ARTICLES

CLIMATE CHANGE GOVERNANCE: BOUNDARIES AND LEAKAGE

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ABSTRACT

This article provides a critical missing piece to the global climate change governance puzzle: how to create incentives for the major developing countries to reduce carbon emissions. The major developing countries are projected to account for 80 percent of the global emissions growth over the next several decades, and substantial reductions in the risk of catastrophic climate change will not be possible without a change in this emissions path. Yet the global climate governance measures proposed to date have not succeeded and may be locking in disincentives as carbon-intensive production shifts from developed to developing countries. A multi-pronged governance approach will be necessary. We identify a new strategy that will be an important component of any successful effort. Our strategy recognizes that in the context of climate change, the simplified Coasian approach to pollution should be updated to include a more complete view of the options firms face in response to emissions reduction pressure and the sources of that pressure. We demonstrate how governments and

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non-governmental organizations can use expanded corporate carbon reporting boundaries and product carbon disclosure to harness social norms in developed countries. This informal social license pressure, in turn, will create incentives for firms to seek emissions reductions from their domestic and global supply chains. The private market pressure conveyed through supply chains will reduce leakage from developed countries, create new incentives for developing country firms and national governments, and play a surprisingly important role in the formation and implementation of a successful post-Kyoto global policy architecture.

INTRODUCTION

At the heart of the global climate governance problem lies a puzzle: how can the risk of catastrophic climate change be reduced if the major developing countries must make substantial emissions reductions, but these countries lack the incentive to reduce emissions, and other nations lack the ability to force them to do so? Atmospheric carbon targets will not be achieved without the active participation of the major developing countries.[1] In all likelihood, this participation ultimately will take the form of a post-Kyoto multilateral agreement, but it will be difficult, if not impossible, for a post-Kyoto agreement alone to create sufficient incentives for substantial reductions from the major developing countries.[2] Scholars have proposed creating incentives through extended compliance deadlines and additional allowance allocations in a global cap-and-trade agreement,[3] but these measures have failed thus far, and providing further extensions and allocations may make it impossible to achieve atmospheric targets.[4] The other leading options—including technology or other

[1] *See infra* Part I.A. We include Brazil, China, India, Indonesia, and Mexico in the term "major developing countries." *See* INT'L ENERGY AGENCY, CO_2 EMISSIONS FROM FUEL COMBUSTION: 1971–2003 at II4–II6 (2005). We include in the term "carbon" all six of the leading anthropogenic greenhouse gases, including carbon dioxide, methane, nitrous oxide, and the fluorinated gases.

[2] *See* Michael P. Vandenbergh et al., *Micro-Offsets and Macro-Transformation: An Inconvenient View of Climate Change Justice*, 33 HARV. ENVTL. L. REV. 303, 309–31 (2009).

[3] *See, e.g.*, Cass R. Sunstein, *The World vs. the United States and China? The Complex Climate Change Incentives of the Leading Greenhouse Gas Emitters*, 55 UCLA L. REV. 1675, 1696 (2008) (discussing excess allowances and extended deadlines as incentives).

[4] China and India have recently rejected national mandatory emissions

subsidies, border trade adjustments, and moral suasion—also face substantial barriers.[5]

After more than a decade of post-Kyoto negotiations, it is becoming clear that multiple strategies will be necessary to solve the global climate governance puzzle. No single strategy will be adequate on its own, and some may fail altogether, but if a sufficient number of strategies create incentives for emissions reductions there is reason for optimism. Some strategies will have direct effects on national incentives and some will create indirect, hydraulic pressure for joining and complying with a post-Kyoto agreement. We offer the latter in this article.

We argue that although scholars and policymakers have focused on international cap-and-trade schemes, a sophisticated approach with an intellectual lineage extending back to Coase,[6] they are functioning as if the simplified Coasian choice of imposing legal obligations on polluting factories or the neighbors who live downwind adequately describes the range of available policy options.[7] Yet the characteristics of carbon emissions and decades of research suggest that two simplifying assumptions in the Coasian example do not fully characterize the complexity of the climate change problem. First, carbon emissions have global effects, blurring the traditional boundaries that define the parties who have incentives to bargain over pollution entitlements and creating incentives for emissions "leakage" through offshoring.[8]

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limits and even rejected a global emissions reduction target for 2050. Peter Baker, *Poorer Nations Reject a Target on Emission Cut*, N.Y. TIMES, July 9, 2009, at A1; Mark Landler, *Event Shows U.S.-India Split on Climate*, N.Y. TIMES, July 20, 2009, at A6; *see also* Vandenbergh et al., *supra* note 2, at 323–31 (discussing limits of post-Kyoto agreement inducements).

[5] *See, e.g.*, Eric A. Posner & Cass R. Sunstein, *Climate Change Justice*, 96 GEO. L.J. 1565, 1611–12 (2008) (noting the use of technology subsidies, other subsidies, and moral suasion); *see also infra* notes 49–60 and accompanying text.

[6] *See* Jonathan Baert Wiener, *Global Environmental Regulation: Instrument Choice in Legal Context*, 108 YALE L.J. 677, 679–80, 704–35 (1999) (discussing Coasian and Pigouvian instruments to address international environmental problems).

[7] *See* R. H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1, 1 (1960) (providing factory example); *see also infra* notes 61–63 and accompanying text.

[8] *See generally* Robert N. Stavins, *A Meaningful U.S. Cap-and-Trade System to Address Climate Change*, 32 HARV. ENVTL. L. REV. 293 (2008) (discussing cap and trade leakage); Jonathan B. Wiener, *Climate Change Policy, and Policy Change in China*, 55 UCLA L. REV. 1805 (2008) (noting leakage concerns arising from movement of industry to China); Jonathan B. Wiener, *Think Globally, Act Globally: The Limits of Local Climate Policies*, 155 U.

Second, although the typical Coasian bargain is over the effects of legal entitlements,[9] informal social influence exerted by nongovernmental organizations (NGOs), investors, employees, and customers generates much of the carbon emissions reduction pressure for firms in the United States (U.S.) and European Union (EU).[10] This social pressure defines the scope of a social license to operate—an informal entitlement that the parties can bargain over.[11] By accounting for this complexity, we identify a new governance strategy in which governments and private actors use information disclosure to harness social norm-driven market pressure across national boundaries.

To assess the risk of leakage, we examine the emerging consensus on the boundary of the entity that should be subject to carbon reporting and cap-and-trade allowance-holding standards.[12] We conclude that the emerging public and private governance schemes do not present a substantial risk of leakage from shifting carbon emissions among domestic facilities in the U.S., but they do present a substantial risk of cross-border leakage. We find that

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PENN. L. REV. 1961 (2007) (noting the need for broader global coverage in climate change regimes to reduce leakage).

[9] *See, e.g.*, Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089, 1090 (1972) (discussing property rules and liability rules and noting that legal rules may arise from common law or government regulation); *see also infra* notes 63–75 and accompanying text.

[10] In some cases the pressure is applied directly; in others it is conveyed and shaped by non-governmental organizations (NGOs), trade associations, or hybrid public-private organizations. *See* Jody Freeman, *The Private Role in Public Governance*, 75 N.Y.U. L. REV. 543, 551–56 (2000) (discussing impact that actors in private sector have in the public realm); Michael P. Vandenbergh, *The Private Life of Public Law*, 105 COLUM. L. REV. 2029, 2041–66 (2006) (identifying how interactions among private actors in response to public laws can enhance or undermine regulatory objectives); BENJAMIN CASHORE ET AL., GOVERNING THROUGH MARKETS: FOREST CERTIFICATION AND THE EMERGENCE OF NON-STATE AUTHORITY 4–5 (2004) (explaining the emergence of non-state market-driven governance systems and their importance).

[11] This phenomenon has been studied at length at the local level but it has important unexplored implications for global climate change. *See, e.g.*, ROBERT C. ELLICKSON, ORDER WITHOUT LAW: HOW NEIGHBORS SETTLE DISPUTES at viii, 40–64 (1991) (examining Coase's parable of the farmer and the rancher and concluding that in Shasta Country the starting point for bargaining is often informal norms, not legal entitlements); *see also* Neil Gunningham et al., *Social License and Environmental Protection: Why Businesses Go Beyond Compliance*, 29 LAW & SOC. INQUIRY 307, 308–10 (2004) (suggesting that firms function as though they need a "social license" to operate).

[12] *See infra* notes 88–164 and accompanying text.

public and private standards have converged on a common carbon footprint boundary that requires reporting emissions from large facilities (e.g., reporting by facilities that emit more than 25,000 metric tons of carbon dioxide equivalent (CO_2eq) per year)[13] but excludes emissions from suppliers.[14] The same narrow facility boundary appears in public cap-and-trade regimes,[15] even though suppliers represent roughly three-quarters of the emissions associated with products in the U.S.[16]

Domestic suppliers are not likely to be a major source of leakage because most emissions from domestic U.S. suppliers that fall below the 25,000 ton threshold are likely to be captured by the "upstream" provisions of government reporting and cap-and-trade systems.[17] These upstream provisions will require reporting and allowance-holding by all major fossil fuel suppliers, thereby capturing within the regulatory regime a substantial share of the

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[13] *See* American Clean Energy and Security Act of 2009 [hereinafter American Clean Energy and Security Act or Waxman-Markey bill], H.R. 2454, 111th Cong. § 713(a) (as passed by House of Representatives, June 26, 2009) (adopting reporting threshold of 25,000 metric tons of CO_2eq annually); *see also* America's Climate Security Act of 2007 [hereinafter America's Climate Security Act or Leiberman-Warner bill], S. 2191, 110th Cong. § 4(7) (2008) (providing reporting requirements for "covered facilities," including industrial facilities that emit more than 10,000 metric tons of CO_2eq annually). CO_2eq includes all six major greenhouse gases, using CO_2 as a common measure of global warming potential. We discuss the Lieberman-Warner bill in this article, but we note that the most recent Senate legislation includes other provisions that differ in some details on the central issues discussed in this article. *See, e.g.*, Clean Jobs and American Power Act, S.1733, 111th Cong. § 700(13) (2009) (adopting a threshold of 25,000 metric tons of CO_2eq). For a discussion of how the empirical basis for the 25,000 metric ton boundary was determined, see *infra* note 18 and accompanying text.

[14] *See* American Clean Energy and Security Act, H.R. 2454, 111th Cong. § 274 (commissioning EPA to study the feasibility of a "national program for measuring, reporting, publicly disclosing, and labeling products or materials sold in the United States for their carbon content . . .").

[15] *See infra* notes 146–160 and accompanying text.

[16] H. Scott Matthews et al., *The Importance of Carbon Footprint Estimation Boundaries*, 42 ENVTL. SCI. & TECH. 5839, 5840 (2008) (indicating that boundaries most commonly employed in calculating carbon emissions in reporting schemes leave up to 74 percent of carbon emissions out).

[17] *See infra* notes 90–166 and accompanying text. For a discussion of upstream and downstream cap-and-trade programs, see STAFF OF H. COMM. ON ENERGY AND COMMERCE, CLIMATE CHANGE LEGISLATION DESIGN WHITE PAPER: SCOPE OF A CAP-AND-TRADE PROGRAM 9 & n.7 (2007), *available at* http://archives.energycommerce.house.gov/Climate_Change/White_Paper.100307.pdf.

emissions from domestic suppliers.[18] Emissions from offshore suppliers, however, will not be accounted for unless the supplier is located in a country with an adequate cap-and-trade scheme or is subject to emissions allowance requirements for imported goods.[19] Thus, in the case of global climate change, firms can create leakage through offshoring production to firm facilities abroad or third-party supply-chain contractors. Shifting carbon-intensive production to developing countries will not only cause leakage, it will reinforce developing country incentives to resist carbon reduction targets.

We argue that social license pressure facilitated by public and private carbon disclosure standards can affect whether a firm's offshore suppliers are more than just a source of leakage. If the prescriptive norms of customers and others add a carbon constraint to a firm's social license to operate, and if the constraint applies to emissions from suppliers without regard to the legal corporate boundary or the location of the manufacturing facility, then emissions reduction incentives can extend to offshore suppliers.[20] A firm can respond to these pressures by imposing new conditions on suppliers through the terms of its supply chain contracts or by only contracting with parties that meet certain conditions. The firm then functions as the private regulator of its supply chain, imposing requirements on suppliers that are typically the concern of governments, not private firms.[21]

Wal-Mart serves as a leading example. In the face of strong social license and other pressures in the U.S., it has imposed energy efficiency and other requirements on its eighteen billion

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[18] *See, e.g.*, EPA, PROPOSED MANDATORY GHG REPORTING RULE: OVERVIEW 12 (2009) (noting that 54.9 percent of emissions will be covered by downstream reporting provisions with a 25,000 metric ton threshold, and another 30–35 percent will be covered by the upstream provisions).

[19] *See infra* notes 90–166 and accompanying text.

[20] Our analysis raises questions about the effects of social license pressure on the firm's make-or-buy decision, but these questions are beyond the scope of this article. *See infra* note 70 and accompanying text.

[21] *See* Graeme Auld et al., *The New Corporate Social Responsibility*, 33 ANN. REV. ENV'T & RES. 413, 424 (2008) (noting that non-state, market-driven systems create incentives for private firms to create global public goods); David Vogel, *Private Global Business Regulation*, 11 ANN. REV. POL. SCI. 261, 264 (2008) (referring to "civil regulations"); John Gerard Ruggie, *Reconstituting the Global Public Domain – Issues, Actors, and Practices*, 12 EUR. J. INT'L RELATIONS 499, 500 (2004) (noting the new "institutionalized arena concerned with the production of global public goods").

dollars per year, 10,000 member supply chain in China.[22] According to one recent report, roughly 20 percent of all Chinese factories are in the supply chain for Wal-Mart's suppliers.[23] Through its huge grocery subsidiary in Brazil, Wal-Mart also recently imposed deforestation restrictions on its beef suppliers.[24] In addition, in response to a Greenpeace report on deforestation practices by the cattle industry, Wal-Mart, McDonald's, and companies in the shoe business including Nike, Timberland, and Adidas recently exerted supply chain pressure on suppliers of beef and leather, inducing the major cattle ranching operations in Brazil to commit not to purchase cattle from recently deforested areas of the Amazon.[25] Although questions exist about the enforcement of these commitments, they have the potential to reduce Chinese and Brazilian carbon emissions as much as or more than many public governance measures available to the U.S. or EU.

The choices available to policymakers in the absence of a global Leviathan thus are not simply various forms of beneficiary pays instruments.[26] If we switch the perspective from the interactions among national governments to the ways public and private actors can harness social norms and private bargaining, new options become apparent. To harness the social license-driven, supply chain contracting opportunities, we argue that the reporting provisions of public and private governance schemes should include supply chains within corporate carbon footprint reporting boundaries. We also argue that these schemes should include product carbon labeling requirements.[27] These disclosure measures will facilitate the development of a clear and broad carbon constraint in the social license to operate, and provide the

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[22] *See* Michael P. Vandenbergh, *Climate Change: The China Problem*, 81 S. CAL. L. REV. 905, 940 (2008).

[23] *See* Daniel Goleman, *Green Intelligence: Toward True Ecological Transparency*, YALE ENV'T 360, Sept. 15, 2009, http://www.e360.yale.edu/content/print.msp?id=2190.

[24] *See* Michael Kepp, *Wal-Mart Brasil Signs Sustainability Pact with Suppliers to Ensure 'Greener' Products*, BNA INT'L ENV'T DAILY, July 6, 2009, at 1.

[25] *See* Alexei Barrionuevo, *Giants in Cattle Industry Agree to Help Fight Deforestation*, N.Y. TIMES, Oct. 7, 2009, at A7 (noting that deforestation accounts for 20 percent of global GHG emissions).

[26] *See, e.g.*, Wiener, *supra* note 6, at 752–53 (arguing that beneficiary pays instruments may be a viable option when polluter pays instruments are unavailable because of the absence of a global regulatory body).

[27] *See infra* notes 200–205 and accompanying text.

information necessary to facilitate private monitoring and enforcement. The resulting social pressure can generate new firm incentives to reduce supply chain emissions, which in turn can change the incentives of firms in developing countries. These firms will then have incentives to influence the policies, investments, and negotiating positions of their national governments. Over time, these market pressures will reduce leakage and increase developing country incentives to join in and comply with a global climate agreement. Market pressures alone cannot be expected to shift national incentives, but they can have an important influence. If the views of many climate scientists and energy experts are on target, it is time to try many different policy instruments, knowing that a collection of successful instruments will be necessary to reduce the risk of catastrophic climate change.[28]

In addition, carbon disclosure strategies can be adopted more easily than many other options. They address concerns about major developing country emissions in a way that is far less intrusive than many other options and thus is likely to provoke less political resistance.[29] They can be appealing across the political spectrum because they address the need for developed and developing countries to reduce emissions. By relying on consumer preferences and private market pressure, disclosure strategies also may be less likely to trigger sovereignty objections in developing countries than national regulatory and nation-to-nation diplomatic efforts. The pressure for emissions reductions will arise from numerous acts by private parties in response to public and private disclosure requirements, not by demands for emissions reductions from national governments.

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[28] *See, e.g.*, Nathan S. Lewis, Professor, Cal. Inst. of Tech., Address on Chemical Challenges in Renewable Energy, *transcript available at* http://nsl.caltech.edu/files/energy_notes.pdf (discussing the need for multiple approaches to generation of low-carbon energy).

[29] In fact, supply chain and product-based carbon disclosure schemes are already beginning to take hold in the private sector, often with explicit government cooperation and encouragement. *See infra* notes 195–210 and accompanying text. In addition, the Waxman-Markey bill includes a provision to require EPA to study product carbon labeling. *See* American Clean Energy and Security Act, H.R. 2454, 111th Cong. § 274 (proposing a new "Product Carbon Disclosure Program"). If applied equally to domestic and foreign firms and goods, information disclosure requirements may be more likely to survive trade challenges than alternatives such as border adjustments. *See infra* notes 54–57 and accompanying text.

Using information disclosure to drive supply-chain contracting pressure may also re-frame one of the most difficult barriers between the developing and developed countries: developing countries assert that they are entitled to emit as much carbon on their path to economic development as the developed countries have over theirs.[30] Although it is hard to argue that developing countries should not be able to act as developed countries have, the developing countries' projected emissions path alone will lead to a substantial risk of catastrophic climate change. The disclosure approach reframes the entitlement question from whether developing countries are entitled to emit as developed countries have to whether they are entitled to economic growth through the production of goods that developed world consumers may not want to buy when they have adequate carbon information.[31] By focusing on the normative aspects of consumption, this approach also may induce consumers in developed countries to form and act upon carbon constraints in their implicit entitlement to consume—an outcome consistent with the Coasian notion of placing entitlements on polluters or neighbors. Consumers might assume some of the carbon emissions mitigation burden in the form of higher prices, reduced selection, different product attributes, or different household behaviors.[32]

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[30] *See, e.g.*, Michael Wines, *China Sees Progress on Climate Accord, but Resists an Emissions Ceiling*, N.Y. TIMES, Aug. 8, 2009, at A10 (noting that China's envoy to the global climate negotiations opposed absolute emissions limits and stated that "[t]he cumulative emissions by the developed countries have caused global warming. Who should take the historical responsibilities?").

[31] Rather than simply shifting burdens from developed to developing countries, the measures we propose are a means to turn the climate change governance focus from industrial emissions to consumption. *See, e.g.*, Hope M. Babcock, *Assuming Personal Responsibility for Improving the Environment: Moving Toward a New Environmental Norm*, 33 HARV. ENVTL. L. REV. 117, 118, 142–52 (2009) (discussing alternate means of changing people's norms in order to reduce their environmental impact); Douglas A. Kysar, *Preferences for Processes: The Process/Product Distinction and the Regulation of Consumer Choice*, 118 HARV. L. REV. 525, 529 (2004) (arguing that consumers' process preferences can have a significant role to play in policy decisions). For an article accounting for consumption in allocating emissions reductions, see Shoibal Chakravarty et al., *Sharing Global CO2 Emissions Reductions Among One Billion High Emitters*, 106 PROC. NAT'L ACAD. SCI. 11,884, 11,885 (July 21, 2009).

[32] *See, e.g.*, Thomas Dietz et al., *Household Actions Can Provide a Behavioral Wedge to Rapidly Reduce U.S. Carbon Emissions*, 106 PROC. NAT. ACAD. SCI. 18,452, 18,452 (Nov. 3, 2009) (drawing on empirical studies to

Part I explores the core components of the global climate governance puzzle and the need to account for the effects of social license pressure and supply chain contracting. Part II examines the emerging public and private governance regimes, exploring how they have defined the targets of carbon emissions regulations (the legal boundary) and the magnitude of the emissions that will be missed by the legal boundary (the physical boundary). Part III examines the effects of these narrow boundaries on national incentives and leakage. Part IV proposes two carbon reporting measures and examines how these measures may affect social license pressure, firm supply chains, and the incentives of the major developing countries. We conclude that a broader carbon reporting boundary is a viable approach that can help resolve the climate change governance puzzle.

I. INFLUENCES ON NATIONAL AND FIRM BEHAVIOR

A. *The Global Climate Change Governance Puzzle*

Although our focus is on creating incentives for developing countries to reduce emissions, we begin this section with a brief review of our assumptions that substantial carbon emissions reductions are required from the major developing countries, that these countries lack the incentive to reduce emissions, and that other nations lack the ability to force them to do so using existing policy instruments.

