), *available at* http://www.conference-board.org/utilities/pressDetail.cfm?press_ID=2985 (reporting that 75% of ninety-two companies surveyed calculated their carbon footprints).

210. In many cases, firms have not included customers or suppliers in their carbon footprint calculations. *Compare* Cortese, *supra* note 179 (noting Timberland's efforts to include suppliers in carbon footprint analysis), *with* Tesco, Measuring Our Carbon Footprint, http://www.tesco.com/climatechange/carbonfootprint.asp (last visited July 27, 2008) (not including either suppliers or customers in its carbon footprint analysis).

211. Several types of organizations are accounting for customer- or user-produced carbon dioxide emissions. *See, e.g.*, Press Release, Middlebury College, *supra* note 207 (including emissions of skiers traveling to and from the ski resort in offset calculations). Other companies are proactively encouraging suppliers to measure their own carbon footprints. *See* Mui, *supra* note 207 (describing Wal-Mart's efforts in asking "suppliers to measure their carbon footprint and find ways to reduce it"). An example of a firm that has calculated the carbon footprint of the consumption of its goods is Shell, which has acknowledged that consumption of its petroleum and other products accounts for several percent of global greenhouse gas emissions. Shell, Carbon Footprint of Our Products, http://www.shell.com/home/content/responsible_energy/environment/climate_change/carbon_footprint_products/carbon_footprints_products.html (last visited July 27, 2008).

discussed below, but including consumer emissions in firm carbon footprints would reinforce the incentives fostered by the labels.

The China Problem demonstrates the importance of gathering and reporting information on the entire carbon footprint of a firm, including suppliers and customers, not just the emissions from a particular facility.[212] A number of authors have noted that the movement of energy-intensive production from the United States and other developed countries to China has had the effect of outsourcing greenhouse gas emissions.[213] If firms are compelled to calculate and disclose their carbon footprints and to include suppliers in the footprints, they will have additional incentives to impose carbon requirements on their suppliers and fewer incentives to shift high-emitting activities to suppliers.

2. Product Labeling

Public or private product labeling also may increase the supply-chain incentives for firms, and be more viable in the short term and less vulnerable to a WTO challenge than a number of other instruments. Whether public or private, a labeling scheme will need to have several elements if it is to induce changes in firm behavior sufficient to reduce greenhouse gas emissions. The scheme will need to provide sufficient information to induce consumers and NGOs to apply pressure on the appropriate targets.[214] For example, if the pressure results in reduced manufacturing emissions in China but increases manufacturing emissions in another country, the effort will not succeed. As a result, the labels will need to apply to both domestic and imported goods, not just the latter. This approach also has the benefit of reducing the risk that the labeling scheme will encounter WTO difficulties.[215]

212. *See* WIEDMANN & MINX, *supra* note 33, at 4 (proposing definition of carbon footprint that includes direct and indirect emissions "accumulated over the life stages of a product").

213. *See, e.g.*, Chatterjee, *supra* note 121, at 4834 (noting that "the boost in imports and associated consumption by the U.S. has added significantly to the greenhouse-gas emissions of its trading partners, especially those with poorly enforced environmental regulations, like China"). China also engages in forms of outsourcing, such as protecting domestic forests at the expense of those in other countries. Liu & Diamond, *supra* note 55, at 1184.

214. *See* W. Kip Viscusi & Richard J. Zeckhauser, *Hazard Communication: Warnings and Risk*, 545 ANNALS AM. ACAD. POL. & SOC. SCI. 106, 109–10 (1996) (discussing the shortcomings of labels, including the difficulty of targeting information to the sophistication of the user and communicating the appropriate level of risk).

215. *See* General Agreement on Tariffs and Trade art. 3, para. 4, Oct. 30, 1847, 61 Stat. A-11, 55 U.N.T.S. 194 (prohibiting discrimination against like-imported products). *See also* Edward M. Thomas, Note, *Playing Chicken at the WTO: Defending an Animal Welfare-Based Trade Restriction Under GATT's Moral Exception*, 34 B.C. ENVTL. AFF. L. REV. 605, 615 n.91 (2007) ("This area of the law is changing quickly, and considerations such as consumer preferences are increasingly taken into account

Similarly, as discussed above, the pressure arising from labels should result in overall net reductions in greenhouse gas emissions, not just reductions in emissions from manufacturing. If a measure reduces manufacturing emissions but increases shipping emissions or emissions during use of the good, the measure may have no net impact or may even increase emissions. To ensure that net emissions reductions are achieved, the labels will need to address the emissions that arise throughout the life cycle of a good, including production, shipment, marketing, sales, and use.[216] Calculating life-cycle emissions will not be easy, but the calculations need not be exact, and as long as perfection is not the goal, it can be done at a reasonably low cost.

