2015

Beyond Gridlock

Michael P. Vandenbergh

Jonathan A. Gilligan

Beyond Gridlock

Michael P. Vandenbergh* & Jonathan A. Gilligan**

* David Daniels Allen Distinguished Chair of Law, Director, Climate Change Research Network, and Co-Director, Energy, Environment and Land Use Program, Vanderbilt University Law School. For comments on the initiatives included in the private climate governance strategy, the authors thank the participants at workshops at the Center for Research on Environmental Decisions at Columbia University, the Radcliffe Institute for Advanced Study at Harvard University, the Kellogg School of Management at Northwestern University, the Environmental Science and Policy Program at Michigan State University, the Ostrom Workshop at Indiana University, and the Private Governance Workshop at Vanderbilt University. Linda Breggin, Mark Cohen, Paul Edelman, Andy Mims, Ed Rubin, J.B. Ruhl, Kevin Stack, and Alan Wiseman provided helpful insights. Daniel Raimi provided research support on energy policy issues, and Lorraine Baer, Nicholas Brill, Emily Burns, Leland Frost, Janelle Geddes, Travis Gray, Kimberly Huey, Sara Jane McMahon, and Amanda Nguyen provided research support on other aspects of the Article.

** Associate Professor, Department of Earth and Environmental Sciences, and Associate Director for Research, Climate Change Research Network, Vanderbilt University.

INTRODUCTION

Private climate governance can achieve major greenhouse gas ("GHG") emissions reductions while governments are in gridlock.[1] Despite the optimism that emerged from the Earth Summit in Rio de Janeiro, Brazil in 1992, almost a quarter century later the federal legislative process and international climate negotiations are years from a comprehensive response. Yet Microsoft, Google and many other companies have committed to become carbon neutral.[2] Wal-Mart has partnered with the Environmental Defense Fund to secure 20 million tons

1. In this Article, "GHG" and "carbon" are used interchangeably to mean the six greenhouse gases that are the principal drivers of anthropogenic climate change. These are often expressed in the form of carbon dioxide equivalents or CO_2e. When referring to one of the six GHGs, such as carbon dioxide (CO_2), the Article uses the specific term.

2. For a discussion of these private initiatives, see *infra* Parts III.B and IV.

of GHG emissions reductions from its suppliers around the world, an amount equal to almost half the emissions from the US iron and steel industry. Investors holding roughly $90 trillion in assets have pressured large corporations to disclose and reduce their carbon footprints, and participating companies report having reduced emissions by an amount equal to a major emitting nation. Private forest certification programs have taken steps to reduce the GHG emissions from deforestation. Household carbon regulation is off the table in many countries, but private advocacy groups and corporations have reduced household emissions through home energy disclosure, eco-driving campaigns, employee programs, voluntary carbon offsets, and other initiatives.

Private environmental governance arises when private organizations perform traditionally governmental functions, including reducing negative externalities and managing public goods or common pool resources.[3] Policy analysis often assumes that when significant negative externalities exist and property rights are poorly defined, as is the case for GHGs, the only feasible remedies are either massive government intervention (a Hobbesian Leviathan) or a Coasian assignment of easily enforceable property rights.[4] But in 2009, Elinor Ostrom received the Nobel Prize in economics for showing that a broad array of other governance schemes, including private governance, can and do succeed.[5]

The emergence of private governance suggests the need to reconsider the choices typically included in comparative institutional analysis. The great contribution of comparative institutional analysis is to force analysts to ask a seemingly obvious but often overlooked question: as compared to what? The standard approach compares the relative merits of three institutions: markets, the political branches of government,

3. *See* Michael P. Vandenbergh, *Private Environmental Governance*, 99 CORNELL L. REV. 129, 134–37 (2013); Michael P. Vandenbergh, *The Private Life of Public Law*, 105 COLUM. L. REV. 2029 (2005).

4. ELINOR OSTROM, GOVERNING THE COMMONS 8–13 (1990) (noting "the presumption that an external Leviathan is necessary to avoid tragedies of the commons" or that "the establishment of full property rights is necessary").

5. *Id.* at 15–21 (noting that private organizations frequently manage similar problems with contracts enforced by private arbitrators and monitors).

and courts.[6] In the last two decades, an extensive literature has demonstrated that the political branches of government do not function in isolation from markets, and thus the comparison cannot just be among the three institutional forms. Instead, governments collaborate with private organizations to form public-private hybrids,[7] delegate public standard-setting,[8] and outsource services to private corporations.[9] These types of public-private activities are an important form of governance, but they all require government action, and, when directed toward climate change, they face many of the same barriers that have contributed to national and international gridlock.

In contrast, the private governance initiatives discussed in this Article occur without government collaboration, delegation, or outsourcing. In fact, although some participants may hope to forestall eventual government action, these initiatives often arise only after it is clear that government will not act in the near term.[10] In some cases, such as when a non-

6. *See* NEAL KOMESAR, IMPERFECT ALTERNATIVES: CHOOSING INSTITUTIONS IN LAW, ECONOMICS AND PUBLIC POLICY 3–13 (1994) (noting that choosing among institutions is the central problem of government); Edward L. Rubin, *The New Legal Process, The Synthesis of Discourse, and the Microanalysis of Institutions*, 109 HARV. L. REV. 1393, 1406–18 (1996) (discussing institutions addressed by comparative institutional analysis).

7. *See, e.g.*, Jody Freeman, *Collaborative Governance in the Administrative State*, 45 UCLA L. REV. 1, 2 (1997) (discussing public-private hybrids).

8. *See* Peter L. Strauss, *Private Standards Organizations and Public Law*, 22 WM. & MARY BILL RTS. J. 497 (2013) (examining delegation of federal standard-setting); Nina A. Mendelson, *Private Control over Access to Public Law: The Perplexing Federal Regulatory Use of Private Standards*, 112 MICH. L. REV. 737 (2014) (same); JESSICA GREEN, RETHINKING PRIVATE AUTHORITY: AGENTS AND ENTREPRENEURS IN GLOBAL ENVIRONMENTAL GOVERNANCE (2013) (discussing delegation of authority on climate change); *see also* Louis L. Jaffe, *Law Making by Private Groups*, 51 HARV. L. REV. 201, 212 (1937) (noting importance of public-private regulatory activity).

9. *See* Jody Freeman & Martha Minow, *Introduction: Reframing the Outsourcing Debates*, *in* GOVERNMENT BY CONTRACT: OUTSOURCING AND AMERICAN DEMOCRACY 1, 20 (Jody Freeman & Martha Minow eds., 2009); Jody Freeman, *Extending Public Law Norms Through Privatization*, 116 HARV. L. REV. 1285, 1285 (2003). *See generally* Michael C. Dorf & Charles F. Sabel, *A Constitution of Democratic Experimentalism*, 98 COLUM. L. REV. 267 (1998) (examining new forms of government-private interactions).

10. An example is the Forest Stewardship Council, which formed after the collapse of an international forestry standards effort. *See* Steven Bernstein & Benjamin Cashore, *Can Non-State Global Governance Be Legitimate?: An Analytical Framework*, 1 REG. & GOVERNANCE 347, 349–50 (2007); *see also* Edward Klump, *Texas Utility CEO Describes 'Inevitability' of Low-Carbon Future*, ENERGY WIRE, Oct. 1, 2014 (noting that electric utility executive remained agnostic on whether climate change is caused by humans, but described a certain "inevitability" of low-carbon policies).

governmental organization ("NGO") conducts a campaign to reduce household emissions, private governance initiatives do not fit neatly into any of the standard institutional forms. In other cases, such as when a corporation responds to NGO pressure by including carbon emissions reduction requirements in supply chain contracts, or when a corporation participates in a private certification and labeling program, private governance initiatives can be characterized as market activities, although the initiatives do not fit the standard conceptions of unfettered markets, government intervention in markets, or collaboration between market participants and government.

Given the unconventional nature of private climate governance initiatives, it is understandable that private initiatives may not even be on the table in many discussions of climate mitigation among scholars and policymakers. Yet this conceptual barrier should not blind us to the opportunity. Whether characterized as a new type of institution or as activities that exist between existing institutional forms,[11] private climate governance initiatives exist at a surprisingly large scale, can be expanded despite government gridlock, can reach constituencies that resist government regulation, can reduce emissions in developed and developing countries, and can complement government policies, rather than compete with them.

The potential for a private climate governance strategy to yield prompt, major reductions at low cost does not rest on unrealistic assumptions about individual or corporate altruism, but it does require rigorous analysis of the motivations for carbon-emitting behavior and the ability of private institutions to respond.[12] The actions that are potentially subject to private initiatives can be evaluated based on their technical potential (the emissions reductions that would arise if all possible

11. A better analytical framework than the three institutions typically included in comparative institutional analysis may be the three systems (government, markets, and civil society) examined by sociologists. *See* JEAN L. COHEN & ANDREW ARATO, CIVIL SOCIETY AND POLITICAL THEORY 316–24 (1992); JURGEN HABERMAS, THE THEORY OF COMMUNICATIVE ACTION, VOL. 2 (Thomas McCarthy trans., 1985).

12. *See, e.g.*, OSTROM, *supra* note 4, at 185 ("Some appropriators can supply themselves with new rules, gain quasi-voluntary compliance with those rules, and monitor each other's conformance to those rules, whereas others cannot.").

household or corporate behavior change occurred) and behavioral plasticity (the extent of the behavior change that can reasonably be expected from an intervention).[13] The actions included in the private climate governance strategy score high on both measures.

The high technical potential arises from the large emissions from many sources and ability to scale up initiatives to address multiple small sources. For instance, households are not the traditional targets of environmental law, but private initiatives directed at households have high technical potential: in the United States, households account for roughly a third of GHG emissions.[14] The corporate sector, a common participant in private initiatives, accounts for a similar share.[15]

The high behavioral plasticity arises from the ability of private initiatives to target behaviors that can be changed without the coercive power or resources of government. Households and corporations often act out of self-interest, and carbon emissions often arise from inefficient use of fossil fuels and other materials. As a result, self-interested actions often will yield emissions reductions. Behavioral failures and market failures are obstacles to emissions reductions, but these failures provide opportunities for private initiatives to draw on self-interest to shift behavior with little or no coercion.[16] For example, research demonstrates that people do not always act in their own interest; on occasion they need a "nudge" to

13. *See, e.g.*, Thomas Dietz, Gerald T. Gardner, Jonathan Gilligan, Paul C. Stern & Michael P. Vandenbergh, *Household Action Can Provide a Behavioral Wedge to Rapidly Reduce US Carbon Emissions*, 106 PROC. NAT'L ACAD. SCI. 18452, 18455 (2009) (evaluating technical potential and behavioral plasticity of 17 action types); *see also* Benjamin Sovacool, *Energy Studies Need Social Science*, 511 NATURE 529, 529–30 (2014) (discussing need to broaden energy policy analysis).

14. *See* Michael P. Vandenbergh & Anne C. Steinemann, *The Carbon-Neutral Individual,* 82 N.Y.U. L. REV. 1673 (2007); Gerald T. Gardner & Paul C. Stern, *The Short List: The Most Effective Actions U.S. Households Can Take to Curb Climate Change,* 50 ENV'T 12, 12–16 (2008).

15. *See, e.g.*, Michael P. Vandenbergh & Mark A. Cohen, *Climate Change Governance: Boundaries and Leakage*, 18 N.Y.U. ENVTL. L.J. 221, 221 (2010) (discussing corporate emissions).

16. *See, e.g.*, WILLIAM PRINDLE, U.S. ENVT'L PROTECTION AGENCY, ENERGY EFFICIENCY AS A LOW-COST RESOURCE FOR ACHIEVING CARBON EMISSIONS REDUCTIONS, 4-1 to 4-3 (2009); INT'L ENERGY AGENCY, MIND THE GAP: QUANTIFYING PRINCIPAL-AGENT PROBLEMS IN ENERGY EFFICIENCY (2007) (summarizing research on market failures in energy efficiency).

motivate them to do so,[17] and by 2020 behavioral initiatives that rely on nudge-type interventions can reduce household emissions by an amount equal to all of the emissions of France.[18] At the corporate level, private efforts have identified a wide range of market failures. An example is the rate structure common in the shipping industry. The standard practice is to allocate most shipping fuel costs to the customer, not the shipping company, leaving the party that has the most control over fuel use with limited incentives to invest in efficiency. These types of market failures undermine efficiency, and private initiatives can correct many of them without the power or resources of government.[19]

Some household and corporate private initiatives have high behavioral plasticity not because they draw on self-interest but because they draw on existing public support for climate mitigation. In the U.S., only a small subset of the population places a high priority on climate mitigation, although a larger share supports mitigation but gives it a low priority.[20] These levels of support are insufficient to drive federal legislation, especially when a minority that places a high priority on blocking climate-related regulation can influence elections.[21] Private initiatives can harness the existing support for mitigation among a subset of the population, however, through initiatives that affect consumer choices, household energy use, investments, corporate management decisions, and other actions.