First, substantial emissions reductions are necessary from major developing countries. Recent emissions from China and other major developing countries are helping drive annual global carbon emissions to levels that exceed even the high-end scenario of the Intergovernmental Panel on Climate Change (IPCC).[33]

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demonstrate that over 7 percent of U.S. carbon emissions can be reduced through prompt, non-regulatory behavioral and social measures). We focus on the major developing countries, but we do so only to bring clarity to one critical part of the climate problem, not to suggest that large reductions from developed countries are not needed. In fact, large reductions from developed countries are needed to account for past and present emissions. *See* Stephen Pacala & Robert Socolow, *Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies*, 305 SCI. 968, 968–69 (Aug. 13, 2004). The private market pressures we seek to encourage in developing countries will have similar effects on developed countries, creating incentives to adopt carbon targets and to comply with the targets after the commitments are made.

[33] INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE WORKING GROUP II,

Global business-as-usual (BAU) emissions (the projected emissions in the absence of carbon reduction measures) are projected to double over the next fifty years.[34] Eighty percent of the growth in global emissions is projected to occur from the major developing countries.[35] Yet total global emissions must decline by 50 percent or more from 1990 levels during that period to achieve atmospheric carbon concentrations of roughly 450 to 500 parts per million (ppm) CO_2eq,[36] which should result in temperature stabilization of roughly 2 degrees Celsius.[37] Atmospheric concentrations are roughly 430 ppm CO_2eq now and are going up by roughly two ppm per year.[38]

Even with an emissions decline of 50 percent and atmospheric concentrations in the 450 to 500 ppm CO_2eq range, there is a small but significant likelihood—perhaps in the low single-digits—of temperature increases far higher than 2 degrees Celsius.[39] Although this may appear to be a low likelihood in the abstract, it represents a magnitude of risk to the planet that few of us would be willing to accept when driving a car or boarding a plane. Table 1 identifies the uncomfortably high likelihood of substantial

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CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY 79–131 (2007); JANE A. LEGGETT ET AL., CONG. RESEARCH SERV., CHINA'S GREENHOUSE GAS EMISSIONS AND MITIGATION POLICIES 5–8 (2008), *available at* http://fas.org/sgp/crs/row/RL34659.pdf.

[34] *See* Pacala & Socolow, *supra* note 32, at 968–69.

[35] *See* Vandenbergh, *supra* note 22, at 915 (citing FLORIAN BRESSAND ET AL., MCKINSEY GLOBAL INSTITUTE, CURBING GLOBAL ENERGY DEMAND GROWTH: THE ENERGY PRODUCTIVITY OPPORTUNITY 24 (2007)). *See generally*, Nicholas Stern, *The Economics of Climate Change*, 98 AM. ECON. REV. 1, 22, 28–9, 32 (2008) (discussing global carbon emissions).

[36] Many actors have converged on a target stabilization temperature of 2 degrees Celsius, which corresponds to an atmospheric concentration in the range of roughly 450 to 500 ppm CO_2eq. *See* Vandenbergh et al., *supra* note 2, at 317 n.66.

[37] Stern, *supra* note 35, at 5 tbl.1; *see also* G8 + 5 ACADEMIES' JOINT STATEMENT: CLIMATE CHANGE AND THE TRANSFORMATION OF ENERGY TECHNOLOGIES FOR A LOW CARBON FUTURE 2 (2009), *available at* http://www.nationalacademies.org/includes/G8+5energy-climate09.pdf (calling for a 50 percent reduction in greenhouse gas emissions from 1990 levels by 2050).

[38] Robert Ball, *Climate Change and Sustainable Futures*, 22 SYSTEMIC PRAC. & ACTION RES. 139, 139 (2009) (noting that atmospheric concentrations are at 430 CO2-eq and are rising by 2.3 ppm each year).

[39] *See* Stern, *supra* note 35, at 5 tbl. 1 (estimating a low single-digit percent probability of a 4–5 degree increase at 450 ppm and of a 5–6 degree increase at 500 ppm).

temperature increases even at 450 or 500 ppm CO_2eq.

TABLE 1: PERCENT LIKELIHOOD OF EXCEEDING A TEMPERATURE INCREASE AT EQUILIBRIUM[40]

Stablization Level (ppm of CO_2e)	**2º**	**3º**	**4º**	**5º**	**6º**	**7º**
450	78	18	3	1	0	0
500	96	44	11	3	1	0
550 (doubling)	99	69	24	7	2	1
650	100	94	58	24	9	4
750	100	99	82	47	22	9

As a point of reference, paleoclimate studies suggest that temperatures have not been 3 degrees Celsius higher than 1900 levels for millions of years (they are 0.8 degrees Celsius higher today), and at that time sea levels were twenty to thirty meters higher, and there were crocodiles in Greenland.[41]

Current per-capita CO_2eq emissions are roughly twenty tons per year in the U.S., ten tons per year in Europe and Japan, five tons in China, and two tons in India.[42] To achieve a target

[40] *Id.*; *see also* John P. Holdren, Professor of Environmental Policy and Professor of Earth and Planetary Sciences, Harvard University, John H. Chafee Memorial Lecture on Science and the Environment at National Conference on Science, Policy and the Environment (Jan. 17, 2008), *transcript available at* http://www.ncseonline.org/Conference/Chafee08final.pdf (noting that "[t]he chance of crossing a tipping point into truly catastrophic climatic change appears to grow rapidly . . . for increases in the average surface temperature of more than about 2 degrees C above the 1900 level").

[41] *See* HOLDREN, *supra* note 40 (noting that temperatures were 3 degrees Celsius higher thirty million years ago). The mid-Pliocene (roughly three million years ago) also may have had temperatures roughly 3 degrees Celsius higher than 1900 levels, with atmospheric concentrations at roughly 360 to 400 ppm CO_2 (not CO_2eq), and sea levels roughly twenty-five meters higher than today. *See* Jane E. Francis & Robert S. Hill, *Fossil Plants from the Pliocene Sirius Group, Transantarctic Mountains: Evidence for Climate from Growth Rings and Fossil Leaves*, 11 PALAIOS 389, 389 (1996); Alan Haywood & Mark Williams, *The Climate of the Future: Clues From Three Million Years Ago*, 21 GEOLOGY TODAY 138, 139 (2005); Alan M. Haywood & Paul J. Valdes, *Modelling Pliocene Warmth: Contribution of Atmosphere, Oceans and Cryosphere*, 218 EARTH & PLANETARY SCI. LETTERS 363, 375 (2004); *see also* Alan M. Haywood et al., *Pliocene Climate, Processes, and Problems*, 367 PHIL. TRANSACTIONS ROYAL SOC'Y A 3, 5 (2009).

[42] *See* World Resources Institute, Climate Analysis Indicators Tool (CAIT), http://cait.wri.org/cait.php?page=yearly&mode=View (last visited March 27,

atmospheric carbon concentration of 500 ppm CO_2eq, the developed and developing worlds cannot simply converge on a per-capita carbon emissions figure somewhere between the existing levels of the U.S. and China. Instead, global per capita emissions in 2050 must be roughly equal to India's per capita emissions, which are less than half of recent Chinese emissions and one-tenth of U.S. per capita emissions.[43] This must occur despite the fact that per capita and total emissions in the major developing countries are going up, not down.[44] In fact, China's current and projected BAU emissions are so large that even if all other countries eliminate emissions entirely, China may push atmospheric levels past consensus target levels.[45]

Second, the major developing countries lack incentives to commit to and comply with an agreement that requires substantial emissions reductions as compared to BAU levels. A full understanding of developing country incentives is beyond the scope of this article, but recent reviews have suggested that although climate change will cause major harms in the long-term, near-term poverty alleviation and economic growth considerations are likely to dominate.[46] In addition, the perceived incentives of the major developing countries may be more important than actual incentives. Recent resistance to hard targets in a post-Kyoto agreement and rapidly increasing emissions growth suggest that

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2010) (providing data for 2005 per capita CO_2eq emissions).

[43] *See* Sunstein, *supra* note 3, at 1687–88; Stern, *supra* note 35, at 5; Vandenbergh, *supra* note 22, at 916. In addition, emissions reductions should begin in the next decade if the maximum global concentration is to be held below roughly 550 ppm CO_2. Naomi E. Vaughan et al., *Climate Change Mitigation: Trade-Offs Between Delay and Strength of Action Required*, 96 CLIMATIC CHANGE 29, 29 (2009) (noting that "if it takes 50 years to transform the energy sector and the maximum rate at which emissions can be reduced is -2.5% year, delaying action until 2020 would lead to stabilization at 540 ppm. A further 20 year delay would result in a stabilization level of 730 ppm.").

[44] Recent post-Kyoto negotiations with China have focused on slowing rates of growth, not net reductions. *See generally* Leora Falk, *Climate Change*: *United States, China Sign Memorandum Pledging Cooperation on Climate, Energy*, BNA INT'L ENV'T DAILY, July 29, 2009.

[45] Vandenbergh, *supra* note 22, at 908.

[46] WORLD BANK, WORLD DEVELOPMENT REPORT 2010: DEVELOPMENT AND CLIMATE CHANGE 1 (2009), *available at* http://www.worldbank.org/wdr. *See generally* Cass R. Sunstein, *Of Montreal and Kyoto: A Tale of Two Protocols*, 31 HARV. ENVTL. L. REV. 1, 64–65 (2007) (discussing the role that cost-benefit analysis plays when countries are determining their involvement in international accords).

the major developing countries perceive the benefits of carbon-intensive economic growth to outweigh the costs of emissions reductions. For example, China has strong incentives to achieve economic growth through carbon-intensive manufacturing, and although it has taken a number of steps to reduce the carbon intensity of its economy, it has unambiguously stated that economic considerations are more important than emissions reductions.[47] Its emissions path is consistent with its public statements: its aggregate national emissions increased 8 percent in 2007 alone.[48]

Third, even if the developed nations are able to make substantial reductions in their own emissions, they lack the ability to force the developing nations to adopt and comply with adequate carbon emissions targets. Thus far no combination of lenient emissions allocations and extended deadlines has been sufficient to induce the major developing nations to sign onto a post-Kyoto agreement.[49] Scholars have suggested three principal extra-

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[47] *See generally* Dean Scott, *Climate Change: China's Priority Remains Economic Growth, Not Curbing Emissions, Ambassador Says*, BNA INT'L ENV'T DAILY, Feb. 6, 2009. For a discussion of carbon intensity reduction efforts, see, for example, Tony Blair, *China Leads the Pack in the Race to Go Green – Report*, GLOBE-NET, Aug. 31, 2009, http://www.wbcsd.org/plugins/DocSearch/details.asp?type=DocDet&ObjectId=MzU1MjE (last visited Mar. 29, 2010) (noting that China is taking advantage of the green technology revolution).

[48] *See* Elisabeth Rosenthal, *Booming China Leads the World in Emissions of Carbon Dioxide, a Study Finds*, N.Y. TIMES, June 14, 2008, at A5. For discussions of China's incentives, see Sunstein, *supra* note 3, at 1675; David G. Victor, *Climate Accession Deals: New Strategies for Taming Growth of Greenhouse Gases in Developing Countries* 13 (Harvard Project on International Climate Agreements, Discussion Paper 08-18, 2008), *available at* http://belfercenter.ksg.harvard.edu/publication/18735/climate_accession_deals.html; Jonathan B. Wiener, *Climate Change Policy and Policy Change in China*, 55 UCLA L. REV. 1805 (2008) [hereinafter Wiener, *Climate Change Policy*]; Jonathan B. Wiener, *Radiative Forcing: Climate Policy to Break the Logjam in Environmental Law*, 17 N.Y.U. ENVTL. L.J. 210, 239 (2008) [hereinafter Wiener, *Radiative Forcing*]. China passed the United States as the leader in annual emissions by 2008, but the US is still the largest source of existing atmospheric carbon stocks. At current emissions growth rates, China will pass the United States in atmospheric stocks within several decades. *See* Sunstein, *supra* note 3, at 1689.

[49] *See* Joseph E. Aldy & Robert N. Stavins, *Designing the Post-Kyoto Climate Regime: Lessons from the Harvard Project on International Climate Agreements* 12 (Harvard Project on International Climate Agreements, Unpublished Interim Report, 2008), *available at* http://belfercenter.ksg.harvard.edu/files/Interim%20Report%20081203%20Akiko%20v6.pdf (proposing delayed compliance deadlines and caps that enable emissions

agreement approaches to increase pressure on China and other developing nations: subsidies, international trade sanctions or border adjustments, and moral suasion.[50] These measures are likely to be necessary but not sufficient. Climate-related subsidies in the form of technology transfers or adaptation funds have been widely discussed, but they have been a drop in the bucket so far, and the prospects seem dim that they will be provided on the massive scale necessary to tip the balance of incentives for these countries.[51] For example, China has suggested that richer nations should contribute 1 percent of their gross domestic product to assist developing nations, an amount far larger than the amounts offered by developed countries and one that would come on top of the amounts the richer nations will be spending to reduce their own emissions.[52] Subsidies for high-priority issues not directly linked to climate change, whether disease prevention, infrastructure, or other project funding, could be an important inducement, but given the history of foreign aid there is little reason to believe that they will be provided at the scale necessary to shift developing country incentives regarding carbon emissions reductions.[53]

Measures that impose trade sanctions or carbon allowance

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growth).

[50] *See generally* SCOTT BARRETT, ENVIRONMENT AND STATECRAFT: THE STRATEGY OF ENVIRONMENTAL TREATY-MAKING (Oxford Univ. Press 2005) [hereinafter BARRETT, ENVIRONMENT AND STATECRAFT]; RICHARD B. STEWART & JONATHAN B. WIENER, RECONSTRUCTING CLIMATE POLICY BEYOND KYOTO (2003); Victor, *supra* note 48, at 13–15 (proposing the use of climate accession deals to build on the internal incentives and development plans of China and other developing countries). Developing country participation may take the form of multiple bilateral or multilateral agreements rather than a single agreement. *See* Scott Barrett, *A Portfolio System of Climate Treaties* 2–3 (Harvard Project on International Climate Agreements, Discussion Paper 08-13, 2008), *available at* http://belfercenter.ksg.harvard.edu/files/BarrettWeb4.pdf [hereinafter Barrett, *Portfolio System*].

[51] *See* Victor, *supra* note 48, at 12 (noting that "[t]he size and political visibility of external assistance is a severe constraint because most governments that would provide resources are not able to mobilize large amounts of on-budget expenditure that is transferred to their most fierce economic competitors").

[52] *See* Tini Tran, *China: Richer States Should Lead on Climate Chang*e, ASSOCIATED PRESS, Oct. 29, 2008, *available at* http://www.usatoday.com/news/world/2008-10-28-2523529892_x.htm. In contrast, a recent proposal by British Prime Minister Gordon Brown suggested $100 billion from rich nations "to help poor nations with the changing climate." Roger Harrabin, *Climate Deal in Peril, Says Brown*, BBC NEWS ONLINE, Sept. 21, 2009, http://news.bbc.co.uk/2/hi/uk_news/8265974.stm.

[53] *See generally* Posner & Sunstein, *supra* note 5.

requirements on imports from countries that have inadequate emissions limits may have the best prospects for shifting developing country incentives.[54] Border allowance provisions, which require foreign manufacturers to purchase emissions permits for products that enter the domestic market from countries without adequate carbon emissions limits, have been proposed as part of cap-and-trade programs in the U.S. and in Europe.[55] At this point, however, the adoption and implementation of these measures in the near term, at least in the U.S., seems unlikely given concerns about triggering a trade war and the delays involved in resolving the inevitable trade disputes.[56] Even President Obama, who has expressed support for strong climate measures, objected to the border allowance provisions in an otherwise favorable comment on recent cap-and-trade legislation.[57]

Moral suasion also may have substantial influence, and movement by the U.S. and EU may increase the pressure on the major developing countries.[58] If the recent statements from China and India are any indication, however, appeals to morality are unlikely to induce commitments to reductions from BAU emissions levels.[59] In addition, the major developing countries

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[54] *See* Barrett, *Portfolio System*, *supra* note 50, at 5–6 (discussing prospects for trade restrictions).

[55] *See* American Clean Energy and Security Act, H.R. 2454, 111th Cong. § 768 (2009); Climate Security Act, S. 2191, 110th Cong. § 6006 (2008) The specific provisions vary, but in general they reduce incentives for leakage and seek to level the playing field for domestic industries by requiring the importer of a good to obtain carbon allowances before importing from a country that lacks an adequate emissions program.

[56] *See* Vandenbergh, *supra* note 22, at 933–34; Wiener, *Radiative Forcing*, *supra* note 48, at 242–43.

[57] *See* John M. Broder, *Obama Opposes Trade Sanctions in Climate Bill*, N.Y. TIMES, June 29, 2009, at A1.

[58] *See* Sunstein, *supra* note 3, at 1696. For a recent analysis combining cap-and-trade and moral suasion measures, see Ian Ayers & Douglas Kysar, *Adam Smith Meets Climate Change: How the Theory of Moral Sentiments Could Be Applied to Cap-and-Trade Greenhouse-Gas Emissions*, SLATE, Sept. 27, 2008, http://www.slate.com/id/2200911/index.html.

[59] *See* BARRETT, ENVIRONMENT AND STATECRAFT, *supra* note 50, at 16–18; Posner & Sunstein, *supra* note 5, at 1592 & n.123; Wiener, *Climate Change Policy*, *supra* note 48, at 1810–11. Only in April 2009 did a senior member of China's climate change negotiating team allude that the government is considering emission targets for 2011. *See* Jonathan Watts, *China Considers Setting Targets on Carbon Emissions*, GUARDIAN, Apr. 20, 2009, at 14, *available at* http://www.guardian.co.uk/world/2009/apr/19/china-environment-kyoto. More recent positions have reflected continued opposition to hard targets. *See*

have argued that the moral burden lies with the developed countries based on their contribution to current atmospheric carbon stocks as compared to the developing countries' contribution to recent flows.[60]

B. *Of Coase and Private Governance*

Our approach to resolving the global climate governance puzzle reflects the dynamic interactions between public and private governance regimes and the responses of private parties to those regimes. For a generation, law and economics scholars have noted that regulated entities bargain around the law. Law students often learn the lesson from what Coase describes as "the standard example," which includes "a factory the smoke from which has harmful effects on those occupying neighboring properties."[61] Subsequent texts have drawn from this example to explore the allocation of entitlements to cause or to be free from pollution,[62] and a vast literature has explored the implications of this idea for property and liability rules.[63]

Coase's work also has been the inspiration for the development of the cap-and-trade schemes that are now the principal carbon regulatory instruments at the domestic and international levels.[64] A cap-and-trade scheme creates clearly

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Baker, *supra* note 4, at A1.

[60] *See* Baker, *supra* note 4, at A1; Landler, *supra* note 4, at A1; *see also* Joshua Chaffin & Jamil Anderlini, *Barroso Presses China on Green Issues*, FIN. TIMES, May 21, 2009, at 7; Thomas L. Friedman, *Can I Clean Your Clock?*, N.Y. TIMES, July 5, 2009, at A12 (noting comments regarding China's right to emit as much as developed countries did in the past).

[61] *See* Coase, *supra* note 7, at 1–2.

[62] *See, e.g.*, A. MITCHELL POLINSKY, AN INTRODUCTION TO LAW AND ECONOMICS 13–16 (Aspen Publishers 3d ed. 2003) (using factory example); RICHARD L. REVESZ, FOUNDATIONS OF ENVIRONMENTAL LAW AND POLICY 7–17 (1997) (same).

[63] *See generally* Calabresi & Melamed, *supra* note 9; Louis Kaplow & Steven Shavell, *Property Rules Versus Liability Rules: An Economic Analysis*, 109 HARV. L. REV. 713 (1996); James E. Krier & Stewart J. Schwab, *Property Rules and Liability Rules:* The Cathedral *in Another Light*, 70 N.Y.U. L. REV. 440, 447–64 (1995); Carol M. Rose, *The Shadow of* The Cathedral, 106 YALE L.J. 2175 (1997); Henry E. Smith, *Property and Property Rules*, 79 N.Y.U. L. REV. 1719 (2004); Stewart E. Sterk, *Property Rules, Liability Rules, and Uncertainty About Property Rights*, 106 MICH. L. REV. 1285 (2008).

[64] *See* Wiener, *supra* note 6, at 776–77 (noting Coasian origins of cap-and-trade schemes). *See generally* Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law*, 37 STAN. L. REV. 1333 (1985) (proposing domestic cap-and-trade scheme).

defined entitlements to pollute (measured in tons of emissions) and a low-transaction cost setting in which those entitlements can be traded. A global cap-and-trade scheme requires that the leading emitting countries commit to and comply with the emissions caps, however, and as we have seen, the major developing countries appear to lack the incentive to do so. Nevertheless, the recognition that parties bargain in the shadow of the law, if updated to reflect the complexities of carbon emissions and the modern influences on firm behavior, can help identify new policy levers. To identify these instruments, we re-examine the two implicit simplifying assumptions in the Coasian example identified at the outset.

1. *Responses to Emissions Reduction Pressures*

The first simplifying assumption is that the polluting firm's choice in response to emissions reduction pressures is between reducing emissions and bargaining with the affected residents over reductions or compensation. In a typical Coasian bargain, the legal entitlements are specified so that those who are affected by pollution may negotiate with the polluter, with one party paying the other to achieve an efficient outcome.[65] The implicit assumption is that the pollution affects only the neighbors who are engaged in the bargain with the polluter. Social welfare is initially defined within the boundaries of that narrow set of actors.