Public and private carbon-labeling efforts are underway around the world. For example, the British government has announced a new program "created jointly by [the] Department for Environment, Food, and Rural Affairs and the Carbon Trust, a government advisory body."[217] The goal is to induce carbon labeling for all products.[218] Several major brands are planning to test the Carbon Trust label, with the expectation that more companies will join.[219]

In the United States, the federal government could impose labeling requirements quickly and widely across many sectors. Little legislative or executive branch activity is underway regarding carbon labeling, however, and action by a number of states may be more likely in the interim. Several states have adopted greenhouse gas labeling requirements for specific types of consumer goods. For example, in 2005 California adopted a requirement

by the WTO in deciding whether two products are 'like' each other."). The WTO considers "evidence relating to consumers' tastes and habits" in its analysis of whether two products are "like products." WTO Appellate Body Report, *European Communities—Measures Affecting Asbestos and Asbestos-Containing Products* ¶¶ 84–154, WT/DS135/AB/R (Feb. 16, 2001). WTO prohibitions on TBT apply to measures that focus on product-related processes and production methods ("PPMs") including "terminology, symbols, packaging, marking or labeling requirements." *See* Pauwelyn, *supra* note 142, at 27 (quoting *Agreement on Technical Barriers to Trade*, Annex I, par. 1). Labeling schemes may survive a WTO challenge even if they focus on PPMs if they are nondiscriminatory and "'not more trade-restrictive than necessary to fulfill a legitimate objective.'" *Id.*

216. *See* Edgar C. Hertwich, *Consumption and Industrial Ecology*, 9 J. INDUS. ECOLOGY 1, 1 (2005).

217. Joel Makower, Two Steps Forward: London Goes Carbon Crazy (June 3, 2007), http://makower.typepad.com/joel_makower/2007/06/london_goes_car.html.

218. *Id.*

219. Ian Herbert, *Carbon Footprint of Products to Be Displayed on Label*, INDEPENDENT (London), Mar. 16, 2007, at H22. Similarly, the Welsh government plans to introduce a label called the "green standard" which will provide information on each food's environmental impact, concentrating on how many miles the food must be flown to get to the Welsh markets. *Eco-Labeling Could Benefit All*, WESTERN MAIL (Cardiff, Wales), Apr. 17, 2007, at 4.

that all new cars display carbon dioxide emissions labels starting with the 2009 model year.[220] New York also has imposed labeling requirements on new motor vehicles.[221] To date, no state has adopted a broader labeling program along the lines of the program under development in the United Kingdom.

In the absence of a public labeling requirement, a private labeling scheme may be able to generate sufficient consumer and NGO pressure to induce firms to impose greenhouse gas emissions-reduction requirements on suppliers. The labeling may occur through inclusion of greenhouse gas emissions-disclosure requirements in existing labels or new labels managed by private standard-setting organizations,[222] or through unilateral action by firms. For instance, in 2006 Timberland added a label to its footwear that resembled a food nutrition label, and more recently it has moved toward a simpler "green index tag" approach that measures greenhouse gas emissions on a scale of one to ten.[223]

Other private firms in the United States also have adopted or begun the process of adopting product carbon labeling. In 2007, Home Depot introduced one of the largest labeling initiatives in the United States in the form of an "Eco Options" brand label for almost three thousand products.[224] The retailer expects the program to include over six thousand products by 2009, which would include 12% of the chain's sales and make it the largest labeling program in American retailing.[225] Energy-efficiency labeling (in the form of products with the Energy Star label) is part of the effort, although it is unclear whether the effort will extend to greenhouse

220. CAL. HEALTH & SAFETY CODE § 43200.1 (Deering 2007). Kate Probst has argued that the federal government should follow California's lead by requiring all new cars and trucks to bear a "global warming performance" label. *See* Katherine N. Probst, *Combating Global Warming One Car at a Time: CO2 Emissions Labels for New Motor Vehicles*, RESOURCES, Spring 2006, at 9, 10, *available at* http://www.rff.org/rff/Documents/RFF-Resources-161_EmissionsLabels.pdf. This label would estimate the pounds of CO2 produced annually for each make and model, place vehicles in five distinct groupings rated from "best" to "worst," and allow prospective purchasers to make easy comparisons among alternatives. *Id.* at 9.