Although the technical potential and behavioral plasticity of private climate initiatives are important, this Article argues that a third concept, policy plasticity, has been given insufficient attention in climate debates.[22] For climate

17. *See, e.g.*, CASS R. SUNSTEIN & RICHARD THALER, NUDGE: IMPROVING DECISIONS ABOUT HEALTH, WELFARE, AND HAPPINESS (2008) (identifying nudging strategies).

18. *See* Dietz et al., *supra* note 13, at 18454.

19. *See* discussion *infra* Parts III.A and IV.

20. *See* discussion *infra* Part III.A.

21. The Tea Party mounted successful primary challenges to conservative Republican incumbents, such as Bob Inglis, who supported action on climate change. *See* Evan Lehman, *Republicans Learn the Perils of Being Politically Incorrect on Climate Change*, CLIMATEWIRE, Nov. 22, 2010.

22. *See, e.g.*, WILLIAM NORDHAUS, THE CLIMATE CASINO: RISK, UNCERTAINTY, AND ECONOMICS FOR A WORLD WARMING 272–73 (2013) (noting political obstacles to carbon tax but not accounting for the timing implications).

mitigation, policy plasticity is the extent to which an organization can implement the initiatives necessary to achieve potential emissions reductions. Policy plasticity can depend on a variety of factors, but the policy plasticity of a carbon price—whether a carbon tax or a cap-and-trade program—is largely a function of political feasibility. Although pricing carbon is a first-best response that holds understandable theoretical appeal,[23] the policy plasticity is low: a national and international carbon price is unlikely to be adopted and implemented in the next decade.[24] For many types of social problems, delay is not a substantial problem, but for climate change, time matters. The delay caused by political infeasibility will raise mitigation costs by forty percent per decade, and the theoretical appeal of a carbon price can crowd out development of second-best responses in the interim.[25]

Private governance initiatives are second-best options that lack the breadth and power of national legislation and international agreements, but they have high policy plasticity.[26] They can bypass many of the barriers to government action at the national and international levels. They also can leverage the recent growth in international

23. *See, e.g.*, *id.* at 220–32 (advocating carbon tax); ANDREW T. GUZMAN, OVERHEATED: THE HUMAN COST OF CLIMATE CHANGE (2013) (concluding that "[t]he story of how best to combat climate change is essentially a pricing strategy"); Jonathan B. Wiener, *Think Globally, Act Globally: The Limits of Local Climate Change Policies*, 155 U. PA. L. REV. 1961 (2007).

24. *See* Jonathan M. Gilligan & Michael P. Vandenbergh, *Accounting for Political Opportunity Costs in Climate Instrument Choice*, 32 VA. ENVTL. L.J. 1 (2014); *see also* discussion *infra* Part II.

25. *See, e.g.*, NORDHAUS, *supra* note 22, at 266–73 (dismissing second-best approaches because "unless we implement an effective policy of carbon pricing, we will get virtually nowhere in slowing climate change").

26. For a recent discussion of second-best responses, see *infra* Part II.C. *See also* Paul Krugman, *The Big Green Test: Conservatives and Climate Change*, NY TIMES, June 23, 2014, at A11 ("Emissions taxes are the Economics 101 solution to pollution problems; every economist I know would start cheering wildly if Congress voted in a clean, across-the-board carbon tax. But that isn't going to happen in the foreseeable future. A carbon tax may be the best thing we could do, but we won't actually do it."); DAVID G. VICTOR, GLOBAL WARMING GRIDLOCK: CREATING MORE EFFECTIVE STRATEGIES FOR PROTECTING THE PLANET 9 (2011) (noting that "[p]olicies that are politically viable will . . . not be identical with policies that are economically optimal, and in some cases the dispersion between the viable and the optimal will be huge"); Lori Snyder Bennear & Robert Stavins, *Second-Best Theory and the Use of Multiple Policy Instruments*, 37 ENVTL. RES. ECON. 111 (2007) (discussing use of second-best instruments).

trade, extending pressure for climate mitigation across national borders. This is a critical feature of private climate governance. The deep divide between developed and developing countries is a principal obstacle to an international climate agreement, and private governance initiatives are one of the few viable tools that can create incentives for developing countries to make credible emissions reduction commitments.[27]

Private governance is also one of the few ways to address ideological barriers to climate mitigation. Many people in the U.S. and other countries who might otherwise be open to climate mitigation are opponents because of concerns about big government.[28] The prevalence of this worldview may explain why more people believe corporations should act to mitigate climate change than believe government should act.[29] By drawing on private institutions, private governance initiatives have the potential to bypass concerns about big government, bringing moderates, conservatives, and libertarians into the climate mitigation effort.

To explain the importance of private climate governance, this Article is structured around three propositions. The first is the need for urgency. Part I demonstrates why substantial GHG emissions reductions are needed over the next decade to reduce the risks of major climate disruption and the costs of mitigation. The second proposition is that the barriers to adopting and implementing a carbon price are unlikely to be overcome in the next decade. Part II demonstrates why national and international processes will leave a large gap between actual emissions and the most widely adopted target level.

The third proposition is that unlocking the potential of private governance will require a conceptual shift by scholars, philanthropists, and corporate and NGO managers. Parts III and IV use extensive examples of existing and new private climate initiatives to demonstrate that private governance is not a sideshow but is one of the few ways to bypass government gridlock and achieve major emissions reductions over the next

27. *See* Michael P. Vandenbergh, *Climate Change: The China Problem*, 81 SO. CAL. L. REV. 905 (2008).

28. *See* discussion *infra* Part II.A.

29. *See* discussion *infra* Part II.B.

decade.[30] The discussion of existing efforts is exhaustive because the continued focus on a carbon price in scholarly and public debates suggests an unwarranted level of skepticism about the viability of other options. Private initiatives already are reducing annual global GHG emissions by millions of tons, and new initiatives such as a private climate prediction market and a climate registry, along with a full-throttled effort to exploit the potential of existing efforts, can yield major new reductions.

Private initiatives cannot keep global emissions on track to achieve the most widely adopted climate target, but they can achieve a private governance wedge: they can reduce emissions by roughly 1,000 million tons (a gigaton) of CO_2 per year between 2016 and 2025. When combined with other efforts, this private governance wedge offers a reasonable chance of buying a decade to resolve the current government gridlock. Part V addresses conceptual barriers that are keeping attention focused on a carbon price and crowding out consideration of other options.

I. URGENCY

Why not just wait for national and international processes to adopt and implement an effective government response? Although the implications of the climate science have been explored at length elsewhere, the continued promotion of

30. *See infra* Parts III and IV. For other examples of private governance, see Ganesh Sitaraman, *Contracting Around* Citizens United, 114 COLUM. L. REV. 755 (2014) (election law); Bernstein & Cashore, *supra* note 10 (political science); David Vogel, *The Private Regulation of Global Corporate Conduct*, 49 BUS. & SOC'Y 68, 68 (2010) (business ethics); Tim Bartley, *Certifying Forests and Factories: States, Social Movements, and the Rise of Private Regulation in the Apparel and Forest Products Fields*, 31 POL. & SOC'Y 433, 433–34 (2003) (sociology); Marc Allen Eisner, *Private Environmental Governance in Hard Times: Markets for Virtue and the Dynamics of Regulatory Change*, 12 THEORETICAL INQUIRIES L. 489 (2011) (public policy); Kenneth W. Abbott & Duncan Snidal, *The Governance Triangle: Regulatory Standards Institutions and the Shadow of the State*, *in* THE POLITICS OF GLOBAL REGULATION 44, 46 (Walter Mattli & Ngaire Woods eds., 2009) (international relations); David P. Baron, *Private Politics, Corporate Social Responsibility, and Integrated Strategy*, 10 J. ECON. & MGMT. STRATEGY 7 (2001) (economics); Errol E. Meidinger, *Environmental Certification Programs and U.S. Environmental Law: Closer Than You Think*, 31 ENVTL. L. REP. 10162 (2001) (environmental law); TIMOTHY LYTTON, KOSHER: PRIVATE REGULATION IN THE AGE OF INDUSTRIAL FOOD (2012) (food regulation).

mitigation measures that will take many years to adopt and implement suggests the need to explain the basis for urgency. At the outset, the optimal levels and timing of emissions reductions are hotly contested and involve questions of science, economics, and justice. Selecting an optimal level involves identifying the climate effects of any given level of emissions, the costs of climate harms and of emissions reductions, and the distribution of those costs within the current generation and across many future generations. Each of these points involves uncertainty, so choices reflect risk tolerance as well as other preferences.

A. Climate Targets

Credible arguments have been made for targets of 1°C,[31] 2°C,[32] and 3°C[33] above pre-industrial levels, suggesting atmospheric CO_2 targets of roughly 350 parts per million (ppm), 450 ppm, and 550 ppm, respectively.[34] Others have advocated eliminating temperature targets altogether.[35] Although not without controversy, 2°C is the target selected by many scientific bodies, and it was recognized by the international climate process at Copenhagen in 2009[36] and Cancun in 2010.[37] In addition, a simple, clear goal, even if imperfect, may be necessary as a focal point around which

31. James Hansen et al., *Scientific Case for Avoiding Dangerous Climate Change to Protect Young People and Nature,* 8 PLOS ONE e81648 (2013), *available at* http://dx.doi.org/10.1371/journal.pone.0081648 [http://perma.cc/QH2R-JB25] (last visited June 7, 2015).

32. For a discussion of the advantages and disadvantages of the 2°C goal, see Céline Guivarch & Stéphane Hallegatte, *2C or Not 2C?*, 23 GLOBAL ENVTL. CHANGE 179, 180–88 (2013). For a discussion of the importance of focal points, see Andrew T. Guzman & Timothy L. Meyer, *International Soft Law*, 2 J. LEG. ANALYSIS 171, 189 (2010).

33. *See, e.g.*, NORDHAUS, *supra* note 22, at 76–77, 140–41 (discussing different temperature targets).

34. *See* Guivarch & Hallegatte, *supra* note 32, at 192; *see also* NORDHAUS, *supra* note 22, at 220–24 (summarizing basis for 2°C target).

35. *See* David G. Victor & Charles F. Kennel, *Climate Policy: Ditch the 2°C Warming Goal*, 514 NATURE 30, 30–31 (2014).

36. *See* United Nations Framework Convention on Climate Change, Copenhagen, Den., Dec. 7–18, 2009, *Draft Decision.* U.N. Doc. FCCC/CP/2009/L.7 (Dec. 18, 2009).

37. United Nations Framework Convention on Climate Change, Cancun, Mexico., Nov. 29 – Dec. 10 2010, *The Cancun Agreement: Outcome of the Work of the Ad Hoc Working Group on Long-Term Cooperative Action Under the Convention*, U.N. Doc. FCCC/CP/2010/7/Add.1 (Mar. 15, 2011) .

support can be mobilized and the fairness of each country's mitigation commitments can be judged.

The 2°C goal is not dictated by the climate science, but it reflects the insights of the science. It is not possible to determine a safe level of temperature increase or of atmospheric CO_2, but exceeding the 2°C target can be analogized to operating a car in the red zone on the tachometer. The tachometer measures the number of revolutions per minute by the drive shaft, and at some point engine failure can occur if the number of revolutions per minute is too high. Operating a car in the red zone may not result in engine failure, but the likelihood of engine failure increases steeply.[38] Although no bright line has been identified, studies suggest that inflection points exist above the 2°C level in the likelihood and severity of climate feedback effects and of cascades in human systems.[39] In fact, recent research finds that it is probably already too late to prevent the West Antarctic Ice Sheet from collapsing over the next several centuries, which would raise global sea levels by roughly to feet.[40]

Emissions reductions will be costly, and a leading economist has suggested that when both the costs of emissions reductions and the costs of climate harms are accounted for, a 2.5 or 3°C target may be preferable to the 2°C target.[41] Data used to calibrate this analysis were recently found to have underestimated the damage caused by small amounts of warming,[42] however, and this analysis gives limited weight to

38. Gilligan & Vandenbergh, *supra* note 24, at 8.

39. *See supra* notes 9–11 & accompanying text. For a recent discussion analogizing climate risks to the subprime debt crisis of 2007 to 2008, see Henry M. Paulson Jr., Week in Review, *The Coming Climate Crash*, N.Y. TIMES, June 22, 2014, at 1.

40. Ian Joughin et al., *Marine Ice Sheet Collapse Potentially Under Way for the Thwaites Glacier Basin, West Antarctica*, 344 SCI. 735, 736–38 (2014); E. Rignot et al., *Widespread, Rapid Grounding Line Retreat of Pine Island, Thwaites, Smith, and Kohler Glaciers, West Antarctica, from 1992 to 2011*, 41 GEOPHYS. RES. LETT. 3502 (2014); Thomas Sumner, *No Stopping the Collapse of West Antarctic Ice Sheet*, 344 SCI. 683 (2014).

41. NORDHAUS, *supra* note 22, at 170–81.

42. Richard S. J. Tol, *Correction and Update: The Economic Effects of Climate Change*, 28 J. ECON. PERSPECT. 221, 222–26 (2014) (reporting that some damages had been omitted and others mistakenly entered as benefits).

low probability, high consequence climate events.[43] Climate scientists have identified a number of these events, and any one of them could be sufficiently large to challenge assumptions that are central to the analysis.[44] Therefore, this Article examines emissions reductions based on a 2°C goal. Goals of 2.5°C or 3°C would relieve the urgency somewhat, but would not eliminate it.