Studies have identified a number of ways in which the polluting firm's choice is not limited to reducing emissions or bargaining with the neighbors affected by its pollution, however, but also can include contracting out or reorganizing production in response to legal requirements.[66] Presumably, if a polluter wants to avoid the cost of bargaining by moving to another location, it will have to bargain with any nearby residents in its newly proposed location. This approach might be efficient in the context of traditional pollution with effects that only occur within narrow geographic boundaries, assuming that adequate incentives exist in the new location (although it will inevitably raise equity

[65] *See* Coase, *supra* note 7, at 2–8.

[66] *See* Vandenbergh, *supra* note 10, at 2061 (noting example of toxics reporting under the Massachusetts Toxic Use Reduction Act). *See generally* Jonathan Remy Nash & Richard L. Revesz, *Grandfathering and Environmental Regulation: The Law and Economics of New Source Review*, 101 NW. U. L. REV. 1677 (2007) (examining effects of public environmental regulations on private investments in new facilities).

concerns—something that is beyond the Coasian model) and shifting carbon emissions does not reduce their effects. Carbon emissions have essentially the same climate-forcing impact whether they are released in Topeka or Beijing. Thus, even if local residents bargain with a polluter and obtain a commitment to reduce carbon emissions, the firm can move those emissions to another jurisdiction through offshore suppliers, and the benefit of the bargain to the residents in the first location is lost as they still must suffer the consequences of climate change.[67] This is the leakage problem that has become a significant obstacle to adopting carbon emission reduction plans.[68] We are not the first to note that firms externalize harms through offshoring and outsourcing,[69] but the analysis suggests that incentives created by the current and proposed climate governance measures have received insufficient attention.[70]

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[67] This can occur through offshoring production to other firm facilities or to third-party supply chain contractors. We focus on the offshoring in this article, although much of the analysis is equally applicable to firm-owned facilities. *See infra* note 69 and accompanying text.

[68] *See* Stavins, *supra note* 8, at 311.

[69] *See, e.g.*, Smita B. Brunnermeier & Arik Levinson, *Examining the Evidence on Environmental Regulations and Industry Locations*, 13 J. ENV'T & DEV. 6, 36 (2004) (discussing offshoring due to environmental costs); Beverley Earle et al., *A Finger in the Dike? An Examination of the Efficacy of State and Federal Attempts to Use Law to Stem Outsourcing*, 28 NW. J. INT'L L. & BUS. 89, 91–93 (2007) (discussing offshoring to avoid health care costs).

[70] In the current regulatory environment, a firm's decision to avoid the costs of carbon emissions reporting and controls may be more likely to be affected by the location of production than whether the production occurs within or outside the legal boundary of the firm, but this analysis raises interesting issues regarding the make-or-buy decision that are beyond the scope of this article. *See generally, e.g.*, FRANK H. EASTERBROOK & DANIEL R. FISCHEL, THE ECONOMIC STRUCTURE OF CORPORATE LAW (1991); Henry Hansmann & Reinier Kraakman, *What is Corporate Law?*, *in* THE ANATOMY OF CORPORATE LAW: A COMPARATIVE AND FUNCTIONAL APPROACH 1 (Reinier Kraakman et al. eds., 2004); Armen A. Alchian & Harold Demsetz, *Production, Information Costs, and Economic Organization*, 62 AM. ECON. REV. 777 (1972); Margaret M. Blair & Lynn A. Stout, *A Team Production Theory of Corporate Law*, 85 VA. L. REV. 247 (1999); Oliver Hart & John Moore, *Property Rights and the Nature of the Firm*, 98 J. POL. ECON. 1119 (1990); Oliver E. Williamson, *Public and Private Bureaucracies: A Transaction Cost Economics Perspective*, 15 J.L. ECON. & ORG. 306 (1999); Carliss Y. Baldwin & Kim B. Clark, *The Fundamental Theorem of Design Economics* (Harvard NOM, Working Paper No. 02-12, 2002), *available at* http://ssrn.com/abstract=312419.

2. *Sources of Pressure for Emissions Reductions*

The second simplifying assumption in the Coasian example is that formal legal requirements, whether common law or regulatory in origin, are the primary source of the emissions reduction pressure that stimulates bargaining. In a Coasian scenario, establishment of clear entitlements is key to efficient allocation of resources because it facilitates bargaining by establishing a clear starting point for negotiation.[71] Scholars have demonstrated that bargaining not only occurs between a polluter and a neighbor or government actor based on a fixed common law or regulatory standard, but also occurs between public and private entities over the shape and enforcement of the legal entitlement.[72] For example, firms and regulatory bodies routinely bargain over the terms in air and water discharge permits.[73]

In addition, scholarship in law, economics, and other fields over the last several decades has explored the importance of bargaining over the scope of implicit entitlements that are shaped by informal norms. An extensive literature has demonstrated the importance of norms in situations ranging from interactions among ranchers and farmers over stray cattle[74] to lobster harvesting and other common pool resource problems.[75] This research has focused in large part on small group settings,[76] but it has identified

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[71] *See* Coase, *supra* note 7, at 8 ("It is necessary to know [the allocation of legal entitlements] since without the establishment of this initial delimitation of rights there can be no market transactions to transfer and recombine them.").

[72] Freeman, *supra* note 10, at 551–56. This bargaining between the regulator and the regulated firm generates public-private hybrid requirements and enforcing entities. Bargaining also occurs in the provision of traditionally public services by private providers. *See* Jody Freeman, *The Contracting State*, 28 FLA. ST. U. L. REV. 155, 164–69 (2000). *See generally* GOVERNMENT BY CONTRACT: OUTSOURCING AND AMERICAN DEMOCRACY (Jody Freeman & Martha Minow eds., 2009); Jody Freeman, *Extending Public Law Norms Through Privatization*, 116 HARV. L. REV. 1285 (2003).

[73] Freeman, *supra* note 10, at 554–59.

[74] *See* ELLICKSON, *supra* note 11, at viii.

[75] *See generally, e.g.*, ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION (1990) (examining norms in common pool resource situations).

[76] For examples of scholarship that examined large group situations, see ERIC A. POSNER, LAW AND SOCIAL NORMS 112–32 (Harvard University Press 2d ed. 2002) (voting); Lawrence Lessig, *The Regulation of Social Meaning*, 62 U. CHI. L. REV. 943, 964–65 (1995) (motorcycle helmets); Lior Jacob Strahilevitz, *Social Norms from Close-Knit Groups to Loose-Knit Groups*, 70 U. CHI. L. REV. 359, 361–63 (2003) (subway riding, driving, and Internet file-sharing); Cass R.

a number of general characteristics of situations in which norms are influential.[77] We believe three characteristics are likely to be important for Coasian bargaining over firm carbon emissions: well-defined entitlements, adequate information, and opportunities for enforcement through social sanctions or rewards.

A modern account of the influences on firm carbon emissions should therefore include social license pressures arising from the prescriptive norms of a firm's stakeholders (e.g., customers, investors, community opinion leaders, employees, and managers),[78] and a new strategy designed to leverage social license pressures should create the conditions necessary for this pressure to result in carbon emissions reductions.[79] To enhance bargaining, the new strategy should seek to clearly delineate the existence and extent of the carbon constraint in the social license to operate. To ensure that the social license pressure reduces leakage and extends to developing countries, the strategy should encourage the scope of the carbon constraint to include supply chain emissions. To ensure that the parties have adequate information to bargain over the carbon aspect of the social license, the strategy should ensure that carbon emissions data are available to firms and their stakeholders in ways that facilitate private monitoring and enforcement.

Substantial development along these lines has occurred in the last two decades.[80] Social pressures increasingly result in a social

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Sunstein, *Social Norms and Social Roles*, 96 COLUM. L. REV. 903, 909–25 (1996) (roadside tipping and littering); Michael P. Vandenbergh, *Order Without Social Norms: How Personal Norm Activation Can Protect the Environment*, 99 NW. U. L. REV. 1101, 1159–63 (2005) (toxics-releasing household activities).

[77] The law and economics literature has examined whether norms are welfare or wealth-enhancing. *See* ELLICKSON, *supra* note 11, at 170–72; POSNER, *supra* note 76, at 10–15. This is an important issue for norms that affect carbon emissions, but for the purposes of this article we assume that the need for prompt, additional carbon emissions reductions is sufficiently great that norms that induce firms to reduce carbon emissions are welfare-enhancing.

[78] *See infra* notes 218–231 and accompanying text. Of course, firms differ from individuals in many important ways, but they also respond to social influences. The classic example involves the Toxics Release Inventory, which has been shown to induce firms to reduce emissions in the absence of any regulatory requirements. *See* Shameek Konar & Mark A. Cohen, *Information as Regulation: The Effect of Community Right to Know Laws on Toxic Emissions*, 32 J. ENVTL. ECON. & MGMT. 109, 122–23 (1997) (demonstrating impact of mandatory disclosure requirements on firm toxic emissions); *see also* Michael P. Vandenbergh, *The New Wal-Mart Effect: The Role of Private Contracting in Global Governance*, 54 UCLA L. REV. 913, 913 (2007).

[79] *See, e.g.*, Gunningham et al., *supra* note 11, at 308–10.

[80] *See infra* notes 207–254 and accompanying text.

license to operate that is more restrictive as to carbon emissions than the applicable formal legal entitlements. The contours of the social entitlement are still emerging, but they often ascribe responsibility to firms based on goods produced and include not only the selling firm but also the entire supply chain with little regard for legal or national boundaries.[81] As we discuss in Part II, however, there is a risk that while public and private standards will create a clear new social license boundary, it will be one that excludes supply chain emissions.[82]

In addition, private and public-private entities have emerged that develop, monitor, and enforce environmental standards in the absence of government regulation.[83] These organizations often focus on environmental effects that are not subject to formal legal requirements,[84] but to date there has been far more activity associated with various forms of environmental sustainability than with carbon emissions.[85] Industry trade associations and joint industry-NGO organizations have developed private standards for environmental performance in forestry, fisheries, chemical production, and other areas.[86] Standards for reporting and restricting carbon emissions are not as far along, but are progressing quickly.

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[81] *See* Vandenbergh, *supra* note 22, at 937–39 (identifying firms that are imposing extra-legal supply chain requirements on domestic and foreign suppliers).

[82] Recent work demonstrates that in some situations, firms bargain in the shadow of legal and social license pressures in ways that enhance, rather than undermine, regulatory objectives. For example, concern about Superfund and other liability induces private firms in the U.S. to spend more money each year on private environmental investigations in connection with loans, mergers, and other transactions than the entire federal Environmental Protection Agency enforcement budget. Vandenbergh, *supra* note 10, at 2048–49.

[83] *See generally* CASHORE ET AL., *supra* note 10; Bradley C. Karkkainen, *Post-Sovereign Environmental Governance*, 4 GLOBAL ENVTL. POL. 72 (2004); Daniel C. Esty, *Good Governance at the Supranational Scale: Globalizing Administrative Law*, 115 YALE L.J. 1490 (2006).

[84] Vandenbergh, *supra* note 10, at 2041–66.

[85] A leading example is the standard developed by the International Standardization Organization (ISO) to induce firms to adopt environmental management systems and conduct environmental audits (the ISO 14000 series). *See* Aseem Prakash & Matthew Potoski, *Racing to the Bottom? Trade, Environmental Governance, and ISO 14001*, 50 AM. J. POL. SCI. 350, 351–52 (2006) (discussing ISO 14001).

[86] *See, e.g.*, Errol Meidinger, *The Administrative Law of Global Private-Public Regulation: The Case of Forestry*, 17 EUR. J. INT'L L. 47, 47–48 (2006) (discussing private forestry standards).

II. LEGAL AND PHYSICAL BOUNDARIES

What should be included within the boundary of a corporate carbon footprint? As we demonstrate below, with little debate a clear choice is emerging in private and public standards that a narrow boundary is preferable. Although the clarity is admirable, the narrow boundary is not. The economic incentives of corporate firms are a function of the physical characteristics of the activity that generates carbon emissions and the ways in which the legal standard includes—or excludes—these emissions from regulation. We begin by examining the legal boundaries that have been proposed or adopted thus far in private and public carbon governance regimes. We find that although substantial differences exist, a common legal boundary has emerged. Private schemes ostensibly include all emissions from facilities owned or controlled by a corporate firm, but they exclude emissions from third-party suppliers. Public schemes exclude emissions not only from third party suppliers, but also from small facilities within the corporate firm. We then review the physical boundaries: the characteristics of the carbon emissions from firms in the most important economic sectors.

A. *The Legal Boundary*

1. *Private Reporting Regimes*

Private climate change governance regimes typically require participants to report carbon emissions, presumably on the theory that public disclosure will lead to legal, economic, and social pressure for emissions reductions.[87] Numerous private organizations have developed voluntary carbon reporting schemes.[88] We summarize the carbon footprint boundary used in several of the programs in Table 1—The Climate Registry (TCR), the World Resources Institute Carbon Protocol (WRI), the Carbon Disclosure Project (CDP), and the Global Reporting Initiative (GRI). We also examine two of them in more detail below. In

[87] *See generally* Gunningham et al., *supra* note 11; Konar & Cohen, *supra* note 78, at 123–24 (discussing role of information as supplement to regulation).

[88] *See, e.g.*, Carbon Disclosure Project, http://www.cdproject.net (last visited Mar. 29, 2010); World Resources Institute, GHG Protocol Initiative, http://www.wri.org/project/ghg-protocol (last visited Mar. 29, 2010); Global Reporting Initiative, http://www.globalreporting.org (last visited Mar. 29, 2010).

short, the private reporting regimes to date have converged on the corporate firm as the entity subject to carbon emissions reporting and do not include third party suppliers. Carbon emissions reporting programs, both voluntary and mandatory, include three "scopes"[89] (sometimes called "tiers"[90]). Although minor variations exist across reporting programs, the basic framework is as follows:

> Scope 1: Direct carbon emissions from sources owned or controlled by a company.[91]
>
> Scope 2: Indirect carbon emissions associated with the purchase of heat, cooling, steam, or electricity consumed by the company.[92]
>
> Scope 3: All other indirect emissions not included in Scope 2, including emissions from the supply chain.[93]

As Table 2 indicates, none of the private voluntary reporting schemes require reporting of supply-chain emissions, though several private voluntary programs encourage some such reporting.[94] For example, both the leading domestic private reporting scheme in the United States, TCR,[95] and the leading

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[89] *See, e.g.*, WORLD BUS. COUNCIL FOR SUSTAINABLE DEV. & WORLD RES. INST., THE GREENHOUSE GAS PROTOCOL: A CORPORATE ACCOUNTING AND REPORTING STANDARD 25 (2004) [hereinafter WRI/WBCSD Carbon Protocol] (using the term "scope").

[90] *See, e.g.*, Matthews et al., *supra* note 16, at 5839 (referring to "tiers" of emissions).

[91] *See, e.g.*, CARBON DISCLOSURE PROJECT, GUIDANCE NOTES 10 (2008), *available at* http://www.syntao.com/Uploads/%7B0AD5353C-63DF-4396-A815-3B197A899E5C%7D_CDP_2008_Guidance_English.pdf [hereinafter CDP Guidance] (incorporating WRI/WBCSD Carbon Protocol and stating that it includes in Scope 1 emissions "from GHG sources owned or controlled by the company, such as combustion facilities . . .").

[92] *See, e.g.*, *id.* at 10 (including emissions "that the company has indirectly caused through its consumption of imported electricity, heat, cooling or steam" in Scope 2).

[93] *Id.* (defining Scope 3 emissions to be "[o]ther indirect emissions that are a consequence of a company's activities, but which arise from GHG sources that are owned or controlled by others").

[94] *See infra* notes 107–108 and accompanying text (discussing nascent supply chain efforts).

[95] We identify The Climate Registry as a private entity, but we recognize that it has a strong public component. The Climate Registry was founded by a number of participating U.S. and Mexican states, native sovereign nations, and Canadian provinces and territories, known as "members." The Registry is governed by its members, with one board member per state, province, or tribe serving on the Board of Directors. Board Members are appointed by their respective Governors, Premiers, or other governing authorities. Major companies from a variety of industries have joined the program. Participants

global private reporting scheme, the CDP, require participants to report Scope 1 and 2 emissions but leave Scope 3 emissions to the discretion of the reporting entity.[96] In practice, it appears that few firms choose to report emissions from suppliers.[97] Thus, although supply chain emissions are explicitly a part of Scope 3 emissions, with one partial exception[98] the leading private reporting systems do not require Scope 3 reporting.[99]

TABLE 2: BOUNDARIES IN PRIVATE VOLUNTARY CARBON EMISSIONS REPORTING PROGRAMS

Program	**Scope of Emissions Reporting**	**Facility Threshold**
The Climate Registry	Scope 1 and 2	None
WRI	Scope 1 and 2	None
CDP	Scope 1 and 2	None
GRI	Scope 1 and 2	None

In addition, although the private reporting standards seek to include in the carbon footprint all emissions from the corporate firm, including all entities owned or controlled by the firm,[100] it is unclear whether the participating firms are reporting emissions from smaller facilities (e.g., facilities that emit less than 10,000 or 25,000 metric tons of CO_2eq). The standard-setting organizations

include National Grid, Wal-Mart, Amtrak, Rio Tinto, and numerous public utilities and local governments. The Climate Registry, List of Members, http://www.theclimateregistry.org/members/ (last visited Feb. 27, 2010).

[96] THE CLIMATE REGISTRY, GENERAL REPORTING PROTOCOL: ACCURATE, TRANSPARENT, AND CONSISTENT MEASUREMENT OF GREENHOUSE GASES ACROSS NORTH AMERICA 32 (2008), *available at* http://www.theclimateregistry.org/downloads/GRP.pdf. The Climate Registry "does not add Scope 3 emissions together or mix Scope 3 with Scope 1 or 2 emissions" because of the potential double-counting of emissions. *Id.* at 34.

[97] *See* Press Release, Carbon Disclosure Project, Supply Chain Report Reveals Need to Improve Supplier Awareness of Business Threats From Climate Change (Mar. 5, 2009), *available at* https://www.cdproject.net/en-US/WhatWeDo/CDPNewsArticlePages/Supply-Chain-Report-Reveals-Need-to-Improve-Supplier-Awareness-of-Business-Threats-From-Climate-Change.aspx.

[98] *See infra* notes 114–118 and accompanying text.

[99] In fact, other downstream emissions (e.g., from the use rather than the manufacture of a car) are also excluded, as are other forms of upstream emissions.

[100] *See* CDP Guidance, *supra* note 91, at 1–2 (defining corporate entity).

exhort firms not to select thresholds below which firms choose not to report,[101] but they do not prevent firms from setting thresholds or from shifting activities to below-threshold facilities, and it is unclear if firms are applying thresholds in practice.

a. *The Carbon Disclosure Project*

The Carbon Disclosure Project (CDP) is a nongovernmental organization headquartered in the United Kingdom with worldwide sponsors.[102] The sponsors include hundreds of institutional investors, including leading banks, insurers, pension funds, and other organizations representing several trillion dollars in funds under management.[103] The CDP has been sending information requests to the world's largest companies since 2003, and in 2008 over 2,200 companies responded.[104] According to the

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[101] For example, the WRI Carbon Protocol discourages the use of a threshold below which the carbon emissions from a facility or activity are not reportable. WRI GREENHOUSE GAS PROTOCOL INITIATIVE 1-3 (2008), *available at* www.ghgprotocol.org/files/psp-draft-1.pdf. The initiative states that:

> [A] threshold is often used to determine whether an error or omission is a material discrepancy or not. This *is not the same as a de minimis threshold for defining a complete inventory*. Instead, organizations need to make a good faith effort to provide a complete, accurate, and consistent accounting of their GHG emissions. For cases where emissions have not been estimated, or estimated at an insufficient level of quality, it is important that this is transparently documented and justified. Verifiers can determine the potential impact and relevance of the exclusion, or lack of quality, on the overall inventory report.

Id. (emphasis added).

[102] *See* CARBON DISCLOSURE PROJECT, SUPPLY CHAIN LEADERSHIP COLLABORATION (SCLC) PILOT RESULTS AND FINDINGS REPORT 7 (2008), *available at* https://www.cdproject.net/CDPResults/CDP_SCLC_Pilot_Report.pdf [hereinafter CARBON DISCLOSURE PROJECT, SCLC PILOT RESULTS] (describing the Carbon Disclosure Project as a "Special Project of Rockefeller Philanthropy Advisors" with tax-exempt status in the United States).

[103] As of February 2010, the CDP had 534 signatory investors that put their name on the CDP voluntary disclosure form. This not only shows that investor's direct support for the CDP but also allows them to access the non-public information gathered by the CDP. Carbon Disclosure Project, About Us, http://cdproject.net/aboutus.asp (last visited Feb. 27, 2010). In 2008, there were more than 2,220 companies responding to the CDP questionnaire (called "responding companies"). Carbon Disclosure Project, Results Overview, https://www.cdproject.net/en-US/Results/Pages/overview.aspx (last visited Mar. 21, 2010); *see also* Carbon Disclosure Project, Resources, http://cdproject.net/resources.asp (last visited Feb. 27, 2010) (including questionnaire and all of CDP guidance documents).

[104] Carbon Disclosure Project, Results Overview, https://www.cdproject.net/en-US/Results/Pages/overview.aspx (last visited Mar. 21, 2010).