221. N.Y. ENVTL. CONSERV. LAW § 19-1103 (Consol. 2007).

222. The Consumer Reports website provides information on sixty-seven certifying organizations. Consumer Reports, Greener Choices Eco-Labels Center, http://www.greenerchoices.org/eco-labels/organizationIndex.cfm (last visited July 28, 2008). For example, the Center for Resource Solutions enables businesses to qualify to use a "Green-e Logo" on their packaging if they meet certain renewable energy use criteria. *See* CTR. FOR RES. SOLUTIONS, GREEN-E VERIFICATION REPORT 7 (2005), *available at* http://www.green-e.org/docs/2005-Green-e_Verification_Report-forweb.pdf.

223. Cortese, *supra* note 180.

224. Michael Barbaro, *Home Depot to Display an Environmental Label*, N.Y. TIMES, Apr. 17, 2007, at C1.

225. *Id.*

gas emissions labels for products that are not eligible for Energy Star status.[226]

On the international level, British supermarkets lead the private carbon labeling movement. Britain's top four supermarket chains—Tesco, Asda, Sainsbury, and Morrisons—have been described as competing to "out-green one another in the public's eyes."[227] In January of 2007, Tesco, the largest chain, "announced that it will begin labeling all 70,000 products on its shelves with the amount of carbon generated from the production, transport, and consumption of those items."[228] Marks & Spencer announced a plan to be carbon neutral by 2012, in part through the adoption of a carbon labeling scheme.[229] The print industry in the United Kingdom also recently announced a new "eco-label campaign" that will disclose the life-cycle carbon emissions of each product.[230]

B. INFLUENCE OF CARBON FOOTPRINTS AND LABELING

1. Firm Efficiencies

As the potato example suggests, incentives to gather and disclose information may lead firms to identify efficiencies.[231] Management focus on the energy use associated with buying potatoes by the pound did not occur until greenhouse gas emissions concerns induced the potato chip

226. *See id.* Another firm has taken the approach of bundling its product with emissions offsets to generate a "carbon-balanced" product. *First Carbon-Balanced Retail Product Announced*, GREENBIZ.COM, Jan. 22, 2007, http://www.greenbiz.com/news/2007/01/22/first-carbon-balanced-retail-product-announced (discussing the efforts of Karcher USA, a manufacturer of pressure washers).

227. Makower, *supra* note 217. The race could be argued to be roughly analogous to the "politicians' dilemma" confronted by Richard Nixon and Ed Muskie in the 1972 presidential election. *See* E. Donald Elliott, Bruce A. Ackerman & John C. Millian, *Toward a Theory of Statutory Evolution: The Federalization of Environmental Law*, 1 J.L. ECON. & ORG. 313, 324–29 (1985).

228. Adam Stein, Terrapass Blog, British Supermarket Chain to "Carbon Label" All Products (Jan. 23, 2007), http://www.terrapass.com/blog/posts/british-superma. The National Consumer Council recently concluded that of the eight major British supermarkets, Waitrose was the friendliest to the environment. SUE DIBB, NAT'L CONSUMER COUNCIL, GREENING SUPERMARKETS: HOW SUPERMARKETS CAN HELP MAKE GREENER SHOPPING EASIER 2 (2006), *available at* http://www.ncc.org.uk/nccpdf/poldocs/NCC132rr_greening_supermarkets.pdf; Rebecca Smithers, *How Green Is Your Supermarket? It Could Try Harder*, GUARDIAN (London), Sept. 14, 2006, at 5, *available at* http://www.guardian.co.uk/environment/2006/sep/14/food.lifeandhealth (discussing the National Consumer Council's report).