Achieving any of these targets will require significant emissions cuts.[45] To achieve the 2°C target, many scientists believe that atmospheric CO_2 concentrations should peak in the near term and should not exceed 450 ppm. Current levels are roughly 400 ppm and are increasing by a little more than 2 ppm per year.[46] Limiting atmospheric CO_2 concentrations to 450 ppm will require reducing annual worldwide greenhouse gas emissions roughly 40–70% below 2010 levels by 2050. Even with these cuts it might be necessary to reduce emissions to zero between 2050 and 2100, and to achieve negative emissions by removing GHGs from the atmosphere.[47] After emissions are curtailed, CO_2 concentrations will remain high for thousands of years.[48]

Why not delay emissions reductions? Temperatures have increased almost 1°C since the beginning of the industrial revolution, and with emissions now at record levels every decade of delay will result in a further commitment of roughly 0.5°C (0.9°F).[49] Delaying emissions reductions will increase the peak temperature and will require steeper emissions reductions in the future to achieve any given temperature

43. Simon Dietz & Nicholas Stern, *Endogenous Growth, Convexity of Damages and Climate Risk: How Nordhaus' Framework Supports Deep Cuts in Carbon Emissions* (Ctr. for Climate Change Economics & Policy, Working Paper No. 180, 2014).

44. *See* Michael Vandenbergh & Jonathan Gilligan, *Macro Risks: The Challenge for Rational Risk Regulation*, 21 DUKE ENVTL. L. & POL'Y FORUM 401 (2011).

45. Thomas Stocker & Myles Allen, *Impact of Delay in Reducing Carbon Dioxide Emissions*, 4 NATURE CLIMATE CHANGE 23 (2014).

46. *See* Guivarch & Hallegatte, *supra* note 32, at 192.

47. O. EDENHOFER ET AL., *Technical Summary*, *in* CLIMATE CHANGE 2014: MITIGATION OF CLIMATE CHANGE. CONTRIBUTION OF WORKING GROUP III TO THE FIFTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, Table TS.1, at 26 (O. Edenhofer et al. eds., 2013).

48. Susan Solomon et al., *Irreversible Climate Change Due to Carbon Dioxide Emissions*, 106 PROC. NAT'L ACAD. SCI. 1704 (2009); David Archer et al., *Atmospheric Lifetime of Fossil Fuel Carbon Dioxide*, 37 ANNU. REV. EARTH PLANET. SCI. 117 (2009).

49. Stocker & Allen, *supra* note 45, at 23.

target. The Intergovernmental Panel on Climate Change ("IPCC") and other analyses conclude that delaying action by a few decades could make it impossible to keep concentrations below 450 or even 550 ppm.[50] Although estimates differ on the costs of delay, a recent Council of Economic Advisors report concludes that each decade of delay will increase mitigation costs by roughly forty percent, and the IPCC found that delaying action until 2030 could more than double mitigation costs.[51] An independent study calculated that delaying action by fifty years would cost $6.5 trillion.[52]

One reason that delay is costly arises from investments in energy infrastructure. Much of the existing energy infrastructure is nearing its end of life, which creates an opportunity to replace it with low-emissions infrastructure. Emissions from current infrastructure over the rest of its expected life will leave atmospheric CO_2 concentrations below 430 ppm, and the global average temperature 1.3°C above preindustrial times.[53] If this infrastructure is replaced at the end of its useful life with equipment that produces high emissions and has an expected lifetime of forty years or more, however, it will be costly to replace it with low-emissions

50. EDENHOFER, *supra* note 47, at 32; NORDHAUS, *supra* note 22, at 178–79 (concluding that the cost of "meeting the Copenhagen objective of 2°C would be modest if it is undertaken efficiently . . . . [But] delayed participation of a substantial part of the world will make it virtually impossible—not just costly—to meet the Copenhagen objective of 2°C"); *id.* at 178–81 (finding that "unless virtually all countries participate very soon, and do so in an efficient manner, . . . limiting the increase in global temperature to 2°C is not possible," and that if some countries take prompt action but many others delay action until the twenty-second century, "the costs rise very quickly for temperature targets below 4°C"); INTERNATIONAL ENERGY AGENCY, WORLD ENERGY OUTLOOK 2014, Annex A 24 (2014) (emphasizing that without steep emissions cuts before 2040 it will be impossible to keep warming below 2°C).

51. COUNCIL OF ECONOMIC ADVISORS, EXECUTIVE OFFICE OF THE PRESIDENT, THE COST OF DELAYING ACTION TO STEM CLIMATE CHANGE 3 (2014); EDENHOFER, *supra* note 47, at 33, fig. TS.13 (finding that delaying action until 2030 could more than double the cost of achieving 2°C); *see also* L. Clarke et al., *Assessing Transformation Pathways*, *in* CLIMATE CHANGE 2014: MITIGATION OF CLIMATE CHANGE 53 (O. Edenhofer et al. eds., 2014) (reporting that even if some countries took prompt action, delays by others until 2030 or 2050 could raise mitigation costs by 50% to more than 100%).

52. NORDHAUS, *supra* note 22, at 300.

53. Steven J. Davis et al., *Future CO_2 Emissions and Climate Change from Existing Energy Infrastructure*, 329 SCI. 1330, 1330 (2010).

technology before then. Thus, a limited window exists for replacing high-emissions energy infrastructure at low cost.

B. Private Governance Wedge

A range of pathways will achieve the 2°C goal. This Article focuses on the "450 pathway" for CO_2 emissions from fossil fuel consumption, published by the International Energy Agency ("IEA").[54] The dotted line in Figure 1 represents the IEA's 450 pathway, which is designed to limit atmospheric CO_2 levels to 450 ppm.

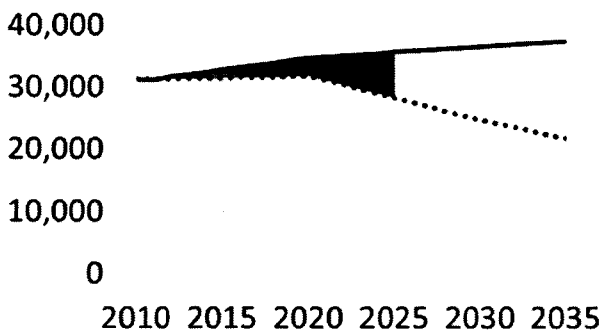

Figure 1. Emissions Reductions Wedge 2016–2025 (million metric tons of CO_2)

The IEA also publishes a projection of the global emissions pathway with likely government policies in the U.S. and around the world (the solid line in Figure 1).[55] A substantial gap exists between the projected emissions under likely government policies and the 450 pathway (the shaded area in Figure 1).

GHG emissions are reported in various ways, but the analysis in this Article uses only metric tons of CO_2 from fossil

54. INTERNATIONAL ENERGY AGENCY, *supra* note 50, at Annex A. For a discussion of the wedge concept, see Stephen Pacala & Robert Socolow, *Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies*, 305 SCI. MAGAZINE 968, 968 (2004).

55. INTERNATIONAL ENERGY AGENCY, *supra* note 50. The IEA analysis is roughly consistent with the analysis performed by the Climate Action Initiative, an NGO that analyzes the impacts of government policies on global carbon emissions. *See Below 2°C or 1.5°C Depends on Rapid Action from Both Annex I and Non-Annex I Countries*, CLIMATE ACTION TRACKER (June 4, 2014), http://climateactiontracker.org/news/156/Below-2C-or-1.5C-depends-on-rapid-action-from-both-Annex-I-and-non-Annex-I-countries.html [http://perma.cc/9XH8-PDJL].

fuel consumption. We omit other greenhouse gas emissions and CO_2 emissions from sources other than fossil fuels for several reasons. CO_2 emissions contribute sixty-five percent of the annual increase in the earth's heat imbalance, and this proportion has grown steadily for more than forty years.[56] CO_2 emissions from industrial and energy activity can be accounted for more accurately than other sources of greenhouses gases.[57] CO_2 is by far the longest lived of the major GHGs, and our policy focus is on the irreversible long-term consequences of climate change. Finally, because of the central role of energy in the world economy, emissions from fossil fuel consumption are widely seen as the most intractable piece of the climate policy conundrum.[58] Thus, in limiting our scope to CO_2 emissions from fossil-fuel use, we focus on the most dangerous GHG and perhaps the most difficult aspect of climate mitigation.

The wedge of emissions reductions necessary to fill the gap between the 450 pathway and the likely government policies pathway is roughly 900 million metric tons of CO_2 in 2016, growing to roughly 6,300 million tons in 2025.[59] On average, the gap is roughly 4,000 million tons (4 gigatons) per year over this period. This is the bogey for any new climate strategy or combination of strategies over the next decade: to reduce the risk of major climate disruption and the costs of mitigation, over the next decade new initiatives should achieve a wedge with average annual CO_2 emissions reductions of roughly 4,000

56. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2014: MITIGATION OF CLIMATE CHANGE 7 (2014).

57. *See* NATIONAL RESEARCH COUNCIL, ADVANCING THE SCIENCE OF CLIMATE CHANGE (2010).

58. *See, e.g.*, Martin I. Hoffert et al., *Energy Implications of Future Stabilization of Atmospheric CO_2 Content*, 395 NATURE 881, 881 (1998) (concluding that "[s]tabilizing atmospheric CO_2 . . . implies a massive transition to carbon-free power").

59. In the remainder of this Article, the term "ton" refers to a metric tonne, or roughly 2,200 pounds. The Article uses the rough target of 4,000 million tons of CO_2, rather than a more precise estimate of 3,730 million tons, because of the wide range of estimates of the quantity and timing of CO_2 emissions necessary to achieve 2°C and the levels that will occur after actual government policies. The 4,000 million ton total includes not only the tons of emissions required between 2016 and 2025, but also roughly 1,300 million tons necessary to make up for emissions over the 450 pathway that occurred between 2012 and 2015. Rounding the target up from 3,700 to 4,000 million tons makes our feasibility estimates conservative so that it may well be easier than we predict to follow a path toward limiting CO_2 to 450 ppm.

million tons per year, over and above the emissions reductions that will be achieved through likely government policies.

II. BARRIERS

The most obvious institutional candidates to achieve major emissions reductions are government regulation or government intervention in markets to establish a carbon price. Many national governments have the legitimacy and the coercive power necessary to dictate emissions reductions within their borders and have the capacity to negotiate international agreements that include credible emissions reduction commitments from other countries. Scholars have identified pricing carbon as the most efficient means by which governments can reduce emissions,[60] and much of the scholarly and policy activity has focused on the design of a domestic and international carbon price.[61] Pricing carbon can limit global warming at a small cost if it is implemented quickly and universally. The greater the delays or the more nations fail to join a pricing accord, however, the less efficient and more expensive the policies will be.[62]

Will a carbon price be adopted and implemented in the United States and by the other major emitting nations in the next decade? It is certainly possible. Only a dozen countries

60. *See* Gilbert E. Metcalf & David Weisbach, *The Design of A Carbon Tax*, 33 HARV. ENVTL. L. REV. 499, 517 (2009); Reuven S. Avi-Yonah & David M. Uhlmann, *Combating Global Climate Change: Why a Carbon Tax Is a Better Response to Global Warming Than Cap and Trade*, 28 STAN. ENVTL. L.J. 3, 45 (2009).

61. *See* Nell Greenfield-Boyce, *Climate Change Adjustments Must Be Fast and Major*, NAT'L PUB. RADIO (Apr. 13, 2014, 9:40 AM), http://www.npr.org/blogs/thetwo-way/2014/04/13/302541260/climate-change-adjustments-must-be-fast-and-large-u-n-panel-says [http://perma.cc/YHJ8-GG45] (discussing comments from Robert Stavins discussing IPCC report conclusion that action is needed in fifteen years and advocating carbon tax); N. Greg Mankiw, *A Missed Opportunity on Climate Change*, N.Y. TIMES, Aug. 9, 2009, at BU4 (regarding a Harvard economist and former advisor to President George W. Bush advocating for carbon tax); WARWICK J. MCKIBBIN ET AL., THE ECONOMIC CONSEQUENCES OF DELAYS IN U.S. CLIMATE POLICY (2014), *available at* http://www.brookings.edu/~/media/research/files/papers/2014/06/03%20economic%20consequences%20delay%20us%20climate%20policy/03_economic_consequences_delay_us_climate_policy.pdf [http://perma.cc/FGN9-YUL7].