CDP's Global 500 Report 2008, 77 percent of the top 500 companies worldwide responded to the requested questionnaire.[105] The CDP makes the data available to its sponsoring organizations and to the public over the Internet.[106]

The CDP requests disclosure of carbon emissions from corporate entities.[107] The CDP provides general guidance to respondents, but for specifics refers them to the more detailed Greenhouse Gas Protocol developed by the World Resources Institute and the World Business Council for Sustainable Development (WRI Carbon Protocol) and a private standard developed by the International Standards Organization.[108] To calculate the emissions subject to disclosure, the CDP identifies the three scopes discussed above, which are defined in the WRI Carbon Protocol. The CDP draws on and follows the WRI Carbon Protocol in requiring participants to report Scopes 1 and 2,[109] and it only suggests that participants voluntarily report Scope 3 emissions.[110]

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[105] *See* CARBON DISCLOSURE PROJECT, CDP 2008 GLOBAL 500 REPORT at ii (noting that "[t]he overall response rate for CDP6 [2008] is 77%—consistent with the record level achieved in CDP5 [2007]"), https://www.cdproject.net/CDPResults/67_329_143_CDP%20Global%20500%20Report%202008.pdf.

[106] Carbon Disclosure Project, About Us, http://cdproject.net/aboutus.asp (last visited Feb. 27, 2010).

[107] *See* CDP Guidance, *supra* note 91, at 1–2 (identifying methods for respondents to determine which entities are subject to references in the survey form to "your company" or "your business"). The CDP guidance states that:

> [w]hen the questionnaire refers to 'your company' or 'your business,' this should be treated as a reference to the group, company, companies and/or businesses within the reporting boundary you identify in answer to question 2(a)(i). The information provided in response to the questionnaire should relate to all of the entities within the reporting boundary identified and the same 'consolidation approach' should be used for all of your answers.

Id.

[108] *Id.* at 1 (referencing WORLD RES. INST. & WORLD BUS. COUNCIL FOR SUSTAINABLE DEV., THE GREENHOUSE GAS PROTOCOL: A CORPORATE ACCOUNTING AND REPORTING STANDARD (2004), *available at* http://www.ghgprotocol.org/files/ghg-protocol-revised.pdf [hereinafter WRI Carbon Protocol] and INT'L STANDARDS ORG. (ISO), 14064-1: SPECIFICATION WITH GUIDANCE AT THE ORGANIZATION LEVEL FOR QUANTIFICATION AND REPORTING OF GREENHOUSE GAS EMISSIONS AND REMOVALS (2006)).

[109] *See id.* at 9.

[110] *Id.* at 13–14 (detailing the "most significant Scope 3 sources" for a participating company, including details on "employee business travel," "external distribution logistics," "use and disposal of company's products and

The CDP and the Carbon Protocol are beginning to focus on the importance of the supply chain, however. They recently conducted studies on improving supply chain reporting and the CDP has instituted the Supply Chain Leadership Collaboration (SCLC) with the goal of creating a standardized process for supply chain reporting of carbon emissions.[111] Similarly, the WRI Carbon Protocol is a pilot program, testing new international standards for calculating carbon emissions in corporate and product supply chains. The new carbon standards will include product lifecycle accounting and full organizational value chain Scope 3 emissions reporting.[112]

b. *The Global Reporting Initiative*

The Global Reporting Initiative (GRI) is a multi-stakeholder process and institution whose mission is to develop and disseminate globally applicable Sustainability Reporting Guidelines.[113] The GRI focuses on corporate-level reporting, although it also includes reporting by NGOs and governmental organizations. GRI Guidelines include Scope 1 and Scope 2 emissions. They encourage but do not require Scope 3 reporting for the energy consumption associated with suppliers.[114] The GRI also encourages use of a reporting boundary that goes well beyond

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services," and the "company supply chain"). Under the WRI Carbon Protocol, participants "shall separately account for and report on [Levels] 1 and 2 at a minimum," while Level 3 is optional. WRI/WBCSD Carbon Protocol, *supra* note 89, at 25. For companies that report Scope 3 emissions, WRI provides guidance on relevant emissions, such as those that "contribute to the company's GHG risk exposure," are "deemed critical by key stakeholders," and that are large "relative to the company's Scope 1 and Scope 2 emissions." *Id.* at 30.

[111] CARBON DISCLOSURE PROJECT, SCLC PILOT RESULTS, *supra* note 101, at 2; *see also* CARBON DISCLOSURE PROJECT, SUPPLY CHAIN REPORT 2009 (2009), *available at* https://www.cdproject.net/CDPResults/65_329_201_CDP-Supply-Chain-Report_2009.pdf.

[112] *See* Greenhouse Gas Protocol Initiative, Product and Supply Chain, http://www.ghgprotocol.org/standards/product-and-supply-chain-standard (last visited Feb. 27, 2010).

[113] Global Reporting Initiative, What is Global Reporting Initiative?, http://www.globalreporting.org/AboutGRI/WhatIsGRI (last visited Feb 27, 2010).

[114] GLOBAL REPORTING INITIATIVE, INDICATOR PROTOCOL SET: ENVIRONMENT (EN) 13 (2006), *available at* http://www.globalreporting.org/ReportingFramework/ReportingFrameworkDownloads/ [hereinafter G3] (noting that indicator EN7 covers "[i]ndirect energy use . . . through purchasing materials and components or services such as travel, commuting, and subcontracted production").

the traditional firm,[115] as well as reporting by small and medium enterprises (SMEs) that are suppliers to GRI reporters.[116] In practice, however, few companies report supply chain emissions, and few SMEs are reporters.[117]

In sum, the leading private reporting standards do not include explicit thresholds on the size of the facilities subject to emissions reporting, and it is unclear whether firms are excluding emissions from small facilities by applying their own thresholds. Private reporting standards focus on firm-level emissions and do not require reporting of supply-chain emissions, however, and in practice most firms do not report supply chain emissions.[118]

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[115] Global Reporting Initiative, Setting the Reporting Boundary, http://www.globalreporting.org/ReportingFramework/G3Online/SettingReportBoundary (last visited Feb. 27, 2010) (noting that "[t]he Sustainability Report Boundary should include the entities over which the reporting organization exercises control or significant influence both in and through its relationships with various entities upstream (e.g., supply chain) and downstream (e.g., distribution and customers)"). However, organizations have considerable discretion over how they define "control" or "significant influence." If they do not quantify such influence, GRI allows the reporter to provide a narrative description. *See id.*

[116] A recent report GRI supply chain report noted that "[t]he assumption, based on GRI's experience and reporting reality, was that suppliers in emerging economies, especially SMEs, face big barriers when it comes to understanding and proactively managing sustainability issues." GLOBAL REPORTING INITIATIVE, SMALL, SMART, AND SUSTAINABLE 7 (2008), *available at* http://www.globalreporting.org/NR/rdonlyres/02AF6322-C207-4F79-85B2-EC017826B60F/0/SSSReport.pdf. GRI also has initiated the Global Action Network for Transparency in the Supply Chain, which is for large firms "to provide support to their suppliers, enabling the embedding of a transparent sustainability reporting framework throughout the chain . . . ." Global Reporting Initiative, Supply Chain, http://www.globalreporting.org/CurrentPriorities/SupplyChain (last visited Feb. 27, 2010).

[117] A 2006 survey conducted by GRI and KPMG's Global Sustainability Services analyzed fifty sustainability reports of Financial Times top global 500 companies and GRI participants. We examined the sustainability reports of those fifty companies and found that only five mention supply chain emissions in their sustainability reports, thirteen note emissions due to employee travel, fourteen report emissions from office products and company-owned real estate, and seven provide quantitative data for any indirect emissions. *See generally* KPMG & GLOBAL REPORTING INITIATIVE, REPORTING THE BUSINESS IMPLICATIONS OF CLIMATE CHANGE IN SUSTAINABILITY REPORTS (2007), *available at* http://www.globalreporting.org/NR/rdonlyres/C451A32E-A046-493B-9C62-7020325F1E54/0/ClimateChange_GRI_KPMG07.pdf.

[118] *See Nine out of 10 Firms Ignoring Supply Chain Carbon Footprint*, BUSINESSGREEN.COM, Feb. 27, 2009, http://www.businessgreen.com/business-green/news/2237398/nine-ten-firms-ignoring-supply.

2. *Public Reporting and Allowance-Holding Regimes*

Public regimes also typically require reporting, and a growing number restrict emissions by requiring regulated entities to hold allowances as part of a cap-and-trade system. Public voluntary and mandatory reporting and mandatory allowance-holding requirements focus on the facility rather than the firm. We summarize the carbon footprint boundary used in many of the schemes in Table 3, and we examine the leading federal, regional, state, and European Union schemes in more detail below.

TABLE 3: BOUNDARIES IN PUBLIC CARBON EMISSIONS REPORTING PROGRAMS

Program	**Scope of Emissions Reporting**	**Threshold**
Voluntary Reporting		
EPA Climate Leaders	Scope 1 and 2	
CCAR	Scope 1 and 2	25,000 tons
UK ETS (C&T)	Scope 1 and 2	10,000 tons
En. Policy Act 1605(b)	None	
Mandatory Reporting		
EPA Rulemaking	Scope 1	25,000 tons[119]
MA Global Warming Act	Scope 1, limited Scope 2	5,000 tons[120]
New Mexico	Scope 1, Scope 2[121]	25 Megawatts/ 10 tons[122]
Oregon	Scope 1	
California	Scope 1	25,000/2,500 tons[123]
Washington	Scope 1	10,000 tons[124]

[119] Mandatory Reporting of Greenhouse Gases, 74 Fed. Reg. 56,260 (Oct. 30, 2009) (to be codified at 40 CFR pts. 86, 87, 89, 90, 94, 98, 1033, 1039, 1042, 1045, 1048, 1051, 1054, 1065).

[120] *See* Massachusetts Global Warming Solutions Act, MASS. GEN. LAWS. ch. 298, § 2(a)(2)–(a)(3) (2008).

[121] N.M. ENV'T DEP'T, FREQUENTLY ASKED QUESTIONS REGARDING MANDATORY GREENHOUSE GAS EMISSIONS REPORTING FOR MAJOR SOURCES UNDER PARTS 73 (20.2.73 NMAC) AND 87 (20.2.87 NMAC) at 1, 1–2 (2007), *available at* http://www.nmenv.state.nm.us/aqb/ghg/documents/FAQ_GHG_Emissions_Reporting.pdf; *see also* Environmental Improvement Act, N.M.

Mandatory Reporting and Allowances		
Waxman-Markey	Scope 1 and 2[125]	25,000 tons
RGGI	Scope 1	25 Megawatts
W. Climate Initiative	Scope 1 and 2	25,000/10,000 tons[126]
EPA Rulemaking	Scope 1	25,000 tons[127]
EU ETS	Scope 1 and limited Scope 2[128]	Various Indus. Facilities

a. *Public Voluntary Reporting Standards*

Public voluntary reporting standards resemble private reporting standards. The EPA Climate Leaders program is a voluntary initiative that requires participants to report Scope 1 and 2 emissions,[129] but not Scope 3 emissions.[130] As to Scope 3 emissions that are voluntarily included in a report, the EPA states that "[c]ompanies should report those activities that are relevant to their business and goals, and for which they have reliable

STAT. ANN. § 74-1-8(A)(4) (West 1978), and Air Quality Control Act, N.M. STAT. ANN. §§ 74-2-1 to -2-22, (West 1978) (note specifically §§ 74-2-5(B)(1) & 74-2-5(C)(5)(d) & (e)).

[122] N.M. ENV'T DEP'T, *supra* note 121, at 2.

[123] *See* CAL. CODE. REGS. tit. 17, § 95101 (2007).

[124] *See* H.R. 2815, 60th Leg. § 5(a) (Wash. 2008), *available at* http://www.ecy.wa.gov/climatechange/2008CATdocs/IWG/tran/091108_ESSHB2815.pdf.

[125] The EPA Administrator is provided with authority to expand reporting requirements. *See* American Clean Energy and Security Act of 2009, H.R. 2454, 111th Cong. § 713(b)(1)(G) (as passed by House of Representatives, June 26, 2009).

[126] The emissions threshold for regulation under the cap and trade initiative is 25,000 metric tons, and 10,000 tons for reporting. *See* W. CLIMATE INITIATIVE, DRAFT DESIGN OF THE REGIONAL CAP-AND-TRADE PROGRAM 3, 9 (2008), *available at* www.ecy.wa.gov/climatechange/WCIdocs/072308_wci_draftdesign.pdf.

[127] *See* EPA, Mandatory Reporting of Greenhouse Gases, 74 Fed. Reg. 56,260, 56,264 (Oct. 30, 2009).

[128] Excludes carbon emissions associated with purchase of electricity. Member states can elect to expand reporting requirements.

[129] EPA, CLIMATE LEADERS GREENHOUSE GAS INVENTORY PROTOCOL: DESIGN PRINCIPLES 16 (2005), *available at* http://www.epa.gov/climateleaders/documents/resources/design-principles.pdf.

[130] *Id.* at 20.

information."[131] Voluntary reporting at the state level has followed along the same lines. For example, the California Climate Action Registry (CCAR) requires participants to report only Scope 1 and 2 emissions, but not Scope 3 emissions.[132] Participants are encouraged to report Scope 3 emissions, but such reporting is optional and unverified.[133]

The Department of Energy manages a voluntary reporting program under Section 1605(b) of the federal Energy Policy Act.[134] The program has few requirements, making reporting of all emissions, regardless of scope, voluntary.[135] Under this program, emissions are treated as direct or indirect, with no mention of a third level dealing with upstream emissions. Perhaps as a result, the program is having little effect on the design of more recent federal carbon reporting programs.[136]

The reluctance to include the supply chain in public voluntary reporting schemes is not limited to the United States. For example, the UK Emissions Trading Scheme (ETS), a voluntary emissions trading program that ended in 2006, directed participants to report Scope 1 and 2 emissions.[137] Reporting did not go beyond Scope 1 and 2 emissions, and the program guidelines directed that "the only type of indirect emissions in the Scheme will be those associated with energy usage."[138]

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[131] *Id.*

[132] CAL. CLIMATE ACTION REGISTRY, GENERAL REPORTING PROTOCOL: REPORTING ENTITY-WIDE GREENHOUSE GAS EMISSIONS 3–4, 6 (2009) (requiring participants to report direct or Level 1 emissions as well as indirect emissions from purchased and consumed electricity use, imported steam, and district heating and cooling).

[133] *Id.* at 4, 21, 70–1 (explaining that voluntary Scope 3 emissions reporting can "highlight" an "organization's environmental goals, policies, programs and performance").

[134] Energy Policy Act of 1992 § 1605(b), 42 U.S.C. § 13385 (2006).

[135] *See* General Guidelines for the Voluntary Reporting of Greenhouse Gases Under Section 1605(b) of the Energy Policy Act of 1992, 10 C.F.R. § 300 (2009).

[136] *See* Dawn Reeves, *Lawmakers Seek to Enhance EPA's Role in Future GHG Control Regime*, INSIDE EPA, May 25, 2007, at 1, 14 (noting limits of Department of Energy reporting program).

[137] UNITED KINGDOM DEP'T FOR ENV'T, FOOD, & RURAL AFFAIRS (DEFRA), GUIDELINES FOR THE MEASUREMENT AND REPORTING OF EMISSIONS BY DIRECT PARTICIPANTS IN THE UK EMISSIONS TRADING SCHEME 11 (2003).

[138] *Id.* at 12.

b. *Public Mandatory Reporting and Allowance-Holding Requirements*

Mandatory reporting and allowance-holding requirements are being developed at the federal level and are in place in a number of states. All of these requirements follow the pattern of the private standards: a carbon boundary that does not include suppliers. For example, pursuant to a 2008 omnibus appropriations bill,[139] in 2009, the EPA finalized mandatory reporting requirements for greenhouse gases produced by major sources in the United States.[140] The rule includes both upstream and downstream provisions. The upstream provisions require reporting by suppliers of fossil fuels (e.g., coal, petroleum products, and natural gas) or industrial greenhouse gases (e.g., fluorinated gases) that will result in 25,000 metric tons or more per year of CO_2eq emissions.[141] The downstream provisions apply to facilities that emit 25,000 metric tons or more per year and use the same threshold for manufacturers of vehicles and engines.[142] The downstream provisions generally require reporting at the facility level, but vehicle and engine manufacturers are required to report at the corporate level.

The reporting requirements in the leading proposed federal legislation also exclude supply chain and other Scope 3 emissions. For example, the Waxman-Markey bill, which passed the House of Representatives in 2009, includes a hybrid upstream and downstream cap-and-trade scheme. Covered entities will have tradable federal permits for each ton of pollution emitted. The bill includes a 25,000 ton threshold for its emissions permit system and a 10,000 ton threshold for its emissions reporting program.[143] The

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[139] Consolidated Appropriations Act of 2008, Pub. L. No. 110-161, 121 Stat. 1844 (2007) (requiring EPA to promulgate "mandatory reporting of greenhouse gas emissions above appropriate thresholds in all sectors of the economy of the United States"). *See also* Steven D. Cook, *EPA Misses Deadline for Proposing Rule to Require Reporting of Industrial Emissions*, BNA DAILY ENV'T REPORT, Oct. 1, 2008, at A-2.

[140] *See* Mandatory Reporting of Greenhouse Gases, 74 Fed. Reg. 56,260, 56,260 (Oct. 30, 2009).

[141] *Id.*

[142] *Id.*

[143] *See* American Clean Energy and Security Act, H.R. 2454, 111th Cong. §§ 700(13)(B), 713(a)(2)(B)(ii) (as passed by House of Representatives, June 26, 2009); *see also* Climate Security Act, S. 2191, 110th Cong. § 1103(a) (2008). The Lieberman-Warner bill would have required periodic reports detailing annual and quarterly data from affected facilities, with a baseline of the three

Lieberman-Warner bill, which was defeated on the floor of the Senate in 2008, also includes reporting and allowance-holding requirements, but it adopts a 10,000 ton threshold.[144] Facilities under the threshold will not be subject to the reporting or allowance-holding requirements. In both bills, third party suppliers are not included in the reporting or allowance-holding requirements, although the EPA is authorized to expand the requirements under certain conditions.[145] Both bills also include upstream reporting and allowance-holding provisions, although the effect of the Lieberman-Warner bill's upstream provisions on smaller facilities will be limited, because the bill places caps only on fossil fuels used for transportation, not on fossil fuels used for small stationary sources.[146]

Supply-chain emissions also are not included in the mandatory reporting and allowance-holding regimes at the regional or state level in the U.S. Ten northeastern states have agreed to form the Regional Greenhouse Gas Initiative (RGGI) CO_2 Budget Trading Program, a uniform budget and allowance trading program directed at large fossil fuel-fired electricity generating units (those having a rated capacity of 25 megawatts).[147] Once a unit triggers coverage under RGGI, the owner or operator of the unit must "record, report and quality-assure" data from systems monitoring its CO_2 emissions.[148] This

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years 2004–2007. S. 2191 § 1103(d). The upstream components would have required reporting by firms that extract or import transportation fuels that will generate more than 10,000 tons of CO_2eq per year. S. 2191 § 4(7) (defining "covered facility).

[144] *See* S. 2191 §§ 1102(1)(A)–1102(1)(B) (noting that the definition of "Affected Facility does not include any facility that is not a covered facility, is owned or operated by a small business . . . and emits fewer than 10,000 carbon dioxide equivalents in any year"). The Kerry-Boxer bill includes a 25,000 metric ton threshold. *See* Clean Jobs and American Power Act, S.1733, 111th Cong. § 713(a)(2) (2009).

[145] *See* S. 2191 § 1103(a)(8) (authorizing EPA to require additional reporting).

[146] *See supra* note 143 (discussing transportation fuels upstream provisions).

[147] *See* REGIONAL GREENHOUSE GAS INITIATIVE, RGGI FACT SHEET 1–4, *available at* http://www.rggi.org/docs/RGGI_Executive%20Summary_4.22.09.pdf; Memorandum of Understanding on the Regional Greenhouse Gas Initiative (Dec. 20, 2005), *available at* http://www.rggi.org/docs/mou_12_20_05.pdf. The participant states are Connecticut, Delaware, Massachusetts, Maine, New York, Maryland, New Jersey, New Hampshire, Vermont, and Rhode Island. *Id.*

[148] RGGI FACT SHEET, *supra* note 147, at 1; *see also* Memorandum of Understanding on the Regional Greenhouse Gas Initiative, *supra* note 147.

reporting does not extend to Scope 2 or Scope 3 emissions, although supply chain emissions are not a substantial issue for the RGGI Trading Program since the program focuses on electricity generating units, for which suppliers comprise less than 5 percent of total carbon emissions nationwide.[149]

The Western Climate Initiative (WCI) is another regional emissions regulatory scheme. WCI has been developed by California, several other western states, and several Canadian provinces. The WCI includes a hybrid upstream and downstream carbon cap-and-trade program, with an emissions threshold for allowance-holding under the WCI of 25,000 metric tons of CO_2eq.[150] Mandatory reporting requirements are facility-specific, and the facility reporting threshold is 10,000 metric tons,[151] in contrast to the 25,000 ton allowance-holding threshold.

To implement the regional initiatives, a number of states have established mandatory reporting and allowance-holding requirements. Under the Massachusetts Global Warming Solutions Act,[152] reporting is required for large emitting facilities, but supply-chain emissions are not included.[153] Similarly, New Mexico has instituted a mandatory carbon emissions reporting program, which requires Scope 1 emissions to be reported for 2008,[154] and Scope 2 emissions in 2009.[155] In Oregon, recently promulgated rules require reporting of Scope 1 direct emissions[156]

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[149] STAFF OF H. COMM. ON ENERGY AND COMMERCE, *supra* note 17, at 10–14.