229. *Marks & Spencer Launches 200 Million Pound Eco Plan*, GREENBIZ, Jan. 16, 2007, http://www.greenbiz.com/news/2007/01/16/marks-spencer-launches-200-million-pound-eco-plan.

230. Adam Hooker, *New Label Set to Show Print's Carbon Output*, PRINTWEEK (U.K.), May 3, 2007, at 9.

231. *See* PARRY ET AL., *supra* note 32, at 1 (describing the supply chain as "one of the most pervasive places where energy can be conserved").

producer to examine the emissions from its supply chain.[232] Examples of supply-chain contracting inefficiencies that have been detected in the United States and the United Kingdom suggest the magnitude and types of inefficiencies that may be identified in China. In the United States, Wal-Mart, as discussed above, recently began to focus on the energy use in its operations and identified $25 million in annual savings by adopting a corporate ban on delivery truck idling. A recent supply-chain analysis conducted by the Carbon Trust in the United Kingdom concluded that in some cases 80% of a retail product's emissions arise from the supply chain rather than the retailer's operations.[233]

Despite the opportunities for efficiency enhancements, the prospect of savings from greater supply-chain efficiency alone will be insufficient to induce China and the United States to adopt and implement emissions-reductions targets. To do so also will require individuals to exert pressure through consumer and civic behavior, as discussed below.

2. Individual Consumer and Civic Behavior

The journey of the minivegetables demonstrates the type of activities that may not occur if customers have adequate information. The savings on labor costs presumably exceeded the energy costs of intercontinental air freighting of chives, minivegetables, and plastic packaging. The value of the vegetables may have been far less to image-conscious consumers, however, if they became aware of the greenhouse gas emissions associated with their preparation. The shipment of water from Fiji may follow a similar pattern. Although certainly not all, many consumers may be unwilling to buy goods with extremely high carbon emissions. With adequate information, their preferences may force the internalization of some of the climate change costs of jet fuel and other fossil fuels.[234]

Information about carbon emissions also may enable many consumers to achieve outcomes through market behavior that they are unable to achieve through civic behavior. Although individuals may be more likely to act altruistically when they conceive of themselves as citizens instead of as

232. Similarly, management focus is a possible reason for the reductions in toxic chemical releases that were cost beneficial and preexisted TRI release reporting. *See* Konar & Cohen, *supra* note 203, at 15. *See also* Harrington, *supra* note 203, at 49.

233. *See* CARBON TRUST, *supra* note 5, at 15 (noting case study involving the *Daily Mirror*).

234. *See* Douglas A. Kysar, *Preferences for Processes: The Process/Product Distinction and the Regulation of Consumer Choice*, 118 HARV. L. REV. 525, 637–38 (2004). Although estimates vary, one recent estimate places the social cost of climate change at $85 per metric ton of carbon dioxide. *See* HM TREASURY, STERN REVIEW: THE ECONOMICS OF CLIMATE CHANGE xvi (2006), *available at* http://www.hm-treasury.gov.uk./media/4/3/Executive_Summary.pdf.

consumers,[235] it is unclear whether this phenomenon holds true regarding climate change, or, even if it does, whether consumer pressure on firms will be greater than the limited citizen pressure that gets filtered through the political system. A variety of sources suggest that the current stance of the U.S. government is only partially reflective of the views of many Americans. For example, despite opposition at the federal level, more than fifteen states representing roughly half of the population have sought to adopt greenhouse gas standards for private motor vehicles.[236] In addition, a large percentage of the population expresses concern about climate change and states support for government action to reduce emissions, but at the same time, expresses deep reservations about taxes and big government.[237] The private consumer response to climate change thus may closely track Americans' desire to reduce greenhouse gas emissions with a minimum of government involvement.

Yet the literature is mixed on whether consumers will bear higher costs for low-carbon products. Consumers in the United States have demonstrated only limited willingness to pay more for green goods,[238] although Europeans have demonstrated a willingness to pay somewhat more.[239] A number of studies suggest that consumers in the United States in the past have opted for goods with green characteristics only if the price and other key features are roughly equal or there is a small price

235. Cass R. Sunstein, *Cognition and Cost-Benefit Analysis*, 29 J. LEGAL STUD. 1059, 1090–91 (2000) ("[T]here may be differences between the choices people make as consumers and the choices that they make as citizens . . . . The context of citizenship may evoke other-regarding or altruistic values that are not reflected in private choices.").