62. *See* Vandenbergh & Cohen, *supra* note 15, at 221 (finding that if many of the world's largest-emitting nations participated in a pricing agreement, incentives for leakage could be reduced, which would make the policies more effective); NORDHAUS, *supra* note 22, at 176–79, 300.

account for roughly seventy percent of global CO_2 emissions, and the U.S. and China together account for roughly forty percent of global emissions.[63] Top-down leadership could emerge among politicians in several of the major emitting countries to shift public opinion and overcome political resistance, and commitments by these countries could induce other countries to make similar commitments. A series of dramatic weather events (droughts, heat waves, storms) or new scientific reports could affect public opinion and create bottom-up pressure for climate policy in these nations.[64] Major technological breakthroughs or advances in geoengineering could reduce the size of the carbon price needed to achieve the temperature target.[65] The depth of the political barriers, however, suggests that adoption and implementation of a carbon price at the national and international levels over the next decade is a long shot.[66]

A. National Legislation

In the U.S., a national carbon price requires federal legislation to create a carbon tax or a tradable entitlement to pollute. The size of the carbon price has a large effect on its political feasibility, but economists are surprisingly uncertain about the price necessary to achieve 2°C or any other

63. *See CAIT Climate Data Explorer*, WORLD RESOURCES INSTITUTE (2011), http://cait2.wri.org/wri/Country%20GHG%20Emissions?indicator[]=Total%20GHG%20Emissions%20Excluding%20Land-Use%20Change%20and%20Forestry&indicator[]=Total%20GHG%20Emissions%20Including%20Land-Use%20Change%20and%20Forestry&year[]=2011&chartType=geo [http://perma.cc/L25T-XRA4].

64. *See* Jeff Joireman et al., *Effect of Outdoor Temperature, Heat Primes, and Anchoring on Belief in Global Warming*, 30 J. ENVTL. PSYCHOL. 358 (2010).

65. *See* ROGER PIELKE, JR., THE CLIMATE FIX: WHAT SCIENTISTS AND POLITICIANS WON'T TELL YOU ABOUT GLOBAL WARMING (2010) (emphasizing need for new technologies); Alan Carlin, *Global Climate Change Control: Is There a Better Strategy Than Reducing Greenhouse Gas Emissions?*, 155 U. PA. L. REV. 200 (2007) (emphasizing role of geoengineering).

66. *See, e.g.*, Krugman, *supra* note 27 (stating that a carbon tax "isn't going to happen in the foreseeable future"); Anthony Adragna, *Recent Republican Calls for Climate Action Unlikely to Produce Results, Senators Say*, 45 ENV'T REP. 1973 (2014) (noting depth of resistance to national carbon tax among conservatives); *see also* Marjorie Connelly, Jon Huang & Jeremy Merrill, *2014 Exit Polls*, N.Y. TIMES, Nov. 4, 2014, *available at* http://www.nytimes.com/interactive/2014/11/04/us/politics/2014-exit-polls.html [http://perma.cc/F25Z-GKHK] (reporting that climate change is second only to the Affordable Care Act in dividing Democrats and Republicans, and is more polarizing than immigration, marijuana legalization, and same-sex marriage).

temperature goal. Estimates of the global carbon price necessary in 2020 to achieve the 2°C target vary from roughly $15 to well over $200 per metric ton of CO_2.[67] Developed countries will likely need to bear a greater share of the mitigation costs than developing countries, and one analysis suggests that achieving the 450 ppm target would require a U.S. carbon price of roughly $53 per ton by 2015, increasing to $210 per ton by 2050.[68] The longer the carbon price is delayed, the higher the price must be.[69] In addition, since the carbon price must go up over time to achieve the reductions needed in later years, the initial legislation must include a schedule of increasing taxes or declining caps, or legislative battles must be re-fought every several years.

The recent history of environmental law suggests the difficulty of adopting any major federal pollution control legislation. After the enactment of more than a dozen major statutes from 1970 through 1990, none has been enacted in the ensuing quarter century.[70] Climate change presents challenges to a legislative response that are at least as great as those

67. *See* Leon Clarke et al., *International Climate Policy Architectures: Overview of the EMF 22 International Scenarios*, 31 ENERGY ECON. S64, tbl.5 (2005) (using 450 ppm CO_2 target); *see also* Kriegler et al., *The Role of Technology for Achieving Climate Objectives: Overview of the EMF-27 Study on Global Technology and Climate Policy Strategies*, 123 CLIMATIC CHANGE 353 (2014) (concluding that a 450 ppm target would require a 2020–2100 average price of $12 to $92 per metric ton of CO_2); NORDHAUS, *supra* note 22, at 228 (reporting prices of $60 to more than $200 per ton in 2050 to achieve a more modest 2.5°C target). The form of the carbon tax also could affect its political feasibility. *See* Tracey M. Roberts, *Mitigating the Distributional Impacts of Climate Change Policy*, 67 WASH. & LEE L. REV. 209 (2010).

68. *See* SERGEY PALTSEV ET AL., MIT JOINT PROGRAM ON THE SCIENCE AND POLICY OF GLOBAL CHANGE, ASSESSMENT OF U.S. CAP-AND-TRADE PROPOSALS (2007) (estimating 2015 CO_2e price of $53 and 2050 price of $210 per ton). The EIA basic case projection of carbon prices under the Waxman-Markey cap and trade bill, which used a 450 ppm CO_2e target, priced carbon at $18 in 2012, increasing to $32 in 2020 and $65 in 2030.

69. *See* Clarke et al., *supra* note 69, at tbl.5; *see also* Kriegler et al, *supra* note 67, at 353 (concluding that a 450 ppm target would require the 2020–2100 average price of $12 to $92).

70. Vandenbergh, *supra* note 3, at 140; *see also* Michael P. Vandenbergh, *The Emergence of Private Environmental Governance*, 44 ENVTL. L. REP. 10125, fig.1 (2014) (noting absence of major pollution control statutes from 1991–2013); David Uhlmann, *The Quest for a Sustainable Future*, 1 MICH. J. ENVTL. & ADMIN. L. 1, 9 (2012); Richard J. Lazarus, *Congressional Descent: The Demise of Deliberative Democracy in Environmental Law*, 94 GEO. L.J. 619, 619 (2006) (describing congressional action as "effectively moribund").

faced by other proposed pollution control statutes, and Congress has rejected carbon tax and cap-and-trade legislation on several occasions in the last decade. In addition, the recent repeal of the Australian carbon tax demonstrates that once a carbon tax begins to bite, the next response is likely to be tax relief.[71]

The difficulties for federal climate legislation are the product of the intrinsic structure of the climate problem and the design features of the federal government.[72] In short, climate poses a difficult problem because individuals and organizations can externalize the harms of carbon-emitting behaviors. This produces intra- and inter-generational concerns. Individuals gain the benefits of carbon-emitting actions, and their carbon emissions cause harm that is shared with others in the U.S. and around the globe. In addition, although mitigation costs will be incurred in the near term, the bulk of the benefits will accrue to future generations. Individuals also face collective action problems in developing organizations to lobby for a government response.[73]

The design features of the federal government exacerbate these problems. Any legislation must achieve not only the support of the President and both bodies of Congress, but also sixty votes in the Senate to avoid a filibuster. As a result, any evaluation of the likelihood of a national carbon price must provide a plausible analysis of how sixty Senators can be induced to support the effort. International efforts to harmonize carbon prices face the greater challenge of winning sixty-seven votes to ratify a treaty.[74] Similarly, if Congress were to pass climate legislation which was then vetoed by the President, a two-thirds majority would be required in both the House and the Senate to override the veto. In addition,

71. *See, e.g.*, Murray Griffin, *Australian Party with Balance of Power Refuses to Back New Carbon Policy*, 37 INT'L ENVT. REP. 948, 948 (2014),.

72. *See generally* Richard J. Lazarus, *Super Wicked Problems and Climate Change: Restraining the Present to Liberate the Future*, 94 CORNELL L. REV. 1153, 1155–56 (2009) (identifying climate challenges); Thomas Dietz, Elinor Ostrom & Paul C. Stern, *The Struggle to Govern the Commons*, 302 SCI. 1907, 1907 (2003).

73. *See* MANCUR OLSON, JR., THE LOGIC OF COLLECTIVE ACTION: PUBLIC GOODS AND THE THEORY OF GROUPS 11–12 (1965).

74. *See* Coral Davenport, *Obama Pursuing Climate Accord in Lieu of Treaty*, N.Y. TIMES, Aug. 27, 2014, at A1.

advocates for a government response confront not only standard collective action problems, but also well-funded, concentrated interests that will be harmed by a carbon price in the near term.

Equally important, government climate mitigation efforts at the national level confront deep differences in worldviews.[75] Research suggests that reports about climate science and climate mitigation often trigger big government concerns among moderates, conservatives, and libertarians.[76] These concerns affect perceptions of the risk posed by climate change and reduce support for government mitigation policies.[77]

B. International Agreement

The barriers to national legislation are compounded at the international level. As with the history of domestic legislation, the history of international climate negotiations suggests room for doubt about the adoption and implementation of an international agreement with credible commitments by the major emitting nations.[78] The slow pace of the international process reflects the collective action challenges at the international level. Countries have incentives to free ride on others' efforts, since all countries will benefit from others' reductions but will bear the costs of the reductions on their own, and even modest free riding can put a 2°C target out of reach.[79] Whether the problem is styled as one involving a public good or a common pool resource,[80] the result is largely

75. *See* Dan M. Kahan, *Ideology, Motivated Reasoning, and Cognitive Reflection*, 8 JUDGMENT & DECISION MAKING 407, 413 (2013); Dan Kahan, *Fixing the Communications Failure*, 463 NATURE 296, 297 (2010).

76. *See* Aaron M. McCright & Riley E. Dunlap, *The Politicization of Climate Change and Polarization in the American Public's Views of Global Warming, 2001–2010*, 52 SOC. Q. 155, 193 (2011).

77. For an overview, see Michael P. Vandenbergh, Kaitlin T. Raimi & Jonathan M. Gilligan, *Energy and Climate Change: A Climate Prediction Market*, 61 UCLA L. REV. 1962 (2014).

78. *See* VICTOR, supra note 26, at 1.

79. NORDHAUS, *supra* note 22, at 179 (stating that "delayed participation of a substantial part of the world will make it virtually impossible—not just costly—to meet the Copenhagen objective of 2°C").

80. For a discussion of whether the climate problem is better analyzed as a public good or common pool resource, see Daniel H. Cole, *Climate Change and Collective Action*, 61 CURRENT LEGAL PROBLEMS 229, 230 (2008).

the same: limited prospects for an international agreement that will result in adoption and implementation of a global carbon price in the next decade.

As with domestic climate efforts in the United States, the design features of the United Nations-sponsored climate process exacerbate the underlying collective action problems. The U.N. process requires a high degree of consensus, yet a meaningful international climate agreement will produce winners and losers in the near term. The U.N. process provides many opportunities for potential losers to slow or stop the development of an agreement with credible commitments.

Although the U.N. process provides roadblocks, the deep divide between developed and developing countries is perhaps the greatest barrier to an international agreement. Developed countries contributed most of the CO_2 in the atmosphere (known as "stocks") and benefited most from the industrialization that generated much of that CO_2. Yet most of the growth in annual CO_2 emissions (known as "flows") over the next several decades will arise from developing countries.[81] As a result, the 2°C goal is unattainable unless developing countries reduce emissions below projected business-as-usual levels.[82] Developing countries not only lack the resources of developed countries, but also can make a strong argument that their emissions are lower on a per capita basis, that they should be allowed to gain the same benefits of industrialization as the developed countries, and that much of their emissions arise from making goods consumed in developed countries.

As with the domestic process in the U.S., shifts could occur in the positions of the major emitting nations at the next meeting

81. *See* Alex Morales, *Rich-Poor Divide on Climate Unresolved in UN Policy Paper, in* BNA ENVT. & CLIMATE REP. 12–13, July 9, 2014. For a discussion of developed versus developing world emissions and mitigation positions, see Vandenbergh, *supra* note 28, at 910–20. *See also* ERIC POSNER & DAVID WEISBACH, CLIMATE CHANGE JUSTICE (2010) (noting that the economic activity associated with developed countries' carbon emissions also benefitted developing countries).

82. *See Below 2 °C or 1.5°C Depends on Rapid Action from Both Annex I and Non-Annex I Countries, supra* note 55 (noting that "the new CAT analysis shows that this [the Clean Air Act 111(d) existing plant emissions rule] wouldn't be enough: additional efforts would have to come from the major developing country emitters to close 2020 emissions gap of 8–13MtCO_2e (as estimated by the CAT)"); *see also* P. Friedlingstein et al., *Persistent Growth of CO_2 Emissions and Implications for Reaching Climate Targets*, 7 NATURE GEOSCIENCE 709, 710–15 (2014).

of the U.N. process, and an agreement with credible commitments for emissions reductions by the major emitters could emerge. The history of the negotiations, the collective action problems, the cumbersome international process, and the deep differences between developed and developing countries all make that outcome unlikely.[83] Certainly many statements claiming success can be expected, but the prospects are dim for an agreement with credible commitments for adoption and implementation of a carbon price by the major emitting countries over the next decade.

C. Other Options

After two decades of focusing largely on making the case for a carbon price, many scholars and policymakers have begun to examine other complementary and gap-filling options.[84] Policymakers at the federal level have developed new motor vehicle standards, Clean Air Act regulations directed at existing and new power plants, and other measures.[85] With California as the leading example, states and local governments have adopted emissions-reduction policies alone and in regional initiatives.[86]

These national, state, and local government steps have been very important, and, along with the increasing availability of

83. *See* Morales, *supra* note 81. *See, e.g.*, Krugman, *supra* note 27 (stating that a carbon tax "isn't going to happen in the foreseeable future").