[150] WESTERN CLIMATE INITIATIVE, DRAFT DESIGN OF THE REGIONAL CAP-AND-TRADE PROGRAM 3 (2008), *available at* http://www.westernclimateinitiative.org/ewebeditpro/items/O104F18808.pdf. The point of regulation varies depending upon the source of the emissions. *Id.* at 6.

[151] *Id.* at 9.

[152] Massachusetts Global Warming Solutions Act, MASS. GEN. LAWS. ch. 298, §§ 2(a)(2)–(a)(3) (2008).

[153] An owner or operator of a facility that is required to report under the state Clean Air Act, or that emits in excess of 5,000 tons CO_2eq must report annually. *Id.* Voluntary emissions reporting is provided for other entities and facilities. *Id.* § 2(a)(4).

[154] N.M. ENV'T DEP'T, *supra* note 121, at 1 (2007), *available at* http://www.nmenv.state.nm.us/aqb/ghg/documents/FAQ_GHG_Emissions_Reporting.pdf.

[155] *Id.* at 2 (stating that "[e]missions of GHG that occur at another location as a result of the production of electricity, steam and heat purchased and consumed at the facility must be reported").

[156] OR. ADMIN. R. 340-215-0040 (2009) ("Any owner or operator required to register and report under OAR 340-215-0030(1) and (2) must report direct emissions of carbon dioxide, methane, nitrous oxide, hydrofluorocarbons,

and provide for voluntary reporting of Scope 2 emissions,[157] but exclude Scope 3 emissions.[158] California follows this pattern with somewhat different thresholds, requiring reporting of Scope 1 emissions with thresholds of 25,000 and 2,500 tons, depending on the type of emitting facility.[159]

A similar pattern holds with the mandatory reporting component of the European Union cap-and-trade program. The European Union Emission Trading Scheme (EU ETS) creates a hybrid upstream and downstream cap-and-trade program, and requires emissions reporting from large facilities.[160] The EU ETS requires reporting for some Scope 2 emissions,[161] but not "emissions associated with the production of heat or electricity imported from other installations."[162] These latter emissions are subject to direct reporting under the EU ETS.[163] Although the thresholds vary among the categories, in each case only large

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perfluorocarbons, and sulfur hexafluoride greenhouse gases . . . ."); *see also* OR. ADMIN. R. 340-215-0020 (2009) (distinguishing "direct" from "indirect" emissions).

[157] OR. ADMIN. R. 340-215-0030 (2009) ("Any owner or operator of a source required to register and report greenhouse gas emissions annually under this division may voluntarily include additional emissions from the previous calendar year not required under this division, including but not limited to mobile combustion and indirect emissions.")

[158] *See* OR. ADMIN. R. 340-215-0020 (2009) (defining "indirect emissions" to include "emissions associated with the purchase of electricity, heating, cooling or steam," not supply chain emissions).

[159] The regulatory scope of AB 32 includes numerous large industrial sources. *See* CAL. CODE REGS. tit. 17, §§ 95100–103 (2007).

[160] Council Directive 2003/87/EC, Annex I, 2003 O.J. (L 275) (EC) (covering "combustion installations with a rated thermal input exceeding 20 MW (except hazardous or municipal waste installations)").

[161] Commission Decision 2007/589/EC, 2007 O.J. (L 229) 11 (EC) (stating that "[m]onitoring and reporting for an installation shall cover all process and combustion emissions from all emission sources *and source streams* belonging to activities listed in Annex I to Directive 2003/87/EC . . . and of all greenhouse gases specified in relation to those activities while avoiding double-counting") (emphasis added). Guidance from the EU defines "source stream" as "annual flows of fuels, raw materials or products leading to greenhouse gas emissions." EUROPEAN COMMUNITY, ANSWERS TO FREQUENTLY ASKED QUESTIONS ON GREENHOUSE GAS EMISSIONS MONITORING AND REPORTING UNDER THE EU EMISSIONS TRADING SYSTEM PURSUANT DIRECTIVE 2003/87 at 3, *available at* http://ec.europa.eu/environment/climat/emission/pdf/mrg2faq_sep_2007.pdf.

[162] Commission Decision 2007/589/EC, 2007 O.J. (L 229) 11 (EC).

[163] Other emissions sources are explicitly excluded from reporting requirements, such as "[e]missions from mobile internal combustion engines for transportation purposes." *Id.*

industrial facilities are subject to reporting and allowance-holding requirements.[164] Member states may include in emissions reporting additional Scope 2 emissions and Scope 3 emissions if they so choose.[165]

B. *The Physical Boundary*

As discussed above, protocols for assessing the carbon emissions from the production of goods typically divide the emissions into three general categories: direct emissions (Scope 1), emissions from purchased energy (Scope 2), and supply chain and other indirect emissions (Scope 3). If the vast majority of emissions arise from Scope 1 and 2 facilities, then reporting and allowance-holding requirements focused on these facilities are unlikely to miss substantial amounts of carbon. Upstream provisions will capture small domestic facility emissions by accounting for the emissions from fuel use but will not capture emissions from small or large facilities abroad.

A recent study by Matthews et al. analyzed the carbon emissions from all 491 economic sectors in the United States.[166] The study concluded that a carbon footprint boundary that includes only direct emissions and purchased energy emissions will capture only 26 percent of the total emissions from the average sector. A number of important economic sectors (roughly 10 percent of all 491 sectors) that have large carbon footprints (e.g., electric power generation, cement manufacturing and transportation) have 80 percent or more of their emissions captured by a boundary that only includes direct emissions and purchased energy emissions. For example, the vast majority of the emissions from a large coal-fired power plant occur from the plant's smokestacks, not from the production of the coal and other inputs into the plant. For the other

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[164] The EU Emissions Trading Directive (ETD) regulates four categories of installations: (1) Energy Activities; (2) Production and Processing of Ferrous Metals; (3) Mineral Industries; and (4) Other Activities. Council Directive 2003/87, Annex I, 2003 O.J. (L 275) (EC). The Emission Trading Scheme (ETS) is based on the ETD. The directive came first, entering into force in 2003, and the EU commenced the scheme in 2005. *Id.*

[165] *See* Council Directive 2003/87, art. 24, 2003 O.J. (L 275) 38 (EC) (allowing Member States to "apply emission allowance trading in accordance with this Directive to activities, installations and greenhouse gases which are not listed in Annex I, provided that inclusion of such activities, installations and greenhouse gases is approved by the Commission . . .").

[166] Matthews et al., *supra* note 15, at 5840.

90 percent of sectors, however, just including direct and purchased energy emissions will exclude a majority of their emissions, which arise from the supply chain.[167] For example, the direct and purchased energy emissions of a book publisher represent just 6 percent of the total emissions associated with book production. Much of the remaining 94 percent arises from the supply chain.[168]

Other studies have reached similar conclusions. For example, an analysis by Timberland, the retail shoe firm, concluded that only 4 percent of its carbon emissions arise from its company-owned production facilities and from employee travel. In contrast, emissions from Timberland's finished product suppliers and inbound transportation are estimated to be nearly six times their own carbon footprint, while the raw materials associated with their products account for approximately 71 percent.[169]

A recent white paper by the staff of the House Commerce Committee provides additional insights into the characteristics of the emissions from the supply chain.[170] The report concludes that electricity generation accounts for 34 percent of U.S. emissions, transportation 28 percent, industry 19 percent, agriculture 8 percent, other commercial sources 6 percent, and residential sources 5 percent.[171] It also suggests that of the 350,000 manufacturing facilities in the U.S., less than 8,000 emit 10,000

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[167] *Id.*

[168] *Id.* For book publishers, post-production emissions (e.g., from the delivery of the books to stores and customers) also are large. Ultimately, the emissions from the entire life cycle of a good, from production through use and disposal, are important, but we focus upstream in the supply chain in this Article.

[169] TIMBERLAND, TIMBERLAND CLIMATE STRATEGY 6, 15 (2009), *available at* http://www.timberland.com/corp/Timberland_Climate_Strategy_2009_report.pdf.

[170] STAFF OF H. COMM. ON ENERGY & COMMERCE, *supra* note 17, at 10. A 10,000 metric ton CO2eq threshold would account for 80 percent of emissions from the manufacturing sector (while burdening 2.1 percent of facilities) and 100 percent of emissions from the electricity power sector (while burdening 35 percent of facilities). *See* Tristram O. West & Naomi Peña, *Determining Thresholds for Mandatory Reporting of Greenhouse Gas Emissions*, 37 ENVTL. SCI. & TECH. 1057, 1059; *see also* NICHOLAS INST. FOR POLICY SOLUTIONS, SIZE THRESHOLDS FOR GREENHOUSE GAS REGULATION 4–5 (2007), *available at* www.nicholas.duke.edu/institute/10Kton.pdf (concluding that a 10,000 ton CO_2 threshold would account for 99.9 percent of emissions from electricity power sector and 58 percent of the U.S. facilities, and in the manufacturing sector, 2.3 percent of the facilities and 84.6 percent of emissions).

[171] STAFF OF H. COMM. ON ENERGY & COMMERCE, *supra* note 17, at 7 fig.2.

metric tons of CO_2 per year.[172] The 10,000 metric ton threshold would account for 90 percent of the carbon emissions from the electric utility industry, but it would exclude the vast majority of other CO_2 emitting facilities in the United States.[173] For example, 90 percent of the CO_2 emissions from the manufacturing sector arise from six industries (petroleum and coal, chemicals, primary metals, paper, nonmetallic mineral, and food), but a 10,000 metric ton threshold would only regulate 10 percent (7,460) of the facilities in this sector.[174] At the same time, this 10 percent of facilities accounts for 80 percent of the CO_2 emissions from the sector.[175] To capture 95 percent of the CO_2 emissions from the industrial sector, the threshold would have to be set at 1,000 tons per year.[176] None of the facilities in the commercial or residential sectors exceed the 10,000 ton threshold.[177] For example, as noted by Matthews et al., direct emissions in the book publishing industry only account for 6 percent of total emissions—with the bulk of the remaining 94 percent being from the supply chain (paper production) and transportation.

The figures for developing countries are likely to be quite different. For example, roughly half of all Chinese carbon emissions are from production for export, and roughly half of all Chinese production for export is by township and village enterprises (TVEs).[178] These TVEs have ten or fewer employees, and most if not all are likely to fall below either a 10,000 or 25,000 ton threshold.[179] A substantial portion of Chinese carbon emissions are thus likely to fall below the emerging common carbon footprint boundary, if China were to adopt the boundary without an upstream component.

C. *Conclusion Regarding Legal and Physical Boundaries*

A mismatch exists between the regulatory and physical

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[172] *Id.* at 10.

[173] NICHOLAS INST. FOR POLICY SOLUTIONS, *supra* note 170, at 4.

[174] West & Pena, *supra* note 170, at 1057 tbl. 1.

[175] *Id.* at tbl. 3.

[176] *Id.* at tbl. 1.

[177] STAFF OF H. COMM. ON ENERGY & COMMERCE, *supra* note 17, at 18–20.

[178] Jianguo Liu & Jared Diamond, *China's Environment in a Globalizing World*, 435 NATURE, 1179, 1180–81, 1184 (2005); Vandenbergh, *China Problem*, *supra* note 22, at 938–39.

[179] Liu & Diamond, *supra* note 178, at 1180–81.

boundaries. The details of private and public climate change governance regimes differ, but these regimes are remarkably similar in their core design. Private standards typically focus on inducing large industrial firms and facilities to report their carbon emissions, and public standards focus on requiring reporting from facilities as well as requiring the facilities to hold carbon allowances. For both private and public standards, by defining the regulated entity only to include the final large industrial facility that produces a good, roughly three-quarters of the emissions associated with the production of the good are at risk of leaking from the private and public regulatory regimes.[180] If these emissions arise from domestic suppliers, they will be captured by upstream provisions, but if they arise from foreign suppliers in countries without cap-and-trade schemes, they will not be subject to reporting or allowance holding requirements. We discuss the implications of the mismatch for carbon emissions leakage in Part III.

III. THE EFFECTS OF NARROW CARBON BOUNDARIES

The mismatch between the physical and legal boundaries of greenhouse gas emissions discussed in Part II suggests the potential for leakage from current and emerging public and private climate change governance regimes. Continued use of the narrow boundary in new international, federal, and state reporting and cap-and-trade schemes also may create incentives for far more leakage in the future.

A. *Incentives*

As discussed above, roughly three-quarters of the GHG emissions from an average U.S. sector occur at locations upstream from the final producing facility.[181] The incentives of firms to externalize the harms of greenhouse gas emissions, and thus the extent to which leakage occurs, depends on the extent to which the firms that comprise the three-quarters are not subject to regulation, as well as the cost to firms of achieving this externalization through shifting production within the firm or outsourcing carbon-intensive production to third-party suppliers. Supply-chain

[180] *See* Matthews et al., *supra* note 16, at 5840.
[181] *See id.*

emissions may escape regulatory pressure because they occur from a facility or activity that falls below regulatory thresholds in a country with carbon emissions limits, because they occur in a country without adequate limits, or because they occur in a country with limits but inadequate enforcement. Restricting the public or private carbon footprint boundary to the large industrial facilities in the U.S. or EU thus creates incentives to shift existing or new production to facilities or firms outside the scope of the public or private regulatory regime. These incentives can be expected to grow as private and public pressure for emissions reductions increases.

Several factors may reduce the leakage that is arising or will arise from the narrow firm boundary and thus also reduce the harm from the current narrow boundary. For example, the leakage may be limited by the transaction costs associated with shifting production from regulated facilities to firms or facilities that are unregulated or by inefficiencies in the production and transport of goods made by other firms or facilities. If the costs of contracting out the most carbon-intensive production exceed the costs of reducing or buying credits for emissions, leakage may not occur in the first place.

To deal with the leakage problem, domestic legal measures and international agreements have sought to include upstream provisions in cap-and-trade programs and impose allowance requirements for imported goods.[182] A number of proposed or adopted U.S. and EU trading schemes include upstream cap-and-trade elements, which could reduce incentives for domestic leakage from larger to smaller facilities. Although some of the proposed trading schemes also include allowance-holding requirements for importers, none has been included in an existing scheme, and the viability of these programs in the face of a trade challenge is uncertain.[183]

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[182] *See* Stavins, *supra* note 8, at 317–18 (describing comprehensive, upstream provision as an aspect of U.S. cap-and-trade program that will most effectively reduce leakage); *see also* NANCY OLEWILER, PAC. INST. FOR CLIMATE SOLUTIONS, A CAP AND TRADE SYSTEM FOR REDUCING GREENHOUSE GAS EMISSIONS IN BC 5–6 (2008) (describing an using an upstream point of regulation to deal with leakage, as used by the Western Climate Initiative), *available at* www.pics.uvic.ca/assets/pdf/Cap%20and%20Trade.pdf.

[183] *See* TREVOR HOUSER ET AL., PETERSON INST. FOR INT'L ECON., LEVELING THE CARBON PLAYING FIELD 31, *available at* http://pdf.wri.org/leveling_the_carbon_playing _field.pdf (referencing the debate over

B. *Leakage*

Experts disagree on the extent to which leakage is occurring and is likely to occur in the future, but many conclude that substantial leakage is likely in both cases. We examine the available studies that assess the evidence of leakage via outsourcing. We then turn to studies that attempt to predict the effects of carbon governance regimes.

1. *Recent Trends*

Although it is not possible to establish a causal link between carbon concerns and offshoring, the past decade has seen a significant rise in imports into the U.S. and EU of items associated with "energy-expensive" and "pollution-causing"[184] production processes, and several studies suggest a link between pressure on firms in industrialized countries to reduce emissions and production outsourcing. Although not directly linking regulatory programs to production outsourcing, Bin and Harriss conclude that 14 percent of China's 2003 emissions were generated in the production of goods for export to the U.S., and they conclude that net global carbon dioxide emissions increased by 720 million metric tons because of China's international trade.[185] The net increase is the product of more carbon-intensive production in China than in the importing country and carbon emissions associated with transportation over long distances. Weber points out that "[b]etween 1997 and 2004, imports into the U.S. increased

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"whether trade measures being discussed would pass WTO muster"); CAROLYN FISCHER & ALAN K. FOX, RES. FOR THE FUTURE, COMPARING POLICIES TO COMBAT EMISSIONS LEAKAGE: BORDER TAX ADJUSTMENTS VERSUS REBATES 2 (2009), *available at* http://ssrn.com/abstract=1345928 (recognizing "many trade law experts have concerns that such trade measures may not be compatible with World Trade Organization (WTO) obligations . . .").

[184] *See* Rhitu Chatterjee, *Outsourcing U.S. Greenhouse-Gas Emissions*, ENVTL. SCI. & TECH., June 13, 2007, at 4834, *available at* http://www.sehn.org/tccOutsourcingUSgreenhousegasemissions.html.

[185] *See* Shui Bin & Robert C. Harriss, *The Role of CO2 Embodiment in US-China Trade*, 34 ENERGY POL'Y 4063, 4066 (2006); *see also* Joseph Kahn & Mark Landler, *China Grabs West's Smoke-Spewing Factories*, N.Y. TIMES, Dec. 21, 2007, at A1, *available at* http://www.nytimes.com /2007/12/21/world/asia/21transfer.html (concluding that China "produces and exports so many goods once made in the West that many wealthy countries can boast of declining carbon emissions, even while the world's overall emissions are rising quickly").

by 128 percent, most of which were energy-expensive, pollution-causing products, such as electric and electronic goods, machinery, and equipment," and attributes U.S. success in curbing emissions relative to consumption to this increase in imports.[186]

A similar pattern has been observed in the United Kingdom. UK emissions were 15 percent below 1990 levels by 2005, a performance that exceeded the UK's Kyoto obligations.[187] According to Watson and Moll, however, "the same products are being consumed but the UK is increasingly importing the more pressure-intensive of these [products]."[188] Watson and Moll conclude that the emissions reductions are largely the result of outsourcing the most carbon intensive extraction and production processes to developing countries such as China.[189] They also conclude that "[i]f all the GHG emissions associated with the life cycle of goods which are consumed in the UK were added up and monitored over time, UK-driven GHG emissions" would have increased 19 percent between 1990 and 2006.[190] Recent studies have shown similar statistics for Sweden, Norway, and other developed countries.[191]

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[186] Chatterjee, *supra* note 184, at 4834 (citing Christopher L. Weber & Scott H. Matthews, *Embodied Environmental Emissions in U.S. International Trade, 1997-2004*, ENVTL. SCI. & TECH., June 13, 2007). The view that decreases in the industrialized world's emissions have come as a result of outsourcing production overseas is not universal. Although addressing air pollution generally, not carbon emissions, Levinson concludes that changes in technology, not the mix of goods produced, accounts for most of the decline in pollution from US manufacturing. ARIK LEVINSON, RES. FOR THE FUTURE, TECHNOLOGY, INTERNATIONAL TRADE, AND POLLUTION FROM U.S. MANUFACTURING 12 (2007), *available at* http://ssrn.com/abstract=1007305.

[187] DAVID WATSON & STEPHAN MOLL, ENVIRONMENTAL BENEFITS AND DISADVANTAGES OF ECONOMIC SPECIALISATION WITHIN GLOBAL MARKETS, AND IMPLICATIONS FOR SCP MONITORING 2 (2008), *available at* http://eea.eionet.europa.eu/Public/irc/eionet-circle/etc_waste/library?l=/namea_report/watson_score_paperpdf/_EN_1.0_&a=d.

[188] *Id.*

[189] *Id.*

[190] *Id.*; *see also* Bin & Harriss, *supra* note 185, at 4066 (noting a similar increase of 12 percent for the U.S. based on the life cycle of U.S.-driven GHG emissions).

[191] WATSON & MOLL, *supra* note 187, at 2. Chatterjee explicitly draws a link between regulation of industry and outsourcing of production, but does not specifically cite carbon caps or reporting as the catalyst moving production outside of reporting regimes. He asserts "over the last two decades . . . industries in industrialized countries" have moved "to developing countries to avoid strict safety and health regulations." Chatterjee, *supra* note 184, at 4834. *See also* Andrew Schatz, Note, *Regulating Greenhouse Gases by Mandatory Information*

2. *Future Leakage*

Multiple studies have attempted to predict future leakage rates under various carbon reporting and allowance-holding programs, but many suggest that it may be roughly 10 to 20 percent of targeted country emission reductions.[192] Some estimates are much higher. For example, Babiker suggests that under emissions caps, "significant relocation of energy-intensive industries away from the OECD may occur, depending on the type of market structure, with leakage rates as high as 130 percent, in which case GHG control policies in the industrialized countries actually lead to higher global emissions."[193]

Other researchers have focused on the U.S. and have reached similar conclusions. Ho, Morgenstern, and Shih estimate a 25 percent leakage rate for U.S. emissions reductions given a $10 per ton carbon dioxide price. The leakage figure reaches as high as 40 percent for energy-intensive industries such as chemicals, nonmetallic mineral products, and primary metals.[194] Fischer and Fox estimate leakage by sector ranging as low as 8 percent in electricity; 11 percent for pulp, paper, and print industries; and 14 percent for iron and steel.[195] However, they estimate higher percentages for energy-intensive goods, such as 20 percent for the chemicals sector, 39 percent for nonmetallic minerals, and as much as 64 percent for refined petroleum products.