236. *See* Richard Simon & Janet Wilson, *EPA Denies California's Right to Mandate Emissions*, L.A. TIMES, Dec. 20, 2007, at A1.

237. John M. Broder & Marjorie Connelly, *Public Says Warming Is a Problem, but Remains Split on Response*, N.Y. TIMES, Apr. 27, 2007, at A20 (citing a *New York Times*/CBS News poll).

238. *See, e.g.*, ENVTL. PROT. AGENCY, EVALUATION OF ENVIRONMENTAL MARKETING TERMS IN THE U.S. iii (1993) (noting that "studies also show that . . . many consumers often do not act on their own assertion that they would preferentially purchase products that are less damaging to the environment"); ENVTL. PROT. AGENCY, STATUS REPORT ON THE USE OF ENVIRONMENTAL LABELS WORLDWIDE 30–31 (1993) (concluding that consumer interest in ecolabels "does not necessarily reflect the actual purchasing choices that consumers make"); Jamie A. Grodsky, *Certified Green: The Law and Future of Environmental Labeling*, 10 YALE J. ON REG. 147, 149 n.1 (1993); James Salzman, *Informing the Green Consumer: The Debate over the Use and Abuse of Environmental Labels*, J. INDUS. ECOLOGY, April 1997, at 11, 13 (noting that effect of ecolabeling programs "still has not been answered empirically," although labels may influence product design); Richard B. Stewart, *A New Generation of Environmental Regulation?*, 29 CAP. U. L. REV. 21, 96–97 (2001) (reviewing the effects of ecolabels on consumer behavior).

239. *See, e.g.*, Thomas Bue Bjørner, Lars Gårn Hansen & Clifford S. Russell, *Environmental Labeling and Consumer's Choice—An Empirical Analysis of the Effect of the Nordic Swan*, 47 J. ENVTL. ECON. & MGMT. 411, 428 (2004) (concluding that consumers' marginal willingness to pay was in the 13%–18% range for toilet paper).

premium.[240] Too much information or contradictory information also may act as barriers. For example, dozens of different types of consumer labels are available in Europe, and the profusion of labels has created a phenomenon described as "label fatigue."[241]

In recent years, however, consumers in developed countries have demonstrated a willingness to pay a price premium for a number of environmental and other social welfare-regarding attributes of products. Empirical studies suggest that environmental labeling is effective in creating demand for premium-priced products in certain niche markets when consumers perceive superior quality in a product, as is the case with organic foods, or when consumers feel that there is an actual environmental impact stemming from a purchase (that is, their purchases will affect a specific environmental outcome).[242] Environmental labeling in some cases has had an influence on nonniche products, such as the "dolphin-safe tuna" label, which has been credited with reviving the canned tuna market in the United States in the early- to mid-1990s.[243] Similarly, the organic foods market is growing rapidly in part through the efforts of large discount firms such as Wal-Mart, the largest grocer in North America, which describes its effort as "democratizing sustainability."[244]

The global market for fair trade coffee provides another example. The fair trade coffee market was $2.2 billion in 2006, a 42% increase from the prior year.[245] The growth in fair trade coffee sales tracks the growth in

240. *See, e.g.*, Paul C. Stern, *Information, Incentives, and Proenvironmental Consumer Behavior*, 22 J. CONSUMER POL'Y 461, 467–68 (1999) (examining limited consumer response to green appeals); Roy C. Andersen & Eric N. Hansen, *Determining Consumer Preferences for Ecolabeled Forest Products: An Experimental Approach*, J. FORESTRY, June 2004, at 28, 29–30 (concluding that wood products with ecolabels outsell others, but not when priced at a 2% premium). *But see* Jeffrey R. Blend & Eileen O. van Ravenswaay, *Measuring Consumer Demand for Ecolabeled Apples*, 81 AM. J. AGRIC. ECON. 1072, 1076 (1999) (finding that over 40% of households would be willing to buy ecolabeled apples at a $0.40 price premium).

241. *See, e.g.*, Clark Williams-Derry, *An Organic, Local Thanksgiving*, SIGHTLINE DAILY, Nov. 5, 2007, http://www.daily.sightline.org/daily_score/archive/2007/11/05/organic-local-thanksgiving.