84. *See, e.g.*, Krugman, *supra* note 26 (arguing for consideration of second-best options); Vandenbergh, *supra* note 3, at 139 (identifying how "[u]nderstanding private environmental governance can lead to new options for tackling climate change"); Vandenbergh, *supra* note 27, at 911 (proposing use of supply chain contracting initiatives to create emissions reduction incentives in developing countries); VICTOR, *supra* note 26, at 9 (observing a large gap between policies that are politically viable and "policies that are economically optimal").

85. The new EPA proposed rule adopts a thirty percent emissions reduction goal for electric generating units from 2005 levels, a significant reduction, but that goal will leave the U.S. with emissions that are five percent higher than 1990 levels, levels that are higher than if the U.S. had ratified and complied with the Kyoto Protocol. *See Below 2 °C or 1.5°C Depends on Rapid Action from Both Annex I and Non-Annex I Countries*, *supra* note 55.

86. *See, e.g.*, Ann Carlson, *Iterative Federalism and Climate Change*, 103 NW. L. REV. 1 (2009) (examining federal and state roles in climate mitigation); Jody Freeman & Andrew Guzman, *Climate Change and U.S. Interests*, 109 COLUM. L. REV. 1531, 1554 (2009); Joel B. Eisen, *Smart Regulation and Federalism for the Smart Grid*, 37 HARV. ENVTL. L. REV. 1 (2013); John C. Dernbach, *Harnessing Individual Behavior to Address Climate Change: Options for Congress*, 26 VA. ENVTL. L.J. 107 (2008).

natural gas and other factors, they will enable the U.S. to make substantial emissions reductions. The anticipated reductions from current and likely new government policies in the U.S. and elsewhere are included in the 450 pathway discussed at the end of Part I, however, and this will still leave the 4 gigaton gap over the next decade between what likely government policies will achieve and the 450 pathway. In response to the limits of current efforts, scholars have suggested several innovative responses to the gridlock at the national and international level.

Climate Clubs. Rather than focusing on the design of a comprehensive international agreement to price carbon, David Victor and others have drawn on club theory in economics and the example of multilateral trade agreements to propose limited climate agreements that can appeal to the interests of a few nations at first and attract additional participants over time.[87] This work suggests that clubs of countries can form over shared interests and can attract other countries with similar incentives. As more countries join these clubs, the benefits of participating could increase, leading to meaningful numbers of participants and emissions reductions.[88]

Polycentric Governance. Before her recent death, Nobel laureate Elinor Ostrom and colleagues began applying the concept of polycentric governance to climate mitigation.[89] Polycentric governance, first applied to the management of water resources and the provision of municipal services, refers to the use of multiple scales of government and NGOs to

87. *See* VICTOR, *supra* note 26, at 3–4; Robert O. Keohane & David G. Victor, *The Regime Complex for Climate Change*, 9 PERSP. ON POL. 7, 7 (2011); Matt Potoski & Aseem Prakash, *Green Clubs: Collective Action and Voluntary Environmental Programs*, 16 ANN. REV. POL. SCI. 399 (2013).

88. For an example of a bilateral agreement that targets GHG emissions, see Press Release, White House, Fact Sheet: U.S.-China Joint Announcement on Climate Change and Clean Energy Cooperation (Nov. 11, 2014), *available at* http://www.whitehouse.gov/the-press-office/2014/11/11/fact-sheet-us-china-joint-announcement-climate-change-and-clean-energy-c [http://perma.cc/W8DW-E3AR].

89. *See* Elinor Ostrom, *Nested Externalities and Polycentric Institutions: Must We Wait for Global Solutions to Climate Change Before Taking Actions at Other Scales?*, 49 ECON. THEORY 353 (2012); Daniel Cole, *From Global to Polycentric Governance*, 2 CLIMATE L. 395 (2011); Benjamin K. Sovacool, *An International Comparison of Four Polycentric Approaches to Climate and Energy Governance*, 39 ENERGY POL'Y 3832 (2011).

address collective action problems, such as managing common pool resources.[90] Ostrom observed that:

> individuals facing [collective action] problems do not always need an external authority to extract them from their tragedy [of the commons]. When they . . . can engage with one another, can learn to trust one another, can draw on sources of reliable data, can ensure monitoring of their decisions, can create new instrumentalities, and can adapt over time, they are frequently . . . able to extract themselves from these challenging dilemmas.[91]

This approach rejects the idea that waiting for a comprehensive international and national government response is the optimal strategy. Ostrom identified a wide range of government activities at the local, regional, national, and global levels that could achieve emissions reductions despite the political gridlock. An example of polycentric governance is the successful effort to obtain commitments for emissions reductions from many cities in the U.S. and around the world.[92]

Bottom-up Strategies. Richard Stewart and colleagues have argued for bottom-up solutions that do not require a comprehensive international agreement at the outset, but may reduce emissions and increase the likelihood of an agreement.[93] Many of these strategies also involve governments at the sub-national level, and some include the types of global actions by

90. *See, e.g.*, Vincent Ostrom et al., *The Organization of Government in Metropolitan Areas: A Theoretical Inquiry*, 55 AM. POLI. SCI. REV. 831 (1961); MICHAEL DEAN MCGINNIS, POLYCENTRIC GOVERNANCE AND DEVELOPMENT: READINGS FROM THE WORKSHOP IN POLITICAL THEORY AND POLICY ANALYSIS (1999).

91. Elinor Ostrom, *A Long Polycentric Journey*, 13 ANN. REV. OF POLI. SCI. 1, 6 (2010).

92. *See* U.S. MAYORS CLIMATE PROTECTION AGREEMENT, THE U.S. CONFERENCE OF MAYORS (2005), *available at* http://www.usmayors.org/climateprotection/agreement.htm [http://perma.cc/CRU3-JJFP].

93. *See, e.g.*, Richard B. Stewart et al., *Building a More Effective Global Climate Regime Through a Bottom-Up Approach*, 14 THEORETICAL INQUIRIES L. 273, 274 (2013) (identifying bottom-up mitigation strategies); Daniel C. Esty, *Bottom-Up Climate Fix*, N.Y. TIMES, Sept. 22, 2014, at A25 (noting that "[t]he real action on climate change around the world is coming from governors, mayors, corporate chief executives and community leaders"); *see also* Eric Orts, *Climate Contracts*, 29 VA. ENVTL. L. J. 197 (2010); Sarah Light, *The New Insider Trading: Environmental Markets Within the Firm*, 34 STAN. ENVTL. L.J. 3 (2015).

private parties that are included in the private climate governance strategy.[94] An insight of the bottom-up approach is the importance of quantifying bottom-up emissions reductions and crediting them to the source nations in international climate negotiations.[95] The bottom-up approach thus recognizes the value of multiple small initiatives, of tracking emissions reductions from these initiatives, and of creating incentives for future initiatives by attributing the emissions reductions to participating nations.

These efforts offer promising new approaches, but many require some form of governmental action. In recent years even seemingly bipartisan issues in the U.S. such as energy efficiency and clean technology promotion have become the subject of legislative gridlock at the national level,[96] and the barriers to government action are not limited to the U.S. If political resistance is a core barrier to a successful government climate response, additional climate responses are needed that can bypass the political process altogether.

III. PRIVATE GOVERNANCE

The conceptual shift at the core of the private climate governance strategy is that private institutions can achieve prompt, large carbon emissions reductions. According to a leading climate policy analyst, "[d]omestic policy design faces one central question: [w]here should government intervene?"[97] In contrast, the central question for private climate governance is how private initiatives can induce emissions reductions in the absence of government intervention. A private climate governance strategy is not a substitute for effective public governance or for the creative thinking that has emerged from work on clubs of countries, polycentric governance, bottom-up

94. *See* Stewart et al., *supra* note 93, at 286–88.

95. *Id.* at 275; *see also* Kenneth W. Abbott, *Strengthening the Transnational Regime Complex for Climate Change*, 3 TRANSNAT'L ENVTL. L. 57 (2014); Kenneth W. Abbott, *Engaging the Public and the Private in Global Sustainability Governance*, 88 INT'L AFF. 543 (2012); Orts, *supra* note 93, at 198.

96. *See* Nick Juliano, *Heritage Urges "Key Vote" Against Senate Efficiency Bill*, E&E NEWS, May 2, 2014, *available at* http://www.eenews.net/eenewspm/2014/05/02/stories/1059998938 [http://perma.cc/H9J4-DKR2].

97. Michael Levi, *The Hidden Risks of Energy Innovation*, 29 ISSUES SCI. & TECH. 69, 73 (2013).

strategies, and other new approaches.[98] Instead, private climate initiatives can be implemented along with these other strategies, and the concept of private governance can serve as a heuristic to identify viable new private initiatives.

The new and existing private climate governance initiatives discussed in Parts III and IV are just examples of the efforts that could be included in a private governance strategy.[99] Part III.A explains why private climate governance is possible—why private parties can be induced to lower carbon emissions even without the power and resources of governments. Part III.B provides examples of the opportunities for cross-cutting private initiatives, and Part IV turns to initiatives that target corporations and households.

A. Model of Private Climate Governance Drivers

As discussed at the outset, the ability of private governance initiatives to contribute large, prompt emissions reductions is a function of the technical potential (the emissions reductions that would arise if all possible behavior change occurred), and the behavioral plasticity (the extent of the behavior change that can reasonably be expected from an intervention) of the targeted actions. It is also a function of the policy plasticity of private interventions (the extent to which an organization can implement the initiatives necessary to achieve the potential reductions).[100]

i. Technical Potential

The Article analyzes technical potential when examining the specific initiatives below, but one overarching point is important: the initiative must either target behaviors or sources with large potential emissions reductions or must be amenable to scaling up to achieve large reductions. For

98. *See* Sovacool, *supra* note 13, at 529–30.

99. For a recent theory of private authority that focuses on the relationship between public and private environmental governance, see GREEN, *supra* note 8. Some of the initiatives included in the private climate governance strategy presented in this Article are what Green describes as forms of "private entrepreneurial authority" (as opposed to "delegated authority"), *id.* at 33–34, but many of the initiatives presented here are not easily characterized as exercises of authority.

100. *See* Dietz et al., *supra* note 13, at 18453 (identifying technical potential and behavioral plasticity).

instance, the household sector is promising not only because of the large share of U.S. emissions attributable to households, but also because of the high technical potential of many specific household actions. Households use a large amount of energy, and many households have not taken simple measures that could significantly reduce energy use, even where these measures would produce financial savings. These measures include purchasing more efficient vehicles and appliances, weatherizing homes, and making small behavioral changes, such as reducing vehicle idling.[101] Yet household initiatives often face challenges of scale. Research suggests that many household interventions are more effective if they are carefully tailored to reflect the norms and beliefs of local communities, and if they have extensive participation by local community members, but many of these features also make the most effective methods difficult to replicate at large scale. The most attractive private governance initiatives use effective methods and do so in ways that can be scaled up to yield major emissions reductions.[102]

ii. Behavioral Plasticity

Many calls for household and corporate initiatives point to the large technical potential of a targeted behavior, arguing that if every household or corporation changed the behavior, the emissions reductions would be huge. These well-intentioned efforts often neglect the challenges of achieving broad and sustained participation. Carpooling has the technical potential to achieve enormous emissions reductions because few drivers currently carpool and each driver who joins a carpool takes one car off the road. Despite the high technical potential, however, behavioral plasticity is low because individuals resist carpooling. Unless the behavioral plasticity can be greatly increased, it would be unwise to target carpooling based on technical potential alone.

In contrast to carpooling, other types of carbon-emitting behaviors have high behavioral plasticity and can be changed

101. *Id.* *See also* Amanda R. Carrico et al., *Costly Myths: An Analysis of Idling Beliefs and Behavior in Personal Motor Vehicles*, 37 ENERGY POL'Y 2881 (2009).

102. *See* Paul C. Stern, *Contributions of Psychology to Limiting Climate Change*, 66 AM. PSYCHOLOGIST 303 (2011).

without the coercive authority or resources of government. For example, inefficient energy use provides an opportunity for private initiatives to target actions that do not require altruistic motivations. Instead, these initiatives can target actions for which market failures or behavioral obstacles are blocking self-interested actions, and when self-interest aligns with energy efficiency or conservation, behavioral plasticity can be high even without government intervention.

Market and behavioral failures can often be corrected relatively inexpensively by providing information. For instance, households and firms often fail to adopt cost-saving energy efficiency measures if the transaction costs of obtaining reliable information are too great or if principal-agent problems create perverse incentives.[103] Behavioral failures can arise when individuals struggle to make rational decisions about investments with long payback periods, engage in confirmation bias rather than accurately evaluate new information, act based on myths, and fail to recognize how much of their behavior is driven by a desire to act and think like those around them.[104] Many private initiatives help individuals reduce energy costs by providing information that addresses these barriers or by overcoming other barriers to household or motor vehicle efficiency.[105]

Private governance initiatives also can harness social norms. Individuals may find it in their interest to reduce carbon emissions if they expect social sanctions or rewards, and empirical studies have demonstrated that social norms have

103. *See, e.g.*, PRINDLE, *supra* note 16; INT'L ENERGY AGENCY, *supra* note 16. In addition, people perceive participation in the political process to be more difficult than consumer activism. Edward W. Maibach et al., *Communication and Marketing as Climate Change-Intervention Assets: A Public Health Perspective*, 35 AM. J. PREVENTIVE MED. 488, 491–92, 498 (2008).