Disclosure, 26 VA. ENVTL. L.J. 335, 357–58 (2008).

[192] Brian C. Murray et al., *Estimating Leakage From Forest Carbon Sequestration Programs* 2–3 (Research Triangle Institute, Working Paper 02_06, 2002), *available at* http://weber.ucsd.edu/~carsonvs/papers/817.pdf. For example, several years ago, the IPCC studied the leakage potential from industrialized to developing countries, and concluded that leakage "in the order of five–twenty percent" was possible. IPCC, SUMMARY FOR POLICYMAKERS—CLIMATE CHANGE 2001: MITIGATION 11 (2001), *available at* http://www.ipcc.ch/ipccreports/tar/wg3/pdf/WG3_SPM.pdf. The IPCC also found that "[a]ctual leakages are likely to be small. Leaky emissions reduction appears to be more of a diversionary tactic rather than a real reason for industrialized nations to withhold support for action on climate change." KEVIN A. BAUMERT & NANCY KETE, WORLD RES. INST., WILL THE KYOTO PROTOCOL DRIVE INDUSTRY TO DEVELOPING COUNTRIES? 2 (2002), *available at* http://earthtrends.wri.org/pdf_library/feature/cli_fea_carbon.pdf.

[193] Mustafa H. Babiker, *Climate Change Policy, Market Structure, and Carbon Leakage*, 65 J. INT'L ECON. 421, 421 (2005).

[194] MUN S. HO ET AL., RES. FOR THE FUTURE, IMPACT OF CARBON PRICE POLICIES ON U.S. INDUSTRY at iv (2008), *available at* http://www.rff.org/Publications/Pages/PublicationDetails.aspx?PublicationID=20680.

[195] FISCHER & FOX, *supra* note 181, at 19.

The leakage studies do not reach uniform conclusions. For example, an Australian study conducted for The Climate Institute concludes that carbon leakage "is likely to be partial and has been widely exaggerated."[196] The Carbon Trust recently released a study that "quantifies, for the first time, the impact of the EU emissions trading scheme (EU ETS) on business competitiveness across the UK at a business sub-sector level."[197] The study concludes that "UK and EU competitiveness will not be damaged" as "'leakage' . . . is likely to represent no more than one per cent of total EU CO_2 emissions."[198]

For the most part, however, these studies suggest that a substantial amount of leakage may already be occurring and may occur in the future in certain industries, although disagreements exist about the extent of the problem. Importantly, many existing studies rely upon data that are now nearly ten years old (and in some cases older) and are hence based on outdated production figures for the developing economies. Moreover, previous models of leakage in the context of exports (e.g., NAFTA) have proven highly unreliable, often dramatically underestimating the amount of leakage that would occur.[199] Part of the difficulty in predicting the effect of NAFTA was the fact that the models cannot adequately predict large changes in trade in sectors that previously had little or no trade.[200]

None of this demonstrates a cause-and-effect relationship, but combined with the simple logic that placing a price on carbon through private or public measures will induce firms to reduce costs, it suggests that boundary-induced leakage is a substantial

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[196] Lenore Taylor, *Warning over ETS Windfalls for Industry*, AUSTRALIAN, Sept. 18, 2008, http://www.theaustralian.news.com.au/story/0,25197,24363386-5013871,00.html.

[197] Press Release, The Carbon Trust, EU ETS To Have Marginal Impact on Competitiveness of EU Industry (Jan. 15, 2008), *available at* http://www.carbontrust.co.uk/news/news/archive/2008/Pages/EU_ETS.aspx.

[198] *Id.*

[199] TIMOTHY J. KEHOE, FED. RESERVE BANK OF MINNEAPOLIS RESEARCH DEP'T STAFF REPORT 320, AN EVALUATION OF THE PERFORMANCE OF APPLIED GENERAL EQUILIBRIUM MODELS OF THE IMPACT OF NAFTA 1–3 (2003), *available at* http://www.econ.umn.edu/~tkehoe/papers/NAFTAevaluation.pdf.

[200] *Id.* at 18 (citing the example of Canada, where exports of motor vehicles jumped from 0.01 percent of Canadian exports to Mexico in 1988, to 5.06 percent in 1999, and where aluminum went from 0 percent to 1.33 percent). A model based on previous production and demand is unlikely to predict such changes.

concern today. Moreover, the economic and social cost to firms of carbon emissions is likely to increase, at least in developed countries, through the expansion of public cap-and-trade schemes and the tightening of caps. Even if only 10 to 20 percent leakage occurs, this could have serious adverse effects on the ability to reduce global emissions by 50 to 80 percent or more.

In addition, leakage in the 10 to 20 percent range may generate substantial economic incentives for China and other major developing countries to resist adoption of a post-Kyoto agreement with mandatory emissions limits for all countries.[201] Not only does the potential for leakage to China reduce its incentive to agree to mandatory limits, but since a large portion of emissions are likely to come from TVEs and other small sources, this further exacerbates China's incentives. This large share from small sources will pose a particular challenge for any Chinese regulatory response, since small sources are likely to fall below most thresholds for cap-and-trade schemes, making it even harder for China to meet overall targets and putting further pressure on their large industrial facilities.

IV. A BROADER BOUNDARY

For the purposes of this article, we assume that a new corporate carbon footprint boundary should achieve three objectives: environmental effectiveness, economic effectiveness, and distributional justice.[202] To enhance environmental effectiveness, the new carbon disclosure strategy should reduce existing incentives for leakage and create new incentives for private firms, and ultimately the major developing countries, to reduce emissions. To enhance economic effectiveness, it should do so at low cost. To achieve distributional justice, it should have a favorable impact on poverty levels in developing and developed countries as compared to alternative strategies. To achieve

[201] If China commits to mandatory emissions reductions, it will be forced to confront its total national emissions, including emissions from both large industrial facilities and TVEs and other small sources, which make up a large portion of Chinese emissions. This large share from small sources will pose a particular challenge for any Chinese regulatory response, since small sources are likely to fall below most thresholds for cap-and-trade schemes.

[202] *See* Stavins, *supra* note 8, at 303 (including environmental effectiveness, cost effectiveness, and distributional equity as three criteria for cap–and-trade policies).

widespread firm behavior change, the Coasian literature suggests the value of clear entitlements, adequate information, and opportunities for monitoring and enforcement.

Our proposed disclosure strategy should be compared to other strategies that have a genuine prospect of influencing the incentives of the major developing countries in the near term. The list of viable strategies that have been discussed in the literature to date (e.g., additional headroom allowances, subsidies, border adjustments, and moral suasion) is remarkably short given the importance of promptly reversing the rapid growth trend in developing country emissions.

A. *Proposed Carbon Disclosure Strategy*

The key elements of our carbon disclosure strategy are as follows:

Supply-Chain Reporting. Public and private reporting schemes in the U.S. and EU should be expanded to require reporting of carbon emissions from the supply chain. The reporting should be required of third party suppliers and firm facilities without regard to whether the supplier or facility is domestic or foreign.[203] The requirement need not be to report all carbon emissions, but it should require a good faith effort to include the substantial majority of all emissions. Although stipulating a threshold (e.g., 80 or 90 percent of supply chain emissions) in theory assumes that a first assessment has been performed to determine total emissions, reasonable judgment can be used to assess whether the estimate includes the substantial majority of all emissions and the judgment can be verified by a third party.[204]

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[203] For some purposes, it is important to know carbon emissions throughout the supply chain. For international accounting purposes, we also need a measure of country-by-country emissions, however. Thus, reporting regimes would need to report supply chain emissions separately.

[204] A wide range of techniques can be used to increase the likelihood of accurate reporting. *See infra* notes 211–212 and accompanying text. An example of efforts to develop effective supply chain carbon reporting standards is the Scope 3 Accounting and Reporting Standards under development by WRI and the World Business Council as a part of the long-term effort to develop and refine the Greenhouse Gas Protocol. *See* Bill Pritchard, *Companies Testing Standards for Measuring Emissions from Products, Supply Chains*, BNA DAILY ENV'T REP., Jan. 21, 2010, at A11 (noting that sixty foreign and U.S. firms in twenty industry sectors are testing the proposed new standards); *see also* GHG PROTOCOL INITIATIVE, SCOPE 3 ACCOUNTING AND REPORTING STANDARD,

Private schemes can be adopted quickly based on the experience with calculating supply chain contracting emissions of a number of firms under the CDP, GRI, and other schemes. Public schemes at the national and sub-national level in the U.S. and EU may take more time, but they also can be adopted fairly quickly. Although in some cases statutory changes will be necessary, in many cases the federal and state public regulatory agencies already have or are likely to be given the statutory authority in the near future to apply the broader carbon footprint boundary we recommend. For example, the congressional directive for the EPA to develop a reporting regulation gives the agency broad discretion to establish the facility boundary.[205] Similarly, the Waxman-Markey and Lieberman-Warner bills would give the EPA broad discretion to establish a corporate carbon reporting boundary that adds reporting requirements for facilities that emit less than the statutory thresholds.[206] The adoption should occur quickly given the time necessary for implementation of reporting schemes. Speed also is important because several of the major developing countries are shifting toward domestic consumer-driven economies and are moving away from export-driven economies.[207] Although export pressure will continue to be influential, the major developing countries may become less dependent on foreign trade and less responsive to export market pressures over the next several decades.

Product Labeling. We also propose the development and expansion of public and private product carbon labeling programs in the U.S., EU, and other developed countries. Product carbon labeling will draw on much of the same data as corporate carbon footprints, and the two disclosure modes will be mutually supportive, enhancing the extent to which firm and product reporting can be compared and verified. The feasibility of product carbon labeling has been demonstrated by Timberland and other

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REVIEW DRAFT FOR STAKEHOLDER ADVISORY GROUP (2009), *available at* http://www.ghgprotocol.org/files/ghg-protocol-scope-3-standard-draft-for-stakeholder-review-november-2009.pdf.

[205] *See* Consolidated Appropriations Act of 2008, Pub. L. No. 110-161, 121 Stat. 1844 § 285 (2007).

[206] *See* American Clean Energy and Security Act, H.R. 2454, 111th Cong. § 714(b)(2)(B)(ii) (as passed by House of Representatives, June 26, 2009); Climate Security Act, S. 2191, 110th Cong. § 1103(a) (2008).

[207] Worldwatch Institute, Moving Toward a Less Consumptive Economy, http://www.worldwatch.org/node/812 (last visited Mar. 27, 2010).

companies in the U.S., and it is widespread among firms in the UK and Europe.[208] For example, Tesco and other major grocers in the UK have announced goals of carbon labeling all products within several years.[209] Japan launched a labeling program in April 2009,[210] and other countries are developing or considering labeling programs.[211]

As with corporate carbon footprints, product carbon labeling schemes should be applied to products without regard to country of origin, and standards should be developed to enable reasonable, good faith, comparable, and verifiable estimates to be made. Limits can be placed on the scope of the required reporting to the extent necessary to speed adoption and reduce transaction costs. For example, a default level of emissions could be established by type of product, size of facility, or production process based on the "worst in class" in order to provide an incentive for firms to verify their superior performance when it is in their financial interest to do so (i.e., when the potential benefits in terms of increased product demand exceed the costs of testing and verification). This would reduce the burden of the labeling standards in a way that allows for speedy and efficient adoption. In addition, the label should be designed to reflect the best social science regarding the influence of label design on consumer behavior.[212]

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[208] Perhaps two numbers should be generated: (1) a total of emissions associated with the product, which will facilitate consumer preference satisfaction; and (2) a total associated with the product that is not otherwise accounted for by another facility, which will facilitate efficient public regulatory carbon emissions reductions schemes and private shareholder and other pressure without double-counting.

[209] *See* Vandenbergh, *supra* note 22, at 941.

[210] *See, e.g.*, RICHARD H. THALER & CASS R. SUNSTEIN, NUDGE: IMPROVING DECISIONS ABOUT HEALTH, WEALTH, AND HAPPINESS 261 (2d ed. 2009) (noting the potential importance of carbon labels).

[211] *See, e.g.*, Posting of James Kanter to *N.Y Times* Green Inc. Blog, *Do You Want to See a Carbon Label on Your Food and Drink?* (Oct. 11, 2007, 10:57 EST) http://greeninc.blogs.nytimes.com/2007/10/11/do-you-want-to-see-a-carbon-label-on-your-food-and-drink/?scp=1&sq=carbon%20labeling%20france&st=cse (noting that the French government is seeking mandatory labeling within three years).

[212] *See generally* W. KIP VISCUSI, PRODUCT RISK LABELING: A FEDERAL RESPONSIBILITY (1993). *See also* Abhijit Banerjee & Barry D. Solomon, *Eco-Labeling for Energy Efficiency and Sustainability: A Meta-Evaluation of US Programs*, 31 ENERGY POL'Y 109, 109 (2003) (suggesting that government programs are often more successful than private programs and simple seals are more effective than complicated information).

In theory, the label should include the anticipated carbon emissions from the use of the product, not just from its production and sale. This would require a lifecycle assessment that would involve making judgments about product usage. Such an analysis would require additional assumptions about consumer-related factors such as frequency of use, life expectancy, misuse, or use for unintended purposes that might not be universal across consumers (especially in different countries). If the product operated on electricity, it would also require assumptions about the carbon intensity of local electricity production. This is not unlike the analysis that goes into Energy Star labels that attempt to calculate a typical annual cost of energy consumption for products.[213] Although this is our preferred approach, the urgency of developing a carbon labeling scheme that influences suppliers beyond the reach of current regulatory schemes is sufficiently great that labeling requirements should not wait to overcome the cost and resistance that estimates of emissions from usage are likely to generate.

In combination, these two carbon disclosure instruments will have the effect of expanding firm carbon reporting boundaries, thus helping to shape and clarify emerging norms regarding corporate carbon emissions to include carbon emissions arising throughout the supply chain. Disclosure will address current limitations in available information about carbon emissions, enabling customers, NGOs, investors, employees, managers, and others to understand, compare, and act based on the carbon profile of firms and products. The carbon disclosure strategy should complement, not displace, cap-and-trade headroom allowances, subsidies, moral suasion, and other means of inducing developing countries to reduce emissions.

B. *Environmental Effectiveness*

To meet the environmental effectiveness objective, our carbon disclosure strategy should be reasonably easy to adopt and implement. It also should reduce firm incentives to offshore carbon-intensive production, facilitate social license pressure on firms to impose requirements on suppliers, reduce supplier

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[213] *See* ENERGY STAR, How a Product Earns the ENERGY STAR Label, http://www.energystar.gov/index.cfm?c=products.pr_how_earn (last visited Mar. 29, 2010).

emissions, and provide positive incentives for major developing countries to reduce their carbon emissions.

Viability. How viable is our proposed carbon disclosure strategy? Of course, if policymakers give climate mitigation low priority and urgency, any remedy with some political and economic costs will be rejected. For those policymakers who are seeking to reduce carbon emissions from developed and developing countries at low cost, however, the question is how a carbon reporting regime compares to other viable options.[214] Further work will be required to evaluate the costs and efficacy of various options, but our carbon disclosure strategy is likely to fall on the low end of the cost spectrum, to be among the least intrusive options, to reach across national boundaries without triggering sovereignty concerns, and to have a low risk of leading to trade protectionism complaints.

At the federal level, broad boundaries inevitably will trigger opposition from industry sectors that have a comparative disadvantage based on their current production patterns, and it will be necessary to demonstrate that supply chain emissions can be calculated at costs that do not overwhelm the benefits of reduced leakage. Nevertheless, if some form of cap-and-trade scheme is seen as inevitable at the federal level, industry could view broad boundaries as the best way to retain a competitive posture while inducing China and other developed countries to reduce emissions. States and local governments could view adoption of a broad boundary in the interim as a means to stimulate the development of a more efficient and effective federal and global system. If alternative mechanisms such as emission taxes or consumption taxes regain serious consideration, broader boundaries will have similar benefits.

An additional comparative advantage of the carbon disclosure strategy is that it can begin in the short term, in some cases with a minimum of government action. Private carbon labeling programs exist now and a recently announced major new sustainability label

[214] We do not argue that a social license-driven approach is the most efficient option, only that it is one of the few viable approaches that have the prospect of prompt, substantial carbon emissions reductions at low cost. *See* Eric A. Posner, *Law, Economics, and Inefficient Norms*, 144 U. PA. L. REV. 1697, 1743 (1996) (concluding that legislatures and courts often generate rules that are more efficient than group norms).

project may accelerate policy development in this area.[215] The efforts of numerous private governance organizations and firms demonstrate that carbon labeling of consumer goods is possible. In addition to investor-based institutions such as the CDP, some organizations have already begun to rate branded products by their carbon footprint in an effort to affect consumer behavior.[216] As discussed above, Tesco, in partnership with the Carbon Trust, has created a consumer label that states how many grams of carbon or equivalent greenhouse gases were emitted as a result of growing, manufacturing, transporting, and storing the individual product.[217] The label also takes into account the impact of preparing, using, and disposing of the good. Some labels also include a carbon comparison guide for other similar products and tips on how to reduce the item's carbon footprint. An emerging online tool for carbon ratings is GoodGuide.com.[218] GoodGuide currently includes the health, environmental, and social impacts of rated products and plans to include carbon comparisons in the future.[219] More reliable and consistent data would facilitate such private efforts. Existing green labeling programs can also be expanded or reshaped to place a greater emphasis on carbon emissions.[220] Public labeling initiatives are likely to take longer, but the Waxman-Markey bill already includes a provision that would

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[215] *See* Miguel Bustillo, *Wal-Mart to Assign New 'Green' Ratings – Labeling Program Requires All Suppliers to Calculate and Disclose the Environmental Costs of Producing Goods*, WALL ST. J. (Brussels), July 17, 2009, at 4; *see also* Marc Gunther, *Wal-Mart to Become Green Umpire*, BIG MONEY, July 13, 2009, http://www.thebigmoney.com/articles/judgments/2009/07/13/wal-mart-become-green-umpire (noting major sustainability index label effort with researchers from Duke, Harvard, Stanford, and the University of California-Berkeley).

[216] *See, e.g.*, Good Guide, www.goodguide.com (last visited Aug. 4, 2009).

[217] Tesco, Rolling Out Carbon Labeling, http://www.tesco.com/greenerliving/greener_tesco/what_tesco_is_doing/carbon_labelling.page? (last visited Mar. 28, 2009); *see also* Carbon Trust, The Carbon Reduction Company, http://www.carbon-label.com (last visited Mar. 27, 2010).

[218] *See* Good Guide, *supra* note 216.

[219] *Id.*

[220] *See, e.g.*, A Carbon Label for California, http://www.carbonlabelca.org (last visited Mar. 27, 2010); New York State Environmental Disclosure (Label) Program, http://www.dps.state.ny.us/EnvDisclosureLabel.html (last visited Mar. 27, 2010); *see also* KATHERINE N. PROBST, RES. FOR THE FUTURE, COMBATING GLOBAL WARMING ONE CAR AT A TIME: CO_2 EMISSIONS LABELS FOR NEW MOTOR VEHICLES 1 (2006), *available at* http://www.rff.org/rff/News/Features/upload/21680_1.pdf.

require EPA to study product carbon labeling.[221]

Social License Pressure. Our proposal for both corporate-level disclosure and product labeling will likely affect the contours of the carbon constraint in the social license to operate, as well as stakeholder monitoring and enforcement of the carbon constraint.[222] Carbon labels and corporate carbon footprints may influence firm decision-making by directly influencing consumer purchasing decisions. In addition, firms may respond to legitimacy or reputational concerns arising from reactions by customers, NGOs, investors, and community members, and to the prescriptive norms of firm employees and managers.[223] For example, NGOs have successfully used environmental information to organize boycotts, which have influenced firm decision-making in a number of areas.[224]

As to the effects of corporate carbon footprints, empirical studies have not yet evaluated the influence of carbon disclosure

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[221] American Clean Energy and Security Act, H.R. 2454, 111th Cong. § 274 (as passed by House of Representatives, June 26, 2009).

[222] *See, e.g.*, Richard H. McAdams, *The Origin, Development, and Regulation of Norms*, 96 MICH. L. REV. 338, 349, 392–97 (1997) (noting the effect of laws on norm formation and enforcement). The research and standards developed by CDP, GRI, and other private carbon reporting schemes suggest that it is feasible to calculate the carbon emissions from a firm and its suppliers. In addition, a number of firms have done so, including more than half a dozen firms that report Scope 3 carbon emissions to the CDP.

[223] *See, e.g.*, Shih-Chi Chiu & Mark Sharfman, *Legitimacy, Visibility, and the Antecedents of Corporate Social Performance: An Investigation of the Instrumental Perspective*, 20 J. MGMT. 1, 5 (2009) (noting the importance to firms of maintaining organizational legitimacy). Although environmental information strategies face limitations, *see, e.g.*, Richard B. Stewart, *A New Generation of Environmental Regulation?*, 29 CAP. U. L. REV. 21, 141 (2001), a number of studies suggest that they can have substantial effects on firm behavior. *See, e.g.*, Dara O'Rourke, *Outsourcing Regulation: Analyzing Nongovernmental Systems of Labor Standards and Monitoring*, 31 POL'Y STUD. J. 1 (2003) (noting effects of shareholder activism against multinationals on labor standards of supply chain contractors); Debora Spar & L.T. LaMure, *The Power of Activism: Assessing the Impact of NGOs on Global Business*, 45 CAL. MGMT. REV. 78, 82–5 (2003) (noting the effect of shareholders, NGOs, and consumers on environmental conduct of supply chain contractors).