242. *See, e.g.*, Jill J. McCluskey & Maria L. Loureiro, *Consumer Preferences and Willingness to Pay for Food Labeling: A Discussion of Empirical Studies*, 34 J. FOOD DISTRIB. RESEARCH 95, 96 (2003).

243. *See* Mario F. Teisl, Brian Roe & Robert L. Hicks, *Can Eco-Labels Tune a Market? Evidence from Dolphin-Safe Labeling*, 43 J. ENVTL. ECON. & MGMT. 339, 355–57 (2002). Interestingly, the consumer response followed an S-shaped curve, with highly informed and interested customers acting promptly, followed by much wider customer response several years later. *Id.*

244. Amanda Griscom Little, *Don't Discount Him: An Interview with Wal-Mart CEO H. Lee Scott*, GRIST, Apr. 12, 2006, http://www.grist.org/news/maindish/2006/04/12/griscom-little/index.html.

245. Andrew Downie, *Fair Trade In Bloom*, N.Y. TIMES, Oct. 2, 2007, at C1 (noting the growing demand for fair trade coffee among consumers and activists and the 20% price premium some growers have received). Coffee growers in some countries are receiving a smaller premium. *Id.*

public information: awareness of fair trade products in the United States increased from 12% in 2004 to 27% in 2006.[246] Fair trade coffee also has expanded outside of the high-end luxury market and is now the house brand at Sam's Club, with other fair trade coffee sellers including Dunkin' Donuts, McDonald's (where fair trade is the only coffee sold in its New England stores), and Starbucks.[247]

Although consumer price elasticity is unclear, by purchasing fair trade coffee on a large scale stores such as Sam's Club have been able to keep the price premium small. Sam's Club has done so in part by reducing the number of intermediaries such as packers, traders, shippers, and warehouse providers.[248] In addition, if the environmental amenity sought by consumers is a good that is manufactured with less carbon-intensive (and thus often more efficient) production, the price premium may not be great for some low-carbon goods.

Moreover, past experience may not be predictive of future consumer behavior. In the last two decades, climate change has been largely a matter of complex, inaccessible predictions based on computer modeling, combined with clumsy attempts to popularize the science.[249] More recently, news accounts that include credible, vivid images of monster hurricanes, the Arctic ice in retreat,[250] and polar bears in distress[251] have become common. If the IPCC's analysis of future climate effects is accurate, the events that generate these images will become more frequent and vivid over the next several decades. In some cases, vivid events may be occurring more quickly than anticipated even by the IPCC. For example, recent news accounts suggest that the Arctic ice cap may disappear entirely during the summer within the next few decades,[252] an event that would be roughly fifty years earlier than initially predicted and one that would create images with the characteristics that social and behavioral scientists find likely to motivate behavior change.[253]

Initial signs of changes in consumer behavior regarding climate change can be found in Europe and the United States. The market for low-

246. *Id.*
247. *Id.*
248. *Id.*
249. *See, e.g.*, THE DAY AFTER TOMORROW (Twentieth Century Fox 2004).
250. Andrew C. Revkin, *Arctic Melt Unnerves the Experts*, N.Y. TIMES, Oct. 2, 2007, at F1.
251. *Id.*
252. *See id.* (noting prediction by Wieslaw Maslowski of the Naval Postgraduate School).
253. *See* NAT'L RESEARCH COUNCIL, DECISION MAKING FOR THE ENVIRONMENT: SOCIAL AND BEHAVIORAL SCIENCE RESEARCH PRIORITIES 75 (Gary D. Brewer & Paul C. Stern eds., 2005) (listing characteristics of information that induces behavior change).

carbon goods is growing rapidly in Europe, where firms ranging from BMW[254] (which is offering an automatic anti-idling device in even its lowest-end models) to many British grocers[255] (which are committing to reduce corporate emissions) have responded in the last several years to consumer pressure. Another indication of the growing consumer support for purchasing goods that address climate change concerns is that more than thirty private firms and NGOs in Europe and the United States now sell retail carbon offsets.[256] The offsets enable individuals to offset their carbon emissions by paying for capture of methane from landfills, wind farms, and other projects. The voluntary carbon-offset market grew from $6 million in 2005 to over $100 million in 2006.[257]

3. Other Influences

The information generated by corporate carbon footprints and product carbon labeling also may affect firms through a range of influences that have been described as constituting firms' "social license" to operate.[258] For example, the information may stimulate NGO-led boycotts[259] and efforts to undermine firms' reputations if they fail to adopt supply-chain contracting requirements.[260] Socially responsible investors may begin to

254. *See* Vito J. Racanelli, *Luxury Autos 2007: Green Machine*, BARRON'S, Sept. 24, 2007, at 33, 33.