104. *See, e.g.*, Michael P. Vandenbergh et al., *Regulation in the Behavioral Era*, 95 MINN. L. REV. 715 (2011) (identifying behavioral failures); Shazeen Z. Attari et al., *Public Perceptions of Energy Consumption and Savings*, 107 PROC. NAT'L ACAD. SCI. 16054, 16055 (2010) (identifying incorrect energy beliefs regarding household actions). Some economists acknowledge the importance of behavioral factors that diminish the efficiency of carbon pricing, but reject policy measures that focus on those behavioral factors. *See, e.g.*, NORDHAUS, *supra* note 22, at 267–72 (observing that many people make irrational and wasteful choices about energy use, but opposing a significant role for regulation in addressing behavioral issues and not considering non-regulatory measures).

105. *See* Dietz et al., *supra* note 13, at 18455.

pervasive effects on energy and environmental behavior.[106] Some private initiatives shift behavior by providing information that leverages these social norm effects.

Another source of motivation for emissions reductions is existing support for climate mitigation. Surveys demonstrate that many individuals support climate mitigation,[107] but the portion of the population that places a high priority on climate mitigation is not sufficiently high to induce the federal government to adopt a carbon price, whereas the minority that places a high priority on blocking climate mitigation wields considerable power.[108] Although the existing levels of mitigation support are insufficient to drive legislation, they can be a resource for private governance initiatives. Whereas public governance measures are often designed to affect most of the population, a private governance initiative can be successful even if it only affects the behavior of a small fraction of the population, especially when it has little or no deadweight loss and can thus coexist comfortably with a wide variety of complementary initiatives.[109] An example is private carbon product labeling, which can be successful if it only affects an influential subset of consumers or if it induces some retailers to change their product offerings (e.g., many shoppers at upscale or organic food stores may be concerned about the carbon footprint of their food).

Private governance initiatives also can motivate emissions reductions by individuals who support climate mitigation but who have concerns about government size or intrusion that discourage them from acting.[110] The actions could involve

106. *See id.* at 18455–56.

107. *See* ANTHONY LEISEROWITZ ET AL., YALE PROJECT ON CLIMATE CHANGE COMMC'N & GEORGE MASON UNIV. CTR. FOR CLIMATE CHANGE COMMC'N, GLOBAL WARMING'S SIX AMERICAS IN SEPTEMBER 2012, at 42 (2013).

108. *See supra* Part II.

109. Tracey M. Roberts, *The Rise of Rule Four Institutions: Voluntary Standards, Certification and Labeling Schemes*, 40 ECOLOGY L. Q. 107, 154 (2013). For a discussion of the parallels in instruments between public and private governance, see Sarah E. Light & Eric W. Orts, *Parallels in Public and Private Environmental Governance* (forthcoming 2015) (on file with authors).

110. *See* Kahan, *supra* note 75, at 13; Vandenbergh et al., *supra* note 79, at 1966–70 (citing studies); Troy H. Campbell & Aaron C. Kay, *Solution Aversion: On the Relation Between Ideology and Motivated Disbelief*, 107 J. PERSONALITY & SOC. PSYCHOL. 809 (2014), *available at* http://www.ncbi.nlm.nih.gov/pubmed/25347128 [http://perma.cc/XFU3-32X4] (last visited Apr. 14, 2015) (noting that a climate-based message reduced

reducing emissions through their household or corporate decision-making, and private governance initiatives can provide an attractive alternative that addresses the climate problem without challenging a deeply rooted worldview.[111] Moderates, conservatives, and libertarians may find that the private governance strategy allows them to reduce the harms of climate change using markets, private institutions and other small government approaches.[112] Indeed, prominent conservative politicians have called for innovation along these lines in the past.[113]

Corporations also may reduce emissions in the absence of government pressure because of self-interested motivations. Although an extensive literature examines the extent to which firms are legally obligated to maximize profits or shareholder value, there is little doubt that many firms attempt to do so much of the time.[114] Private governance initiatives may reduce transaction costs by providing information to firms or may create the motivation to identify efficient practices by the firm or its suppliers. Although efficient markets theorists assume that firms will identify efficiencies even without external interventions, if private initiatives simply accelerate the

efficient light bulb uptake by Republicans); Irena Fegina et al., *System Justification, the Denial of Global Warming, and the Possibility of "System-Sanctioned Change,"* 36 PERSONALITY & SOC. PSYCHOL. BULL. 326 (2010) (noting the influence of emphasizing maintenance of the status quo).

111. This is not a trivial concern. *See, e.g.*, Dena M. Gromet et al., *Political Ideology Affects Energy-Efficiency Attitudes and Choices*, 110 PROC. NAT'L ACAD. SCI. 9314, 9315 (2013) (noting that a climate-based message reduced efficient light bulb uptake by Republicans); Vandenbergh et al., *supra* note 85, at 757 (citing studies).

112. *See, e.g.*, Colin Camerer et al., *Regulation for Conservatives: Behavioral Economics and the Case for "Asymmetric Paternalism,"* 151 U. PA. L. REV. 1211 (2003) (discussing the potential appeal of behavioral options for conservatives); Vandenbergh et al., *supra* note 77, at 1966–70 (discussing literature on world views and confirmation bias).

113. *John Kerry, Newt Gingrich Take on Environment, Each Other*, FOX NEWS, Apr. 11, 2007, http://www.foxnews.com/story/2007/04/11/john-kerry-newt-gingrich-take-on-environment-each-other/ [http://perma.cc/Y2EA-F76G] (quoting Gingrich calling for "green conservatism" that would "urgently" reduce carbon emissions using "entrepreneurially, market-oriented, and locally led environmentalism").

114. *See, e.g.*, Einer Elhauge, *Sacrificing Corporate Profits in the Public Interest*, 80 N.Y.U. L. REV. 733, 770–71 (2005) (discussing business judgment rule). For examples of successes and failures in corporate environmental initiatives, see DANIEL C. ESTY & ANDREW WINSTON, GREEN TO GOLD: HOW SMART COMPANIES USE ENVIRONMENTAL STRATEGY TO INNOVATE, CREATE VALUE, AND BUILD COMPETITIVE ADVANTAGE (2006).

achievement of efficiencies and carbon emissions reductions, that acceleration may yield important social dividends.[115]

An anecdotal example demonstrates the types of market failures that affect corporations and that may be ferreted out by private governance initiatives. Walkers is the United Kingdom's largest snack food manufacturer and is a subsidiary of PepsiCo.[116] Working with The Carbon Trust, Walkers conducted a supply chain study to estimate its carbon footprint. The project identified opportunities to save 18,000 tons of CO_2 each year without major operational changes, a reduction of eight percent of total supply chain emissions. For instance, the firm concluded that the supply chain could save 9,200 tons of CO_2 just by changing the way potatoes are purchased. Walkers pays per ton of potatoes, creating incentives by farmers to increase the water content, and therefore price, of the potatoes by storing them in humidified warehouses. The humidifiers emit a significant portion of the CO_2 associated with this process, and Walkers later removes the excess water, using additional energy. A different pricing strategy could result in efficiencies for farmers and the manufacturer, and PepsiCo has examined how it can use the Walkers experience to improve the efficiency and carbon emissions of other companies in its portfolio.[117]

In addition to identifying opportunities to improve efficiency, private initiatives may draw on corporate self-interest by affecting a firm's reputation with customers, lenders, investors, employees or other stakeholders.[118] Although consumers often demonstrate limited willingness to pay for lower-carbon goods, firms respond to more generalized reputational concerns, not just direct consumer purchasing behavior.[119] A recent U.S. survey found that more people believe corporations should act

115. For the original efficient markets work, see Eugene Fama, *Efficient Capital Markets: A Review of Theory and Empirical Work*, 25 J. FIN. 383 (1970).

116. *See* THE CARBON TRUST, CARBON FOOTPRINTS IN THE SUPPLY CHAIN: THE NEXT STEP FOR BUSINESS 11–14 (2006), *available at* https://www.carbontrust.com/media/84932/ctc616-carbon-footprints-in-the-supply-chain.pdf [https://perma.cc/8XXH-J5TM].

117. *Id.* at 14.

118. *See, e.g.*, DANIEL A. DIERMEIER, REPUTATION RULES (2013) (examining the role of reputation in corporate behavior).

119. *See* Mark A. Cohen & Michael P. Vandenbergh, *The Potential Role of Carbon Labeling in a Green Economy*, 34 ENERGY ECON. S53–S63 (2012) (citing studies).

on climate mitigation (roughly seventy percent) than should government (roughly sixty percent), suggesting a basis for corporations' concern about their climate reputation.[120] Firms also may expect first-mover advantages if they believe that government will accept climate mitigation policies in the future. Firm managers also may believe they can shape government efforts if they participate in private initiatives, which may become the model for government policies and programs.[121]

Pecuniary advantages also may arise for a firm if climate actions improve employee morale or if corporate buyers, lenders, or investors reward climate mitigation efforts. A number of large corporations are offering employees discounts on home solar-electricity installations to "attract and retain a work force that is increasingly attuned to the environment and to the steps employers take to preserve it."[122] In response to the wide range of incentives to reduce emissions, firms sometimes function as regulators, insisting on emissions reductions from other firms, such as suppliers and borrowers. In other situations they function as regulated entities, responding to pressure from other firms, individuals, or NGOs.

Finally, the decisional space provided by the business judgment rule and by benefit corporation statutes also may enable corporate managers to act on personal preferences for climate mitigation when the costs to the firm are limited or uncertain.[123] Anecdotal examples and limited empirical work suggest that the norms of corporate managers influence corporate environmental behavior, but the extent of this influence is unclear, and the opportunity for private climate governance does not turn on the altruism of firm employees or directors, or on the form of corporate organization.[124] Initiatives directed at corporations can reduce emissions even if they only draw on self-interest, although the opportunity is

120. *See* LEISEROWITZ ET AL., *supra* note 107, at 7.

121. *See* GREEN, *supra* note 8, at 43.

122. Diane Cardwell, *Home Solar Power Discounts Are Worker Perk in New Program*, N.Y. TIMES, Oct. 23, 2014, at B1.

123. *See, e.g.*, Elhauge, *supra* note 114 (discussing business judgment rule).

124. *See, e.g.*, Sally S. Simpson et al., *An Empirical Assessment of Corporate Environmental Crime Control Strategies*, 103 J. CRIM. L. & CRIMINOLOGY 231, 240–77 (2013) (discussing empirical results and citing studies).

greater if altruistic or pro-social motivations also influence corporate behavior.

Despite the motivations for corporations to reduce carbon emissions, private governance initiatives certainly face constraints on what they can achieve. For instance, many firms can be expected to respond to reputational threats with the least investment necessary to respond to the threat. As a result, green-washing (claiming environmental benefits that do not exist) is a concern, as is the formation of competing private governance standards and certification systems that appear to address consumers concerns while offering reduced environmental benefits.[125] Private oversight by NGOs has arisen in part to address these concerns. NGOs provide third party verification and enable firms to make credible claims regarding their climate mitigation efforts,[126] but concerns remain about the incentives and capacity of NGOs, as well as the independence of certifying bodies.[127]

Another constraint on private governance is that firms often have incentives to invest in emissions-reducing measures only to the extent other investments would yield lower returns for the firm. Similarly, if firms are motivated by a desire to reduce support for government regulation or to gain a first mover advantage in anticipation of regulation, reductions in the likelihood of government action may reduce firm participation in private governance efforts. Firms also have incentives to invest in lobbying against government regulation rather than

125. *See* STEERING COMM. OF STATE-OF-KNOWLEDGE ASSESSMENT OF STANDARDS & CERTIFICATION, TOWARD SUSTAINABILITY: THE ROLES AND LIMITATIONS OF CERTIFICATION 9 (2012) (citing studies); Errol E. Meidinger, *Environmental Certification Programs and U.S. Environmental Law: Closer Than You Think*, 31 ENVTL. L. REP. 10162 (2001).

126. *See* STEERING COMM., *supra* note 125, at 9; Lesley K. McAllister, *Regulation by Third Party Verification*, 53 B.C. L. REV. 1 (2012).