[224] *See generally, e.g.*, MONROE FRIEDMAN, CONSUMER BOYCOTTS: EFFECTING CHANGE THROUGH THE MARKETPLACE AND THE MEDIA (1999); Dennis E. Garrett, *The Effectiveness of Marketing Policy Boycotts: Environmental Opposition to Marketing*, 51 J. MARKETING 46 (1987); David P. Baron, *Private Politics and Private Policy: A Theory of Boycotts* 2–3, 33 (Stanford Univ. Graduate Sch. of Bus., Working Paper No. 1766, 2002) *available at* http://ssrn.com/abstract=367261 (noting the use of market pressure tactics by NGOs and their effects on firm international behavior).

on firm carbon emissions, but the size of the corporate voluntary carbon offset market and anecdotal accounts suggest that firms are experiencing social license pressures to reduce carbon emissions long before formal legal requirements are adopted.[225] In addition, in a roughly analogous setting, firms that were identified in Toxics Release Inventory data releases as being among the highest emitters of toxic chemicals in their industrial sectors experienced an abnormal negative effect on firm stock value.[226] Despite the absence of a legal requirement to reduce emissions, the firms subsequently reduced emissions more than those who were among the lowest emitters, and the reductions occurred even though the emissions reductions were not legally mandated.[227]

The effect of corporate carbon footprint disclosure on retail consumer behavior is likely to be limited, but additional pressure may arise from corporate customers, NGOs, and investors. Studies demonstrate that substantial pressure for improved firm environmental behavior arises from individual investors, public pension funds, and socially responsible investment (SRI) funds.[228] Public pension funds hold over $2.2 trillion in assets, or 33 percent of all U.S. pension assets.[229] Many firms have been the subject of

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[225] *See*, *e.g.*, Therese Dunphy, *Embracing Sustainability*, AGGREGATES MANAGER, May 1, 2008, *available at* http://www.aggman.com/embracing-sustainability ("Mindful of the importance of maintaining their social license to operate, many aggregate companies include sustainability and sustainable development among their core values.").

[226] *See* James T. Hamilton, *Pollution as News: Media and Stock Market Reactions to the Toxics Release Inventory Data*, 28 J. ENVTL. ECON. & MGMT. 98, 108–109 (1995); Konar & Cohen, *supra* note 78, at 109; *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 Toxic Release Inventory analogues); Mark A. Cohen, *Empirical Research on the Deterrent Effect of Environmental Monitoring and Enforcement*, 30 ENVTL. L. REP. 10,245, 10,250 (reviewing empirical literature); Winston Harrington, *Enforcement Leverage When Penalties Are Restricted*, 37 J. PUB. ECON. 29, 49 (1988) (noting threat of bad publicity may incentivize firms to comply in the absence of penalties).

[227] *See* Konar & Cohen, *supra* note 78.

[228] *See* Jason Scott Johnston, *Signaling Social Responsibility: On the Law and Economics of Market Incentives for Corporate Environmental Performance* 88–91 (Univ. of Pa. Law Sch., Inst. for Law & Econ., Research Paper No. 05-16, 2005), *available at* http://ssrn.com/abstract=725103 (reviewing studies of the effects of socially responsible investors).

[229] Mary L. Shapiro, Chairman, U.S. Sec. & Exch. Comm'n, Statement at

shareholder resolutions seeking corporate carbon disclosure in recent years, and a number of them have been withdrawn after the firm agreed to take additional disclosure or emissions reduction steps.[230]

Corporate carbon footprint disclosure also may affect the extent of social license pressure from other sources. Firms respond to the norms of community members upon whom the firm depends for goodwill, including neighbors and community leaders with whom company employees and managers may interact on a frequent basis, and local government officials who may influence future permitting, zoning, and other approvals.[231] The norms of employees and managers whose recruitment and retention is important to the firm's economic success also appear to be influential.[232] Although the extent of these social license pressures is often difficult to discern, studies suggest that they are common and affect firm environmental behavior when they occur.[233]

As to the effects of product carbon labels, there is growing support for the proposition that carbon labeling induces firms to reduce carbon emissions.[234] The extent of the direct consumer

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SEC Open Meeting (July 22, 2009), *transcript available at* http://www.sec.gov/news/speech/2009/spch072209mls.htm.

[230] *See* Press Release, CERES, Investors Achieve Major Company Commitments on Climate Change: First-Ever Majority Vote, Tougher Mountaintop Removal Scrutiny, Cancelled Coal Plants Among Highlights (Aug. 24, 2009), *available at* http://www.ceres.org/Page.aspx?pid=1121 ("A record 68 climate-related shareholder resolutions were filed by investors [in 2009], of which 31 were withdrawn after the companies agreed to positive climate-related commitments.").

[231] *See* Neil A. Gunningham, Dorothy Thornton & Robert A. Kagan, *Motivating Management: Corporate Compliance in Environmental Protection*, 27 LAW & POL'Y 289, 300–07 (2005) (giving example of actions taken by firms in the chemical industry to preserve their goodwill).

[232] *See, e.g.*, Raymond Paternoster & Sally Simpson, *Sanction Threats and Appeals to Morality: Testing a Rational Choice Model of Corporate Crime*, 30 L. & SOC'Y REV. 549, 575–76 (1996) (reporting results of a study of firm managers and concluding that when moral beliefs are strong, other factors were "virtually superfluous"); Michael P. Vandenbergh, *Beyond Elegance: A Testable Typology of Social Norms in Corporate Environmental Compliance*, 22 STAN. ENVTL. L.J. 55, 76–78, 81–117 (2003) (discussing empirical literature on influence of environmental norms on environmental decision-making).

[233] *See* Cohen, *supra* note 226, at 10,250 (noting research on social influences on firm behavior).

[234] *See* CARBON TRUST, PRODUCT CARBON FOOTPRINTING: THE NEW BUSINESS OPPORTUNITY 2 (2008), http://www.carbontrust.co.uk/publications/pages/home.aspx (search "carbon label;" then follow "Product Carbon Footprinting: The New Business Opportunity Pack CTC744" hyperlink).

influence is unclear, but firms appear to respond in a much more complex way than simply by reacting to immediate changes in consumer purchasing behavior. Actual shifts in consumer purchasing appear to be only a part of the influence on firm behavior. Many firms are risk-averse and appear to act to protect legitimacy, reputation, and brands even when changes in consumer behavior are uncertain.[235] For this reason, disclosure requirements may affect actual emissions even if they do not have prompt effects on consumer purchasing behavior. NGOs take advantage of this phenomenon by targeting firms regarding their purchasing policies directly rather than focusing on promoting consumer activism.[236] Thus, the effectiveness of a consumer labeling strategy may turn more on the potential for long-term consumer and stakeholder responses than on immediate changes in consumer purchasing behavior, an important point because the literature on green consumer behavior is mixed.

On the one hand, U.S. consumers have demonstrated only

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[235] *See* Auld et al., *supra* note 21, at 425–26. Recent studies on the effect of New York restaurant disclosure standards on consumer food purchases and diet have been mixed. *Compare* Julie S. Downs et al., *Eating by the Numbers*, N.Y. TIMES, Nov. 13, 2009, at A31 (concluding that few changes occurred in consumer food purchasing decisions), *with* Julie S. Downs et al., *The Psychology of Food Consumption: Strategies for Promoting Healthier Food Choices*, 99 AM. ECON. REV.: PAPERS & PROC., 159, 159–60 (2009) (stating that studies show that food labeling alone does little to improve diet); *compare also* Brian Ebel et al., *Calorie Labeling and Food Choices: A First Look at the Effects on Low-Income People in New York City*, 28 HEALTH AFF. w1110, w1114–17 (Oct. 6, 2009) (discussing studies of food labeling in New York City and Newark indicating no impact on calorie consumption), *with* David Morgan, *New York Study Says Menu Labeling Affects Behavior*, REUTERS, Oct. 26, 2009, http://www.reuters.com/assets/print?aid=USTRE59P4O720091026 (reporting on results of study finding changes in consumer food purchasing decisions). The most important effects may be on the long-term decision-making by restaurant managers about the caloric content of the foods sold at the affected restaurants, however.

[236] For a discussion of the importance of corporate customers on firm environmental policies, see Auld et al., *supra* note 21, at 425. A possible example of the outcome of this strategy is that NGOs obtained commitments from many major grocers (Albertsons, Food Lion, Kmart, Safeway, and Wal-Mart) and restaurants (Long John Silvers, Red Lobster, Subway, Olive Garden, Carl's Junior, and Walt Disney) to sell only dolphin-safe tuna despite the absence of specific consumer boycotts or other activities in many cases. *See* Defenders of Wildlife, Dolphin-Safe Retailers, http://www.defenders.org/programs_and_policy/habitat_conservation/marine/dolphin-safe_tuna/take_action/dolphin-safe_retailers.php (last visited Mar. 2, 2010).

limited willingness to pay more for green goods,[237] often opting for goods with green characteristics only if the price and other key features are very similar or the price premium is small.[238] In addition, the profusion of labels has generated "label confusion" and "label fatigue."[239] On the other hand, as the remarkable growth of organic and fair trade foods demonstrates, a large and growing segment of the retail market appears to be willing to pay a premium for environmentally preferable goods.[240] Studies also have found that Europeans are willing to pay somewhat more than Americans for goods with ecolabels.[241] In addition, many

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[237] Wesley Nimon & John Beghin, *Are Eco-Labels Valuable? Evidence from the Apparel Industry* 17 (Iowa State Univ. Ctr. for Agric. & Rural Dev. Working Paper 99-WP 213, 1998) (finding that consumers would pay a premium for clothing with organic fiber label, but not for labels indicating "no-dye").

[238] *See, e.g.*, 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 when priced at a 2 percent premium, wood products with eco-labels do not outsell others); Roy C. Anderson & Eric N. Hansen, *The Impact of Environmental Certification on Preferences for Wood Furniture: A Conjoint Analysis Approach*, 54 FOREST PROD. J., Mar. 2004, at 42, 48 (demonstrating that compared to price, wood origin is relatively unimportant to consumers of wood furniture); Paul C. Stern, *Information, Incentives, and Proenvironmental Consumer Behavior*, 22 J. CONSUMER POL'Y 461, 467–68 (1999) (noting limited consumer response to many green appeals).

[239] *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 DISTRIBUTION RESEARCH 95, 96 (2003); Morten Scholer, Senior Market Dev. Adviser, Int'l Trade Centre, Presentation at 13th Int'l Fed. of Organic Agric. Movements Scientific Conference, Basel, Switzerland (August 2000), *summary available at* http://www.intracen.org/mds/coffee_certification.htm ("Coffees can be labeled (1) organic, (2) Fair Trade and (3) Bird Friendly. This has created a certain label confusion and label fatigue among consumers.").

[240] *See, e.g.*, Jeffrey R. Blend & Eileen O. van Ravenswaay, *Measuring Consumer Demand for Ecolabeled Apples*, 81 AM. J. AGRIC. ECON. 1072, 1076 (1999) (concluding that over 40 percent of households would be willing to pay a $0.40 price premium for ecolabeled apples); Brian Roe et al., *US Consumers' Willingness to Pay for Green Electricity*, 29 ENERGY POL'Y 917, 924 (2001) (concluding that "a wide array of population segments are willing to pay small amounts for tangible improvements in air emissions" and that "for certain population segments only, larger premiums may be obtained . . ."); *see also* Andrew Downie, *Fair Trade In Bloom*, N.Y. TIMES, Oct. 2, 2007, at C1 (noting that demand for fair trade coffee has grown among consumers and is sold at Sam's Club, Dunkin Donuts and other non-specialty stores); Amanda Little, *Don't Discount Him: An Interview with Wal-Mart CEO H. Lee Scott*, GRIST.COM, Apr. 12, 2006, http://www.grist.org/news/maindish/2006/04/12/griscom-little/index.html (noting Wal-Mart's growing selection of organic products).

[241] *See, e.g.*, Thomas Bue Bjørner et al., *Environmental Labeling and Consumers' Choice—An Empirical Analysis of the Effect of the Nordic Swan*, 47

consumers do not appear to view some purchases as a matter of the comparative cost of the good. Instead, in some cases, they view firms and products in a moral light, and if a firm or product is viewed as "bad," many customers will shun them with little regard to cost.[242] NGOs have relied on customers' prescriptive norms and tendency to categorize firms and products in absolute terms in organizing successful boycotts and information campaigns directed at the reputation of a firm or industry sector.[243]

In addition, consumer concerns about environmental harms appear to have very strong effects on product choices when an environmental issue becomes particularly salient and is linked in the media to consumer behavior, as climate change may become at some point in the future. For example, concern about dolphin deaths devastated consumer markets in the U.S. for canned tuna in the late 1980s, until the "dolphin-safe tuna" label helped revive the canned tuna market in the 1990s.[244] The consumer response also may have contributed to supply chain pressures that resulted in improvements in tuna fishing practices: annual premature dolphin deaths dropped from over 100,000 in the 1980s to under 5,000 in

J. ENVTL. ECON. & MGMT. 411, 428 (2004) (finding a 13 to 18 percent range in consumers' marginal willingness to pay for eco-labeled toilet paper).

[242] *See, e.g.*, N. CRAIG SMITH, MORALITY AND THE MARKET: CONSUMER PRESSURE FOR CORPORATE ACCOUNTABILITY 200–325 (1990) (discussing consumer responses to NGO boycott campaigns); Ruth V. Aguilera et al., *Putting the S Back in Corporate Social Responsibility: A Multi-Level Theory of Social Change in Organizations* 40 (Univ. of Ill. Coll. of Business, Working Paper No. 04-0107, July 2004), *available at* http://ssrn.com/abstract=567842 ("[T]he moral concerns of consumers are most relevant in determining the amount of pressure they will place on firms to engage in [corporate social responsibility]."); Jill Gabrielle Klein et al., *Why We Boycott: Consumer Motivations for Boycott Participation and Marketer Responses* 4 (Ctr. for Marketing, Working Paper No. 03-702, June 2003), *available at* http://facultyresearch.london.edu/docs/03-702.pdf (concluding that "boycott participation is generally prompted by the belief that a firm has carried out some egregious act"); *see also* N. Craig Smith & Elizabeth Cooper-Martin, *Ethics and Target Marketing: The Role of Product Harm and Consumer Vulnerability*, 61 J. MARKETING 1, 1 (1997), *available at* http://www.jstor.org/stable/1251786.

[243] *See, e.g.*, Garrett, *supra* note 224, at 49 (noting the importance of policy commitment and image pressure in addition to economic influences on firm responses to boycotts); Robert Innes, *A Theory of Consumer Boycotts Under Symmetric Information and Imperfect Competition*, 116 ECON. J. 355, 361–62 (2006) (reviewing economics and literature on consumer boycotts).

[244] *See* Mario F. Teisl et al., *Can Eco-Labels Tune a Market? Evidence from Dolphin-Safe Labeling*, 43 J. ENVTL. ECON. & MGMT. 339, 355–57 (2002).

1993.[245] Similarly, although labels were not involved in the early stages of the issue, consumer concern over the ozone hole led to declines in consumer purchases of aerosol containers in the mid and late 1970s.[246] The consumer reaction was strong and, in the absence of a label, even extended to aerosol containers that did not actually contain ozone depleting chemicals.

Finally, high income consumers comprise much of the market for green goods, but the market is not limited to high-end consumers. Organic foods and fair trade coffee are examples of ecolabeled products that have expanded from the luxury market to discount stores. For example, fair trade coffee is now the house brand at Sam's Club, is sold at Dunkin' Donuts, and is the only coffee sold in McDonald's stores in New England.[247]

Supply Chain Contracting Pressure. As discussed above, if supply chain emissions are included in corporate and product reporting regimes, firms will have less incentive to outsource production solely for the purpose of avoiding the emissions. Instead, firm decisions will reflect the total carbon footprint of their operations. Although only limited empirical research has been conducted on the relationship between social license pressure and supply chain contracting,[248] studies in the environmental and labor areas suggest that disclosure of corporate and product carbon emissions could induce firms not only to change the practices of their own facilities in developing countries, but also to impose supply chain requirements on their domestic and foreign third-party suppliers.[249] Studies suggest that firms respond to private

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[245] *See* 2004 ANNUAL REPORT OF THE INTER-AMERICAN TROPICAL TUNA COMMISSION (2006), *available at* http://iattc.org/PDFFiles2/IATTC-Annual-Report2004ENG.pdf.

[246] *See* Douglas W. Cray, *Aerosol Industry Is Trying Hard To Find Fluorocarbons Substitute*, N.Y. TIMES, Nov. 20, 1976, at 45.

[247] Downie, *supra* note 240, at C5.

[248] For recent literature reviews, see Vogel, *supra* note 21, at 264–75; Auld et al., *supra* note 21, at 424.

[249] *See* Tim Bartley, *Corporate Accountability and the Privatization of Labor Standards: Struggles over Codes of Conduct in the Apparel Industry*, 14 RES. IN POL. SOC. 211, 219–25 (2005) (noting that pressure for better labor standards extends to third party suppliers in the apparel industry); O'Rourke, *supra* note 223 (noting that shareholder activism affects labor standards imposed through supply chain contracts); Aseem Prakash & Matthew Potoski, *Investing Up: FDI and the Cross-Country Diffusion of ISO 14001 Management Systems*, 51 INT'L STUD. Q. 723, 730 (2007). *See generally* POSTIMPERIALISM AND WORLD POLITICS (David G. Becker & Richard L. Sklar eds., 1999).

standards by imposing environmental requirements on suppliers in developing countries, and these requirements affect supplier behavior.[250] For instance, empirical studies demonstrate that developing country exporting firms that contract with developed country importers participate more frequently than other developing country firms in private governance schemes that impose extra-legal requirements.[251] These developing country firms also have better environmental compliance than peer firms that are less involved in exporting to developed countries.[252]

Recent activity by Wal-Mart provides a valuable example of the potential extent of the supply chain contracting activity that could be expanded to many sectors. Wal-Mart has responded to social license and other pressures by adopting extensive environmental requirements that apply to its domestic and foreign suppliers. The firm recently announced that it is imposing energy efficiency requirements (which will reduce carbon emissions) on its Chinese suppliers under new corporate responsibility guidelines that will be phased in from 2008 through 2010.[253] The firm uses a Sustainability Index as a tool for buyers to evaluate its 60,000 suppliers. The Sustainability Index requires suppliers to sign documents of environmental law compliance, starting with Chinese suppliers to the U.S., UK, and Canada in early 2009. The top 200 suppliers also will be asked to demonstrate 20 percent energy efficiency improvements, and by 2012, all direct Wal-Mart suppliers will be required to source 95 percent of their products from companies with the best audit ratings. All suppliers also will need to reveal the name and location of all factories used for each good produced.[254] As discussed at the outset, the potential influence on Chinese facilities is substantial: Wal-Mart has 10,000 direct Chinese suppliers, and 20 percent of Chinese firms are

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[250] *See* Vandenbergh, *supra* note 78, at 930–32 (providing examples of supply chain contracting requirements imposed on foreign suppliers).

[251] *See* Petra Christmann & Glen Taylor, *Globalization and the Environment: Determinants of Firm Self-Regulation in China*, 32 J. INT'L BUS. STUD. 439, 452–53 (2001).

[252] *Id.*

[253] *See* Bustillo, *supra* note 215, at 4 (discussing sustainability index initiative). *See generally* Kathleen E. McLaughlin, *Wal-Mart Hikes Standards for Suppliers in China on Product Safety, Environment*, BNA INT'L ENV'T DAILY, Oct. 24, 2008.

[254] WAL-MART STORES, INC., 2009 GLOBAL SUSTAINABILITY REPORT 68 (2009), *available at* http://walmartstores.com/Sustainability/.

somewhere in the Wal-Mart supply chain.

Deforestation in the tropics is a leading source of carbon emissions, and the recent Wal-Mart supply-chain activity also has the potential to reduce carbon emissions in this area. Beef production is particularly important because tropical forests are cleared to make way for cattle grazing and the clearing process releases tremendous amounts of carbon, both directly as forests are burned and indirectly from the release of carbon from tropical soils and the loss of carbon uptake from the vegetation.[255] Direct public restrictions on deforestation have been very difficult to develop and implement, and measures to reduce deforestation were not included in the Kyoto Protocol.[256] A Wal-Mart grocery subsidiary is one of Brazil's largest grocers, however, and in 2009, after Greenpeace released a report critical of the cattle sector, the Wal-Mart subsidiary joined a boycott of beef suppliers linked to tropical deforestation. Other participants included McDonald's, Timberland, Adidas, and other firms with large consumer markets in the U.S. and EU. The Brazilian government was not a signatory to the agreement that was reached among the other international firms, Greenpeace, and the beef suppliers.[257] The effects remain to be seen, but this step has the potential to reduce emissions from Amazonian deforestation directly and to buttress other private and public efforts at the domestic and global levels.

The Coasian literature of the last several decades has highlighted the importance of clearly defined entitlements, information, and monitoring and enforcement. Not surprisingly, the social license pressure that has been brought to bear on firms has been heavily influenced by organizations and activities that focus on these areas. New non-state market-driven governance systems have arisen that seek to shape environmental social

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[255] *See* William Boyd, *International Forest Carbon and Climate Governance: Current Status and Prospects*, *forthcoming in* DEFORESTATION AND CLIMATE CHANGE: REDUCING CARBON EMISSIONS FROM DEFORESTATION AND FOREST DEGRADATION 1 (Valentina Bosetti et al., eds. 2010) (manuscript on file with the authors) (concluding that there is "mounting evidence that we cannot stabilize atmospheric CO_2 at a safe level without addressing emissions from the forest sector").