255. *See, e.g.*, PARRY ET AL., *supra* note 32, at 1; *Marks & Spencer Launches 200 Million Pound Eco Plan*, *supra* note 229.

256. Vandenbergh & Steinemann, *supra* note 26, at 1719–20.

257. James Kanter, *Guilt-Free Pollution. Or Is It?*, N.Y. TIMES, Feb. 20, 2007, at C1.

258. Gunningham et al., *Social License*, *supra* note 193, at 308–10. *See also* PARRY ET AL., *supra* note 32, at 1 (noting concerns driving recent supply-chain energy conservation activity); Irene Henriques & Perry Sadorsky, *The Determinants of an Environmentally Responsive Firm: An Empirical Approach*, 30 J. ENVTL. ECON. & MGMT. 381, 384 (1996) (examining shareholder, employee, and management issues).

259. *See* Dennis E. Garrett, *The Effectiveness of Marketing Policy Boycotts: Environmental Opposition to Marketing*, J. MARKETING, Apr. 1987, at 46, 49 (suggesting that in addition to direct economic pressure, image pressure and policy commitment play an influential role in firm responses to boycotts); Robert Innes, *A Theory of Consumer Boycotts Under Symmetric Information and Imperfect Competition*, 116 ECON. J. 355, 361–62 (2006). *But see* Philippe Delacote, *Are Consumer Boycotts Effective?* 3–4 (2008), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1016773) (concluding that imperfect information, consumer demand for consumption, transaction costs, and free rider problems reduce the likelihood of success of boycotts); Konar & Cohen, *supra* note 203, at 29 (failing to find significant effects on environmental performance from consumer pressure in study of 520 firms).

260. *See, e.g.*, David P. Baron & Daniel Diermeier, *Strategic Activism and Nonmarket Strategy*, 16 J. ECON. & MGMT. STRATEGY 599, 603–04 (2007); Henriques & Sadorsky, *supra* note 258, at 393 (concluding based on the results of a Canadian empirical study that firms "down-play" the effect of consumer and neighborhood pressure, but that these groups have a "significant impact on firms' decisions to formulate environmental plans"); Sheoli Pargal et al., *Formal and Informal Regulation of Industrial Pollution: Comparative Evidence from Indonesia and the United States*, 11 WORLD BANK ECON. REV. 433, 448 (1997) (finding a "powerful role for informal regulation" based on community

view supply-chain contracting requirements regarding greenhouse gas emissions as an important indicator of firm social responsibility.[261] Firms may believe that their supply-chain contracting will influence regulators' decisions regarding new regulations, enforcement activity, and permitting.[262]

Finally, the information generated by these schemes may influence the norms of corporate managers. The influence of norms is very difficult to identify empirically and to translate into general observations that can inform legal remedies.[263] Nevertheless, there is reason to believe that when the decisional space is available, some managers' behavior reflects personal and social norms, and it does so in ways that are important for predicting how firms will react to information regarding product- and firm-level greenhouse gas emissions.[264]

In particular, the recent behavior of a number of managers presents intriguing anecdotal information that norms may be having a strong effect on firm responses to climate change. For example, many of the firms that have taken public stands in favor of firm or societal greenhouse gas reductions are led by executives who appear to be driven by normative considerations. Perhaps the best example is Rupert Murdoch, whose News Corporation owns Fox News but also has adopted carbon neutrality.[265] Murdoch's son is a strong environmentalist.[266] Goldman Sachs adopted a

ability to pressure polluting factories).

261. Jason Scott Johnston, *Signaling Social Responsibility: On the Law and Economics of Market Incentives for Corporate Environmental Performance* 74–76 (Univ. of Pa. Law Sch., Inst. for Law & Econ., Research Paper No. 05-16, 2005), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=725103.