127. Workplace disasters in Bangladesh revealed conflicts of interest and sham certifications of workplace safety. *See, e.g.*, Stephanie Clifford & Steven Greenhouse, *Fast and Flawed Inspections of Factories Abroad*, N.Y. TIMES, Sept. 2, 2013, at A1. Similar concerns arose about corporate financial audits and bond ratings in the wake of the 2001 Enron bankruptcy and the 2008 collapse of the mortgage security markets. For popular treatments of these issues, see KURT EICHENWALD, CONSPIRACY OF FOOLS (2005); MICHAEL LEWIS, THE BIG SHORT (2010).

invest in private governance actions if the latter are more costly.[128]

In short, although the opportunities are not boundless, sound reasons suggest that private climate governance initiatives can target many household and corporate actions with high technical potential and behavioral plasticity. Perhaps most important, the high behavioral plasticity does not require unrealistic assumptions about household or corporate altruism. Instead, it arises because private initiatives can address market failures and behavioral failures, and can draw on existing levels of support for climate mitigation.

iii. Policy Plasticity

In addition to the high technical potential and behavioral plasticity of targeted actions, successful private governance initiatives must have high policy plasticity, defined in the climate mitigation context as the extent to which an organization can implement the initiatives necessary to achieve potential emissions reductions.[129] The policy plasticity of private governance initiatives is a function of factors such as cost-effectiveness and the ability of private initiatives to build on existing initiatives. For many climate initiatives, high plasticity also requires that the initiative not depend upon government resources or changes in public laws or policies. Many individuals and corporations have incentives to reduce carbon emissions, but policy plasticity often turns on the ability of NGOs to stimulate corporations to act and to monitor their efforts. The important challenge for private climate governance is how NGOs can be effective given the limited government regulatory threat.[130]

128. Corporate decisions can be modelled as a choice between investing in lobbying to reduce the costs of regulation versus investing in private governance activities. *See* John W. Maxwell et al., *Self-Regulation and Social Welfare: The Political Economy of Corporate Environmentalism*, 43 J.L. & ECON. 583 (2000); David Baron, *Private Politics*, 12 J. ECON. & MGMT. STRAT. 31 (2003).

129. The importance of policy plasticity is often overlooked by critics of private governance initiatives. *See, e.g.*, Jennifer Jacquet et al., *Seafood Stewardship in Crisis*, 467 NATURE 28, 29 (2010) (critiquing private seafood certification); JULIA HAILES, CARBON FOOTPRINT AND CARBON LABELLING, BRIEFING PAPER (on file with *The Columbia Journal of Environmental Law*) (critiquing carbon labeling).

130. The reasons for the formation of NGOs despite the incentives for free riding and other obstacles are beyond the scope of this analysis. *See* OLSON, *supra* note 73.

The ability of NGOs to engage in private governance initiatives can be understood by viewing private governance through the lens of new institutional economics. Ronald Coase argued that parties will bargain to efficient outcomes if entitlements or property rights are clear and if transaction costs are not a barrier, and he explored the implications of transaction costs for government policy choices.[131] Coase and many other economists start with an implicit assumption that the relevant actor to address harmful externalities must be either an unfettered market or government.[132] Transaction costs preclude efficient negotiations among billions of people over the global climate, so Coaseans have proposed that governments act as agents for their publics by selling emissions permits or collecting Pigovian emissions taxes.[133]

Private governance initiatives have played a quasi-governmental role by creating entitlements in carbon emissions through voluntary private carbon offset programs,[134] but the more important role has been to reduce transaction costs: private actors can provide expertise and credible information about the carbon emissions associated with organizations, projects, and products. When emissions reductions are in an individual's or firm's interest, private initiatives reduce costs by providing access to information and reliable service providers.[135] In other situations, NGOs may play a role closer to a government regulator, generating information that creates internal or external pressure for a corporation to act. The pressure may arise from consumer purchasing decisions,

131. Ronald H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960).

132. *See* Vandenbergh & Cohen, *supra* note 15, at 223–24; *see also* OSTROM, *supra* note 4, at 12–13.

133. Emissions trading systems have been implemented in the European Union, Korea, California, and almost a dozen Northeastern states.

134. These private carbon offsets accounted for $523 million and 101 million tons of GHG emissions in 2012. *See* ECOSYSTEM MARKETPLACE, STATE OF THE VOLUNTARY CARBON MARKETS 2013, *available at* http://www.ecosystemmarketplace.com/pages/dynamic/article.page.php?page_id=9789 [http://perma.cc/ZN2F-4BDY].

135. *See* Mark A. Cohen & W. Kip Viscusi, *The Role of Information Disclosure in Climate Mitigation Policy*, 3 CLIMATE CHANGE ECON. 1, 21 (2012). *See also* PRINDLE, *supra* note 16; Paul C. Stern et al., *Design Principles for Carbon Emissions Reduction Programs*, 44 ENVTL. SCI. & TECH. 4847, 4847–48 (2010).

investor or lender concerns, regulator relationships, employee morale, or norm-driven satisficing by managers.[136]

NGOs are able to act absent the power or resources of government in part because their principal weapon is information, and information is often cheap. For household and corporate actions that will reduce costs, adequate information at the point of decision may be sufficient to affect behavior, and NGOs can be a source of general information as well as more targeted expertise.[137] For household actions that may require some sacrifice or change of habit, more expensive private initiatives may be required to create social norm pressure, activate personal norms, or create monetary incentives.[138] For corporate actions that require additional motivation, so long as a sufficient number of a firm's stakeholders favor climate mitigation, an NGO may only need to provide the information necessary to create a perceived threat to the firm from those stakeholders. Access to traditional and social media can reduce the costs to the NGO of creating that threat. Surveys suggest that NGOs are more trusted than corporations or government, making reputation campaigns a credible threat in many cases.[139] Some NGOs, such as Oxfam and Greenpeace, commonly play a naming-and-shaming role, driving firms to other NGOs that play a more neutral information disclosure and counseling role, such as the Global Reporting Initiative ("GRI"), CDP (formerly the Carbon Disclosure Project), and Ceres.[140] Many NGOs play both roles.

On the surface, an important constraint on NGO effectiveness is the global nature of the activities that generate carbon emissions. Yet despite the global nature of the problem, NGOs may be influential because a surprisingly small number of individuals from multinational corporations and NGOs

136. *See* Cohen & Vandenbergh, *supra* note 119, at S53–S63 (citing studies).

137. *See* GREEN, *supra* note 8 (emphasizing importance of NGO expertise).

138. *See* Ruth Greenspan Bell & Elke U. Weber, *Focus on the Habits: Applying Behavioral Insights to Reduce Greenhouse Gas Emissions*, BOAO REVIEW (2014) at 56–57.

139. *See* EDELMAN, 2014 EDELMAN TRUST BAROMETER EXECUTIVE SUMMARY 3, *available at* http://www.edelman.com/insights/intellectual-property/2012-edelman-trust-barometer/ [http://perma.cc/5DPV-MVRT].

140. *See* Tiffany Stecker, *General Mills Joins Sustainability Group, Commits to GHG Reductions*, E&E NEWS PM, July 28, 2014, *available at* http://www.eenews.net/eenewspm/2014/07/28/stories/1060003635 [http://perma.cc/VZM9-DU76].

interact in a variety of settings, in effect creating a small community with opportunities for social sanctions and rewards. These small groups, although spread across great distances, have many of the attributes identified by Elinor Ostrom as necessary for resolving common pool resource problems.[141]

Not surprisingly, corporations often respond to pressure to reduce emissions by bargaining around legal requirements and transferring emissions-intensive activities to third party suppliers. These suppliers are sometimes located across state or national borders in jurisdictions that have fewer legal or social constraints on carbon or other emissions. From a Coasean perspective, the outsourcing of emissions or other activities that may provoke social sanctions is an inefficiency caused by the high cost of information about supply-chain emissions. When private governance initiatives provide information about suppliers' behavior, however, consumers often hold corporations responsible for the entire supply chain without regard for corporate legal boundaries or the location of facilities.[142] The normative boundary of a firm thus extends beyond the legal boundary, and the fact that many people include suppliers within the normative boundary of the firm enables NGOs to use information disclosure to create incentives for firms to manage the carbon emissions of their suppliers, even though the suppliers are in another jurisdiction.[143] In this way, NGOs play a quasi-governmental role regarding corporate supply chains and do so across

141. *See* Ostrom, *supra* note 91, at 6; OSTROM, *supra* note 4, at 88–102; *see also* Vandenbergh, *supra* note 3, at 164–65 (discussing the parallels between the small communities studied by Ostrom and others and the community of global corporate sustainability managers and NGO managers).

142. *See, e.g.*, Laura D'Andrea Tyson, *The Challenges of Running Responsible Supply Chains*, N.Y. TIMES ECONOMIX BLOG, http://economix.blogs.nytimes.com/2014/02/07/the-challenges-of-running-responsible-supply-chains/ [http://perma.cc/M4BZ-G44T] (last visited Apr. 14 2015) ("Major global retailers run the risk of harming their brand and alienating their consumers if they purchase from factories that don't open their doors to Better Work inspections. Reputational risk has been found to play a critical role in improving compliance."); Steven Greenhouse, *2nd Supplier for Walmart at Factory That Burned*, N.Y. TIMES, Dec. 11, 2012, at A12 (noting that despite Walmart's demurrals that it did not know unsafe subcontractors were producing its garments, it was facing criticism for not taking more responsibility for its entire supply chain).

143. *See* Vandenbergh & Cohen, *supra* note 15, at 224.

national and corporate boundaries, free from many of the limits faced by governments.

NGOs' global supply chain efforts can have substantial effects because of the growth of global trade over the last several decades. Supply chains now extend from retailers who sell to consumers in countries where climate mitigation support is strong to manufacturers in countries where climate mitigation support is weak. As a result, climate mitigation support in one country can lead to corporate policies and actions that reduce carbon emissions in other countries. By harnessing supply chains, NGOs thus extend the incentives arising from consumer or investor preferences in one country to carbon-emitting sources in many other countries.

Private governance initiatives also may have high policy plasticity because of their ability to attract funding and other support from individuals who are concerned about climate change but are moderate to conservative free market advocates. Recent examples include George Schultz, Henry Paulson, and Michael Bloomberg.[144] By adding new philanthropists and advocates to the climate mitigation effort, the use of private initiatives may increase the resources available and may reduce the likelihood that private governance will compete with public governance.

NGOs are also subject to important constraints that limit policy plasticity. As with any type of organization, NGOs are subject to the limits of the conceptual frameworks and expertise of their managers, employees, and funders. Organizations established and staffed to lobby governments and to litigate may need new strategies and expertise to develop and implement private governance initiatives.[145] Employees with expertise in lobbying Congress and agencies may need to be retrained or supplemented with employees who understand supply chains, finance, consumer behavior, and other areas important for private governance.

In addition, NGOs rely on private funding and on credibility with the media and the public, and those resources are limited and subject to conceptual blinders. When NGOs and private

144. *See* RISKY BUSINESS: THE ECONOMIC RISKS OF CLIMATE CHANGE IN THE U.S., http://riskybusiness.org/ [http://perma.cc/9ZN8-K65A] (last visited June 15, 2015).

145. *See* STEERING COMM., *supra* note 125, at 26–27.

certification firms function in quasi-governmental roles, they can be vulnerable to capture by special interests, much like government regulatory agencies,[146] and they may have incentives to under- or over-state emissions reductions from the targets of climate initiatives. Competition with other NGOs for funding, publicity, and employees may induce NGOs to establish duplicative programs or send multiple and confusing messages to households and corporations about desired conduct.

In sum, although the principal actors in private climate governance (households, corporations, and NGOs) all face substantial constraints, there is reason to believe that the technical potential, behavioral plasticity, and policy plasticity are often quite high. The remainder of Part III and all of Part IV address the principal conceptual constraint on development of a private climate governance strategy—the assumption that government is the only actor that can achieve major emissions reductions—by providing examples of existing and new private initiatives.

B. Motivating Action

A first role for private governance initiatives is to motivate public support for GHG emissions reductions from many types of actors. This section identifies two potential new cross-cutting initiatives that could do so, but these are only indications of the types of initiatives that could be developed in the near term. These initiatives can be implemented promptly, are likely to buttress many other private emissions-reduction initiatives, and are unlikely to undermine—and may well foster—government mitigation measures.

i. Private Climate Prediction Market

The first cross-cutting private initiative, a private climate prediction market, has the potential to address the mismatch between climate science beliefs by scientists and the public.[147]

146. *See, e.g.*, THE CREDIBILITY OF TRANSNATIONAL NGOS: WHEN VIRTUE IS NOT ENOUGH (Peter A. Gourevitch et al., eds., Cambridge Univ. Press 2012); *see also* Clifford & Greenhouse, *supra* note 127.

147. *See* Vandenbergh et al., *supra* note 77, at 1966–67.

Doubts about climate science undermine the perceived need for emissions reductions, and many moderates, conservatives and libertarians dismiss new government reports and scientific studies. Government efforts to fund and communicate climate science have been extraordinary, but recent polling suggests that only about half of the American population clearly understands that the climate is changing because of human activities.[148] Among some populations doubts about anthropogenic climate change are growing even as the science becomes more certain, and much of the doubt occurs among individuals who strongly oppose government interference in free markets.[149] The doubt is fueled by the argument that governments and government-funded climate scientists are not accounting for information that is inconsistent with the climate consensus. Many responses involve re-framing climate information or making it more accessible, but the private climate governance strategy offers a promising alternative based on changing the source of the information: the creation of a private prediction market to assess and communicate the implications of the climate science.[150]

Markets can provide information about the likelihood of future events and can account for information that is outside of the conventional wisdom. A government-sponsored climate prediction market would face many of the same barriers as a carbon price,[151] but a private climate prediction market could be established quickly and could yield information that is more credible to moderates, conservatives, and libertarians than a government-sponsored market. Although little research exists

148. *See, e.g.*, ANTHONY LEISEROWITZ ET AL., YALE PROJECT ON CLIMATE CHANGE CLIMATE CHANGE IN THE AMERICAN MIND 8 (2014), *available at* http://environment.yale.edu/climate-communication/files/Climate-Change-American-Mind-April-2014.pdf [http://perma.cc/32A8-VBPB] (finding that only forty-four percent of Americans believe that global warming is happening, and that it is largely caused by humans).