[256] *See id.*

[257] Kepp, *supra* note 24, at 1; Barrioneuvo, *supra* note 25, at A7; *see also* GREENPEACE INT'L, SLAUGHTERING THE AMAZON (2009), *available at* http://www.greenpeace.org/international/press/reports/slaughtering-the-amazon (calling attention to the cattle-related issues).

licenses and to reduce the costs and provide the information necessary to improve the effectiveness of supply-chain monitoring and enforcement.[258] These organizations range from purely private NGOs, to NGO-corporate hybrids, to NGO-corporate-government hybrids. Examples include the Forest Sustainability Council for forestry practices and the Marine Stewardship Council for sustainable fisheries. They often set standards for sustainable conduct, certify compliance, and allow the use of labels for certified products. Monitoring and enforcement of private supply-chain contracting requirements can be costly and has been questionable in some cases,[259] but numerous NGOs pressure firms to adopt supply chain requirements and police their suppliers' compliance.[260] Compliance with the new private standards has contributed to the creation of a new market for private assurance services,[261] and in response to recent criticisms, some firms have announced that they will increase unannounced, third-party audits as a way to enforce environmental requirements.[262]

Numerous questions exist about the origins, function, and relative merits of these new actors in the global environmental, labor, and health areas.[263] Although these developments have been the subject of active research in recent years, policymakers and NGOs have yet to appreciate fully their potential role in global climate change governance.

Major Developing Country Incentives. Pressure on the supply chain may reduce the direct carbon emissions from the major developing countries and may create incentives to shift policies regarding carbon emissions in a variety of ways. If firms in a developing country face pressure for carbon emissions reductions from the firms to which they sell, the developing country firms

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[258] *See* Vogel, *supra* note 21, at 270 (noting the increase in non-state, market-driven governance systems).

[259] *See generally* Vandenbergh, *supra* note 78.

[260] *See* Vogel, *supra* note 21, at 266 (noting that some NGOs have shifted the target of their advocacy from states to private firms).

[261] *See, e.g.*, Margaret M. Blair et al., *The New Role for Assurance Services in Global Commerce*, 33 J. CORP. L. 325, 328 (2008) (examining the growth of private firms that verify corporate compliance with public and private standards for environmental and other performance).

[262] *See, e.g.*, Press Release, Wal-Mart, Wal-Mart Announces Sustainable Product Index (July 16, 2009), *available at* http://walmartstores.com/FactsNews/NewsRoom/9277.aspx.

[263] *See generally* Vandenbergh, *supra* note 78.

may seek ways to reduce emissions. In some cases, the supplier in the developing country will take direct actions to increase efficiency and reduce the carbon emissions from their facilities (particularly if the importing firms provide organizational, financial, and technological assistance). If a supplying firm identifies efficiencies, its costs of complying with carbon limits will decline, and it will have less reason to advocate for resistance to national carbon targets. In other cases, the supplier will have incentives to find emissions reductions in its supply chain. For example, it will have incentives to pressure the private or public electricity and other energy suppliers to provide less carbon-intensive energy.

The supplying firm and its suppliers also will have incentives to advocate for changes in government investments and policies within the developing country to help them reduce the carbon emissions associated with their products. In particular, firms will have incentives to advocate for domestic policies and investments that promote low-carbon energy generation systems and a low-carbon transportation infrastructure. The focus on carbon emissions reductions by exporting firms also may spill over to other firms in the developing country as best practices spread through industry sectors.[264]

Although the possible reasons for corporate pressures for carbon regulation vary from raising rivals' costs, leveling the playing field, reducing uncertainty, assuring the long-term supply of materials, or simply reducing stakeholder pressure, it is clear

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[264] *See* RONIE GARCIA-JOHNSON, EXPORTING ENVIRONMENTALISM: U.S. MULTINATIONAL CHEMICAL CORPORATIONS IN BRAZIL AND MEXICO 2 (2000) (noting spillover effects in environmental practices); Brian Greenhill et al., *Trade-Based Diffusion of Labor Rights: A Panel Study, 1986-2002*, 103 AM. POL. SCI. REV. 669, 678 (noting spillover effects in the labor rights area). Supply chain contracting may be one of the mechanisms by which the "California effect" occurs. *See generally* DAVID VOGEL, TRADING UP: CONSUMER AND ENVIRONMENTAL REGULATION IN A GLOBAL ECONOMY (1995) (noting that trade can induce more stringent regulatory standards in exporting countries). As Daniel Abebe and Jonathan S. Masur have argued, however, the difficulties of inducing China to join an international climate change agreement are closely linked to domestic political dynamics and should not be underestimated. *See* Daniel Abebe & Jonathan S. Masur, *International Agreements, Internal Heterogeneity, and Climate Change: The "Two Chinas" Problem*, 50 VA. J. INT'L L. 325, 326–28 (2010). We do not suggest that our approach alone will create the necessary incentives, only that it is an important and viable additional means of creating incentives to participate in an international agreement and to reduce emissions even in the absence of an agreement.

that companies themselves can become an important source of pressure for government regulation. Consider a company based in a developing country that sells its products in the home country as well as exports them to a developed country with emission caps. The company might be able to split its production between domestic and foreign production and hence avoid carbon reductions in the domestic component of its production, but a more likely scenario is that factories will produce for multiple markets, including the home market. Thus, if the company reduces carbon emissions and raises its cost of production, this will also affect its cost of producing domestically, which will put it at a competitive disadvantage to other domestic companies that do not export their products. It might be in the firm's interest to lobby for domestic carbon regulation to level the playing field. At the same time, there may be less political opposition to regulation to the extent "new jobs" are no longer being created by developed country offshoring. Overall, our carbon disclosure strategy would appear to provide both positive political pressures for regulation in developing countries and a loosening of political opposition to regulation in these countries.

C. *Economic Effectiveness*

In the final analysis, the costs of our carbon disclosure strategy (including the transaction costs of generating and disclosing carbon information and the costs arising from the consumer, firm and other responses to this information) should be weighed against the costs of not inducing the major developing countries to reduce emissions, and of reducing those emissions through the other viable strategies. A full analysis of these issues is beyond the scope of this article, but we do examine several types of costs likely to arise from our disclosure strategy and efforts that could reduce them.

A leading concern about supply-chain emissions is that the transaction costs of calculating the emissions from numerous small suppliers could be substantial. For our proposal to succeed, lines must be drawn around the required reporting to reduce incentives for leakage without generating transaction costs that exceed the benefits of the reduced leakage. If a perfect or near-perfect accounting of all emissions from the supply chain is necessary, the costs may exceed the benefits in many cases. A rough approximation may, however, eliminate most leakage incentives

without triggering substantial transaction costs. The optimal boundaries of a new carbon footprint that includes the supply chain will need to be studied empirically, but we are optimistic that a boundary can be drawn that will strike an appropriate balance between discouraging leakage and incurring transaction costs.

One possible approach for lowering transaction costs is to establish default carbon emission levels by type of facility (perhaps varying by characteristics such as fuel sources, country-level regulatory regime, etc.) based on existing facility and newly sampled estimates. Such estimates could be made either by government regulatory agencies or by independent third party verification agencies. These default emission factors would be based on the most polluting technologies used by each type of facility/fuel source/country. These carbon emissions would then be included in any calculations of a customer's carbon footprint. Firms (and their customers) would have an option to apply a lower level of emissions, however, if they provide third-party verifiable evidence that their facility's emissions were lower than the default level.[265] This provides an economic incentive to lower emissions at an upstream facility, as the ultimate seller can presumably command a higher price than competitors in its home country by offering a reduction in the carbon footprint of its products. As long as the benefits of reduced emissions exceed the firm's costs associated with verification, the facility would have an incentive to reduce emissions. Thus, emission reductions are likely to take place in facilities that have the least cost control technologies available to them. Further, firms with high control costs are not burdened by excessive verification costs, assuming they can still compete and stay in business.

In addition, many of the data requirements and calculations will be comparable for corporate carbon footprints and carbon product labels, and cost savings may arise if reporting requirements and methodologies for the two are coordinated. Many firms also use the same suppliers or types of suppliers and cost savings can arise from data sharing among firms. To facilitate data sharing, the Sustainability Consortium[266] recently launched an

[265] Many third-party verification schemes have been adopted for certification and labeling programs in similar contexts. *See, e.g.*, Forest Stewardship Council, What is Certification?, http://www.fscus.org/faqs/what_is_certification.php (last visited Apr. 29, 2010).

[266] The Sustainability Consortium is a collaborative research effort with

open-source database on corporate carbon supply chain emissions, and it is encouraging companies to use the data in their carbon calculations and to contribute new data. The development of more accurate supply chain data also will reduce the cost of developing a border adjustment scheme in the future. In fact, a well-designed carbon labeling scheme might reduce the need for a border adjustment program or at least enable policymakers to limit and better target border adjustments to the areas that yield the greatest leakage.

One source of cost savings is from the efficiency that will arise as firms focus intensively on reducing the carbon emissions of their supply chains. A large share of all carbon emissions arise from energy use, but the low cost of fossil fuels over the last several decades in many cases has not forced firm managers to focus on energy when looking for efficiencies. Although raising the price of fossil fuels would create renewed incentives to reduce energy use, the political will to increase prices significantly may be decades away. In the interim, pressure throughout the supply chain could stimulate increased efficiency. Firms that have developed sophisticated practices or technologies may have incentives to share them with their suppliers. Examining the supply chain for carbon emissions can yield overlooked information about ways to generate net cost savings or to reduce carbon emissions at low cost.

The extent of the cost-saving opportunity is hard to assess, but recent case studies by the Carbon Trust in the United Kingdom have identified large, previously overlooked efficiencies when firms focused on reducing carbon emissions in the supply chain. For example, a leading potato chip maker discovered that by paying farmers by the pound for potatoes, it was inducing farmers to pick wet potatoes, to ship the potatoes in this heavier condition, and to humidify warehouses, only to remove the water in the chip-making process.[267] All of these steps increased energy use, costs, and carbon emissions.[268] Other studies have found similar results.

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participants from the University of Arkansas, Duke, Harvard, Stanford, and other universities. *See* Sustainability Consortium, Members, http://www.sustainabilityconsortium.org/members (last visited Mar. 28, 2010).

[267] *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?productid=ctc616.

[268] *Id.*

PepsiCo found that orange growing was a surprisingly large part of the carbon footprint of its Tropicana emissions and is working to reduce those emissions.[269] Timberland had a similar experience regarding the share of its emissions attributable to the leather in its shoes.[270] Savings of these types cannot be expected to make carbon foot-printing and labeling costless, but they may reduce the net costs, reduce political resistance to adoption of a carbon disclosure strategy, and make the disclosure strategy cost-competitive as compared to the other viable alternatives.

D. *Distributional Justice*

A full discussion of the distributional justice or equity issues associated with our proposed carbon disclosure strategy is beyond the scope of this article. Nevertheless, to stimulate initial inquiry, we assume that emissions mitigation is necessary at some level, and we briefly examine whether our disclosure strategy differs in its distributional justice implications from other viable approaches (e.g., subsidies, moral suasion, and border adjustments).[271] The core climate justice problem is that economic activity is closely associated with carbon emissions, creating a tension between carbon emissions reductions and poverty alleviation.[272] This tension is particularly acute in the developing world, where substantial percentages of the population are living in poverty. It is tempting to argue that the poverty problem in developing countries can be addressed simply by increased economic growth, assuming that after exceeding some level of per capita income countries will begin to reduce carbon emissions just as developed countries have done with other pollutants.[273] To date this

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[269] Andrew Martin, *How Green is My Orange?*, N.Y. TIMES, Jan. 22, 2009, at B1.

[270] Vandenbergh, *supra* note 22, at 940–41.

[271] We do not address whether distributional justice concerns dictate not reducing the risk of catastrophic climate change if doing so will hamper poverty alleviation efforts in the developing world. The response depends upon projections about the effects of climate change on the poor, and views of intergenerational equity, discount rates, the costs of emissions mitigation and adaptation efforts, and other issues. *See generally* Posner & Sunstein, *supra* note 5. We assume that the effects of catastrophic climate change will be sufficiently severe and long-lasting that reducing the risk is in the interest of even those countries with large populations in poverty.

[272] Vandenbergh et al., *supra* note 2, at 307–08.

[273] *See* John Tierney, *Use Energy, Get Rich, and Save the Planet*, N.Y. TIMES, Apr. 20, 2009, at D1; *see also* Gady Epstein, *Climate: China Waits for the U.S.*

phenomenon has not occurred with regard to carbon in the developed countries, however, and it would have to occur very soon and begin at low per capita income levels in the major developing countries to avoid exceeding atmospheric carbon targets.[274]

Poverty alleviation, increases in well-being, and increases in per capita income are not synonymous, however.[275] For instance, China has had dramatic increases in per capita income over the last decade, but the studies are mixed on whether individuals are more satisfied with the way things are going in their life.[276] Because of the importance of perceptions of relative wealth and consumption, to the extent our strategy creates incentives to reduce the most extravagant consumption in the developed countries, it may increase well-being in developing countries.[277]

In addition, to the extent our carbon disclosure strategy generates emissions reductions at lower cost than other strategies, it will be more favorable for poverty alleviation. Our strategy also may result in the transfer of substantial amounts of technology, knowledge, and resources to firms in developing countries, as developed world firms seek low-cost ways to reduce their carbon footprints that now include offshore suppliers. If this transfer enables developing countries to continue to be competitive in

to Act, FORBES.COM, Sept. 17, 2009, http://www.forbes.com/2009/09/17/china-climate-change-ge-beinecke-opinions-beijing-dispatch.html (noting opinion of leading environmentalist that economic growth in China will lead to carbon emissions reductions).

[274] The U.S., Canada, and Australia are leading examples of countries with high per capita incomes that have per capita carbon emissions that are over twenty tons and rising. *See* Vandenbergh, *supra* note 22, at 919 (discussing literature on the applicability of the Kuznets Curve to carbon emissions).

[275] Mark A. Cohen & Michael P. Vandenbergh, *Consumption, Happiness, and Climate Change*, 38 ENVTL. L. REP. 10,834, 10,835–37 (2008).

[276] *Compare* John M. Gowdy, *Behavioral Economics and Climate Change Policy*, 68 J. ECON. BEHAV. & ORG. 632, 641 (2008) (noting survey results showing reduced life satisfaction between mid-1990s and mid-2000s), *with* THE PEW GLOBAL ATTITUDES PROJECT, THE CHINESE CELEBRATE THEIR ROARING ECONOMY, AS THEY STRUGGLE WITH ITS COSTS 1 (2008), *available at* http://pewglobal.org/reports/display.php?Re[prtOD=261 (noting increases in various measures of life satisfaction between 2002 and 2008).

[277] *See* Cohen & Vandenbergh, *supra* note 275, at 10,836–37. Some strategies may be available that increase well-being without increasing the types of economic activity that generates meaningful amounts of carbon emissions or that reduce carbon emissions while generating major health co-benefits. *See* Vandenbergh et al., *supra* note 2, at 329–30.

export markets, but now with lower carbon intensity production, it will enhance the prospects for poverty alleviation.

Further, as Posner and Sunstein have emphasized, there are rich and poor individuals in developed and developing countries,[278] and the rich individuals typically emit far more than the poor even when the rich live in developing countries.[279] To the extent rich consumers in all countries will bear a greater burden of emissions reductions under our carbon disclosure strategy, it may be more equitable than other approaches. Our proposed carbon disclosure strategy also could induce developed world consumers to increase their willingness to pay for low-carbon goods from developing countries, which could result in comparative advantages for poverty alleviation.

Developing countries blame developed countries' consumption for causing emissions, yet they argue that they are entitled to the benefits of further production to feed that consumption in the future. Our approach re-frames the equity issues from how the rich can help the poor avoid an unfair share of the costs of climate change mitigation, to what the obligations are of consumers in developed countries to reduce the emissions associated with their consumption. Are developed world consumers obligated to buy goods if purchasing the goods results in poverty alleviation? Does or should the scope of the implicit entitlement to consume include a carbon constraint? What if the carbon emissions from the production of those goods will not only contribute to poverty alleviation, but also to serious climate change harms in developed and developing countries that occur in two or ten generations and extend for multiple generations thereafter? If our carbon disclosure strategy triggers a public debate on these issues, it may stimulate consumer behavior changes and increase pressure on firms to find ways to continue to buy goods from countries with large populations in poverty, while also reducing the carbon-intensity of these goods. By emphasizing the disparity in per capita carbon emissions between the developed and developing worlds, the reframed debate also may increase public support for other types of emissions reductions in developed countries.

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[278] Posner & Sunstein, *supra* note 5, at 1568–70.

[279] *See* Chakravarty et al., *supra* note 31.

If preferences for carbon emissions reduction and poverty alleviation among developed world consumers are sufficiently strong, the disclosure strategy also could result in private wealth transfers from developed country consumers to low-carbon suppliers in developing countries. The booming fair trade coffee market provides some sense of the opportunity.[280] How would these wealth transfers compare to direct government-to-government subsidies, whether for climate-related activities, disease reduction, or other activities?[281] At this point there is no way to know, but anemic levels of foreign aid for poverty alleviation currently flow from developed to developing countries.[282] Willingness to act in the private sphere, where consumers control the effects of their choices, may exceed willingness to lobby governments to act through subsidies. It is possible that more resources will flow to developing countries through the transfer of wealth that occurs when social license pressures induce firm supply chain contracting actions than through government-to-government aid programs.

CONCLUSION

The time is ripe to add an information-driven approach to existing efforts before the public and private regulatory regimes lock in on a leaky system that fails to create the necessary new incentives for the major developing countries. Opportunities exist at the global, federal, state, and local levels and in the private sphere. At the global level, negotiations for a post-Kyoto cap-and-trade regime are proceeding slowly. The divide between developed and developing countries is at the root of the problem. Developed countries are wary of adopting stringent emissions reductions standards that will be ineffective in reducing the risk of catastrophic climate change if developing countries fail to participate. Developing countries need incentives to reduce emissions, yet allocations of excess allowances, technology subsidies, and other measures proposed to date have been insufficient.

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[280] For example, how does the subsidy implicit in fair trade coffee compare to the relevant direct foreign aid on a country-specific basis?

[281] Posner & Sunstein, *supra* note 5, at 1590 (suggesting direct subsidies unrelated to climate change).

[282] *See* Sunstein, *supra* note 3.

At the federal level, cap-and-trade legislation is likely to become law at some point, but it is becoming more likely that delay by the U.S. will provide further reasons for delay by the major developing countries. The U.S. can design a program that will address the boundary problem, but the proposed legislation and regulations thus far have not done so. Similarly, several regional cap-and-trade schemes are still in their formative stages, but all appear to be taking a narrow approach. Although the federal and regional approaches appear to be heading down the same narrow boundary path, the opportunity exists to re-examine the issue before federal and regional programs are finalized.

Private reporting schemes that create incentives for firms to reduce or shift emissions also are ripe for change. The bulk of the initial efforts to date have been focused on inducing firms to engage in voluntary reporting using a narrow definition that excludes suppliers. In the last few years, private organizations that develop and enforce these reporting schemes have begun to explore the costs and benefits of a boundary that incorporates the supply chain and have demonstrated the feasibility of doing so.

We argue for a boundary that captures the majority of emissions from the supply chain. Further research will be needed to assess the costs of implementation and anticipated emission reductions, but given the existing understanding of the importance of supply chains, offshoring, and the reluctance of developing nations to regulate carbon emissions, our proposal could yield remarkable net benefits. In fact, it is difficult to imagine a successful global policy architecture over the long term that does not include supply chain and product carbon disclosure. Remedying the boundaries and leakage problem also may lead to a more fundamental shift in regulatory thinking in the long run: a move away from the exclusive focus on the emissions from the locus of production to an additional focus on the emissions associated with the consumption of goods.

The effort to address boundaries and leakage in climate change governance is also an opportunity to take a fresh look at the implications of bargaining in the shadow of the law for global climate change policy. Bargaining occurs not only over legally-constructed entitlements, but also socially-constructed entitlements, and it occurs not only at the local level, but also at the global level. Clear entitlements, adequate information, and opportunities for monitoring and enforcement are important

components of governance options that rely on private bargaining, and our disclosure strategy addresses each of them.

Today, the principal focus of academics, policymakers, and NGOs is on how nation-states can enter into a successful post-Kyoto agreement.[283] It is not surprising that the almost exclusive focus would be on nation-to-nation bargaining and public governance options. Successful international negotiations could yield prompt emissions reductions, and for NGOs, applying direct pressure on governments is well within their comfort zone. Yet our analysis suggests that the price of creating sufficient incentives for the major developing countries may be so high that additional bargaining at the international level alone may not yield a viable agreement in the short amount of time available. Traditional advocacy efforts that pressure governments to regulate carbon emissions are necessary but not sufficient given the limited public appetite for serious emissions reductions in the developed world or for large wealth transfers to the major developing countries. Carbon information disclosure is a viable approach that can be adopted by private and public actors now, even in the absence of widespread public support for costly government action. We have little time to waste.

[283] *See, e.g.*, Epstein, *supra* note 273 (noting environmentalist's statement that "we're putting as much emphasis and as much pressure as we possibly can on the US Senate to get action [on a domestic cap and trade bill]").