262. Cohen, *supra* note 203, at 10,250.

263. *See* Eric A. Posner, *Law and Social Norms: The Case of Tax Compliance*, 86 VA. L. REV. 1781, 1788–91 (2000).

264. *See, e.g.*, Raymond Paternoster & Sally Simpson, *Sanction Threats and Appeals to Morality: Testing a Rational Choice Model of Corporate Crime*, 30 LAW & SOC'Y REV. 549, 575 (1996) (finding based on empirical study that when moral beliefs are strong, other factors were "virtually superfluous"); Aseem Prakash, *Why Do Firms Adopt "Beyond-Compliance" Environmental Policies?*, 10 BUS. STRATEGY & ENV'T 286, 296 (2001) (noting the importance of personal preferences in management); Michael P. Vandenbergh, *Beyond Elegance: A Testable Typology of Social Norms in Corporate Environmental Compliance*, 22 STAN. ENVTL. L.J. 55 (2003) (reviewing empirical studies and proposing typology of norms likely to influence managers' environmental compliance decisionmaking).

265. Louise Story, *The Hidden Life of Paper and Its Impact on the Environment*, N.Y. TIMES, Oct. 25, 2006, at C3.

266. Ronald Grover, *The Murdoch Who Could Be King*, BUSINESSWEEK, June 25, 2007, at 66, 66 ("At a moment when corporations are at last preaching the benefits of environmentalism, James [Murdoch] is prodding his father to go green. News Corp.'s May 10 announcement that it would be carbon-neutral by 2010 is modeled on James' own initiatives at BSkyB that cut carbon emissions 20%, including software that powers down idle set-top boxes.").

strong environmental policy during the leadership of Henry Paulson, who also chaired the Nature Conservancy board of directors.[267] Wal-Mart's ecoawakening is certainly influenced by factors unrelated to its managers' norms, but it also appears to have been influenced by the trips that one of the Waltons took to ecologically sensitive areas with the head of Conservation International.[268] Additionally, a growing number of chief executive officers have remarked about the effects of climate change data on their conscience.[269] These statements could be self-serving marketing ploys or genuine but incorrect statements of their motives, but they also could signal that firm behavior, when confronting an issue with the potential harms presented by climate change, will be more influenced by managers' norms, and thus by information about emissions, than standard accounts would predict.

VI. CONCLUSION

This Article suggests how information collection and disclosure can facilitate a private market response that will reduce China's near-term economic incentive to emit greenhouse gases. The proposed remedy will not reverse the balance of incentives on its own, but it will add an important additional incentive. It will generate private pressure on Chinese manufacturers to make emissions reductions directly and to pressure the Chinese government to make the investments and policy changes necessary to achieve widespread reductions.

The proposed solution also will have an effect on the U.S. political climate and its incentives. Reductions in Chinese emissions will undermine opposition to U.S. reduction efforts to the extent the opposition is based on China's failure to act. In addition, carbon labeling and carbon footprint schemes that induce supply-chain contracting requirements also may educate the American population about U.S. emissions. Consumer, NGO, and other pressures thus may lead to U.S. emissions reductions from the same types of efficiency gains and other steps as will occur in China. In combination, these effects may induce the *pas de deux* between China and

267. *See* Goldman Sachs Environmental Policy Framework, http://www2.goldmansachs.com/citizenship/environment/policy-framework.pdf (last visited July 30, 2008). *See also* Press Release, Nature Conservancy, Henry M. Paulson Elected Chairman of the Nature Conservancy Board of Governors (Jan. 20, 2004), *available at* http://www.nature.org/pressroom/press/press1315.html.

268. Ylan Q. Mui, *Wal-Mart Extends Its Influence to Washington: Under Siege, Retailer Engages Opponents*, WASH. POST, Nov. 24, 2007, at A01.

269. *See, e.g.*, Jane L. Levere, *A Law to Cut Emissions? Deal With It*, N.Y. TIMES, Oct. 21, 2006, at C3 (quoting Peter A. Darbee, president, CEO, and chairman of PG&E as being driven by his conscience to address global warming).

the United States to come to a swift and positive conclusion.