149. Dan M. Kahan, et al., *The Polarizing Impact of Science Literacy and Numeracy on Perceived Climate Change Risks*, 2 NATURE CLIMATE CHANGE 732, 732–35 (2012).

150. *See* Vandenbergh et al., *supra* note 77, at 1991–2011.

151. *See, e.g.*, Nate Silver, *Best Idea of the Day: Climate Change Futures Markets*, FIVETHIRTYEIGHT (Nov. 23, 2009, 11:57 PM), http://fivethirtyeight.com/features/best-idea-of-day-climate-change-futures/ [http://perma.cc/WW48-PXJ7] (proposing government-sponsored climate change futures market); Shi-Ling Hsu, *A Prediction Market for Climate Outcomes*, 83 U. COLO. L. REV. 179, 183 (2011) (proposing a government climate prediction market linked to tradable carbon emission permits under a government cap-and-trade system).

on the effects of market information on these individuals, many support market solutions to problems and may find markets to be credible sources of information. The market could enable individuals to trade predictions about the global average temperature and other relevant outcomes, and market-generated information may be more credible to doubters than government-generated information. A prediction market also may be a valuable addition to climate debates, enabling private individuals and politicians to argue that opponents should "put their money where their mouth is."

To address the need for prompt action, an initial climate market could take the form of an experimental effort along the lines of the Iowa presidential prediction market.[152] Trading could occur over the types of predictions that matter for global climate change, such as the global average temperature or sea level in 2020, 2030, or 2100, with the current market value of the prediction signaling the likelihood of the outcome. Experience with other prediction markets suggests that a climate prediction market could provide an accurate, credible, and widely-disseminated signal about the status of the climate science. The predictions could become the subject of political debates, media accounts, and daily discussions among millions of individuals.

ii. Private Climate Legacy Registry

The second cross-cutting initiative, a private climate legacy registry, is designed to motivate support for carbon emissions reductions by addressing the fact that individuals in this generation will bear much of the cost of mitigation, but they know that future generations will lack information about who acted in ways that merit social sanctions or rewards.[153] Anecdotal examples suggest that individuals care about their legacy. How many philanthropists have established universities or foundations in their names in the hope that their legacy will continue long after their death? How many people have tried to distance themselves from ancestors whose actions are now considered shameful? Recent empirical

152. *See* Vandenbergh et al., *supra* note 77, at 1995.

153. *See* Michael P. Vandenbergh & Kaitlin T. Raimi, *Climate Change: Leveraging Legacy*, 41 ECOLOGY L.Q. (forthcoming 2015).

research supports this point: if given the choice to buy a better reputation after they die or during their lifetime, on average, individuals would allocate roughly $40 to their reputation after they die and $60 to their reputation during their lifetime.[154]

Individuals know that their behavior in this generation will not be known to future generations, however, so an intergenerational information problem undermines the effects of legacy on individuals' and organizations' motivation to reduce GHG emissions. A private climate registry could facilitate intergenerational accountability by harnessing legacy concerns. The registry could overcome the information problem by collecting, storing, and making available data on the climate views and actions of individuals, policymakers, corporations, universities, and other institutions. For example, the general public, corporations, and politicians could be given the chance to record information about their actions and policy views in light of the climate science. Advocacy groups also could gather and submit publicly available information on corporations and politicians from public media sources and emissions databases.

To influence behavior, the registry would need to manage, store and disclose the information in a way that would assure individuals and organizations today that future generations would know how they responded to the climate science. If the legacy-related information is made public now, it also may motivate emissions reductions through social sanctions and rewards. Readers who are dubious about the effects of legacy on climate views and behavior can try this experiment: when engaged in a discussion about climate change, offer to have the participants write down their names and their beliefs about whether climate change is occurring and whether investments should be made today to reduce emissions. Let the participants know that if a legacy registry is formed, the documents will be sent to the registry to be made available to future generations.

Although it is difficult to assess the technical potential and behavioral plasticity of a private climate registry, the policy plasticity is high. Many governments would face political and other obstacles, but private organizations could establish a climate legacy registry quickly and at low cost.[155] In addition,

154. *Id.* at 10 (reporting results of empirical study).
155. *Id.* at 6.

as with other private governance initiatives, the legacy registry need not affect a majority of the population to have an effect. Further research is needed on how a registry will influence individual and corporate behavior, but even if it only increases the likelihood that a small percentage of mitigation supporters will act on their views or shifts the views of a small percentage of moderates, it will increase the pool of motivated actors at low cost.

IV. CORPORATE AND HOUSEHOLD EMISSIONS

In addition to cross-cutting initiatives designed to motivate many types of actors, private climate governance initiatives also target specific source categories. Part IV.A examines corporate GHG emissions initiatives. Part IV.B focuses on households.

A. Corporate Emissions

As discussed at the outset, firms such as Microsoft have responded to a variety of pressures by announcing that they will become carbon neutral.[156] The influences on firm behavior discussed in Part III.A shape the types of corporate initiatives that may succeed, but reasonable skepticism exists about whether firms will reduce emissions or simply engage in green-

156. *See* Robert Bernard, *Going Carbon Neutral and Putting an Internal Price on Carbon*, MICROSOFT GREEN BLOG (May 7, 2012, 4:01 PM), http://blogs.msdn.com/b/microsoft-green/archive/2012/05/08/going-carbon-neutral-and-putting-an-internal-price-on-carbon.aspx [http://perma.cc/Q8GS-K7S5]; Light, *supra* note 93, at 42. For others, see GOOGLE, http://www.google.com/green/ [http://perma.cc/2JR5-NVMN] (last visited June 15, 2015); GOLDMAN SACHS, http://www.goldmansachs.com/citizenship/environmental-stewardship-and-sustainability/operational-impact/operational-impact-pages/promoting-energy-efficiency.html [http://perma.cc/586H-Q8RX] (last visited June 15, 2015) (committing to carbon neutrality by 2020); Arden Jobling-Hey, *People & Planet Positive: IKEA Plans to Go Energy-Neutral by 2020*, BIZENERGY (Nov. 22, 2012, 10:29 PM), http://www.bizenergy.ca/success-stories/people-planet-positive-ikea-plans-to-go-energy-neutral-by-2020/ [http://perma.cc/WN64-L2BE] (same). Not all firms have maintained their commitments over time. *See, e.g.*, Matthew Wheeland, *Dell Backs Away From Carbon Neutrality, Focuses on Efficiency & E-Waste*, GREENBIZ (Sept. 6, 2011, 9:28 AM), http://www.greenbiz.com/news/2011/09/06/dell-backs-away-carbon-neutrality-focuses-efficiency-e-waste [http://perma.cc/7LQ9-N3MX] (noting Dell's shift away from carbon neutrality focus after achieving carbon neutral status in 2008).

washing.[157] The extensive examples below, often involving participation and verification by NGOs with little interest in signing off on green-washing, suggest that emissions reductions are occurring at a large scale and that many opportunities have yet to be exploited.

i. Sector-Specific Initiatives

A recent initiative demonstrates the potential for sector-specific efforts that focus on correcting large-scale market failures. The Carbon War Room ("CWR") is a private, non-profit organization founded in 2009 by Sir Richard Branson and other philanthropists to achieve gigaton-scale emissions reductions.[158] The CWR focuses principally on initiatives that address market impediments to the adoption of more efficient technologies. A CWR research group identifies opportunities, and teams work with corporate leaders in specific industries to coordinate emissions reduction initiatives. The CWR has five major operations underway, four of which are directed at corporations: shipping efficiency, renewable jet fuels, building efficiency, and trucking efficiency. The CWR estimates that each of these efforts will reduce emissions by a cumulative total of more than a gigaton of CO_2 over the next several decades.[159]

The maritime shipping industry example discussed in the introduction demonstrates the types of market failures that CWR targets. The shipping sector emits more than a gigaton of CO_2 each year, and emissions are projected to increase 250% by 2050. The CWR estimates that existing technologies and operational measures could cut emissions by up to thirty percent by addressing market failures such as suboptimal information, split incentives, and lack of capital for retrofitting.

157. Walmart has been criticized for making corporate pledges toward carbon neutrality while its majority shareholders and top management give generously to groups opposing solar power. *See* Tim McDonnell, *Walmart Is the Biggest Corporate Solar User. Why Are Its Owners Funding Groups That Oppose Solar?*, MOTHER JONES (Oct. 9, 2014, 5:57 PM) http://www.motherjones.com/blue-marble/2014/10/walmart-biggest-corporate-solar-user-why-are-its-owners-blocking-solar [http://perma.cc/8562-EK95].

158. CARBON WAR ROOM, *Mission & Vision,* http://www.carbonwarroom.com/what-we-do/mission-and-vision [http://perma.cc/V2YV-FCQH] (last visited June 15, 2015).

159. *See* CARBON WAR ROOM, *Research & Intelligence,* http://www.carbonwar room.com/our-process/research [http://perma.cc/39NF-D42S] (identifying seven sectors, each of which accounts for over a gigaton of carbon emissions).

Split incentives based on pricing structure are particularly important: seventy percent of bunker fuel typically is paid for by the cargo owner, rather than the shipper, reducing the shipper's benefit from investments in more efficient shipping technology. The CWR effort is focused on changing the way costs are shared to increase shippers' incentives to reduce fossil fuel use.[160]

In addition, new opportunities exist for private initiatives in the industry sector category. The CWR has not identified all potential targets of opportunity at the gigaton level and has not turned its attention to opportunities below the one gigaton threshold. Private standards and certification programs also can contribute additional sector-based emissions reductions. For example, forestry standards and certification programs and private efforts targeting palm oil seek to reduce carbon emissions from deforestation.[161] These initiatives can be expanded and the focus on carbon emissions increased, and additional agricultural and industrial sectors could be subject to private standards and certification initiatives.

ii. Carbon Disclosure

Disclosure of carbon footprints is another promising approach for private initiatives. Disclosure is often inexpensive and can harness existing drivers for corporate carbon emissions reductions. The examples below examine carbon disclosure at the corporate, lender and investor, project, and product levels.

a. Corporate Carbon Footprints

Several initiatives encourage corporations to disclose and reduce their corporate carbon footprints. Private organizations such as CDP, Ceres, and GRI focus on increasing the collection and disclosure of reliable emissions data. CDP was established in 2000 through the collaborative efforts of U.K. businessman Paul Dickenson, institutional investors, and philanthropic foundations, and it uses investor pressure to create incentives

160. *See* CARBON WAR ROOM, *supra* note 158; ERIC HEISMAN & CLAIRE DANIELLE TOMKINS, A GIGATON ANALYSIS OF THE SHIPPING INDUSTRY 21 (2011), *available at* http://www.carbonwarroom.com/sites/default/files/reports/2011%20Shipping%20Report%204.26.11_0.pdf [http://perma.cc/P6DQ-57NV].

161. *See* STEERING COMM., *supra* note 125.

for firms to disclose and reduce emissions.[162] Over 700 institutional investors with $92 trillion in assets support the CDP, and it collects and discloses self-reported climate-change data from over 4,000 corporations and other entities.[163] The responding corporations include more than 1,000 of the largest global corporations and include roughly 70% of the Standard & Poors 500.[164] The CDP information disclosure initiatives provide corporations and investors with reputational and other incentives to reduce carbon emissions.[165]

A number of opportunities exist to expand the types of information collection and disclosure efforts conducted by CDP and other organizations. For instance, the CDP has already reached many of the largest firms around the world, but hundreds of additional large firms could be subject to further pressure to participate, and thousands of the next tier of smaller firms could be the subject of additional initiatives. Efforts ranging from targeting by socially responsible investors, to NGO-led consumer reputation campaigns, to boycotts and other advocacy initiatives are all possible. A recent example is General Mills' 2014 announcement that it would participate in a Ceres disclosure initiative and join the CDP. These commitments occurred after a protest by Oxfam America at the New York Stock Exchange.[166] In addition, as

162. *See* Leslie Kaufman, *Emissions Disclosure As a Business Virtue*, N.Y. TIMES, Dec. 29, 2009, at B1. CDP began collecting carbon emissions information in 2002 by sending information requests on behalf of 35 institutional investors holding assets of $4.5 trillion to corporations included in the FT500 Global Index. It then published the data. *See* CARBON DISCLOSURE PROJECT, CARBON FINANCE AND THE GLOBAL EQUITY MARKETS (Feb. 2003), *available at* https://www.cdp.net/CDPResults/cdp_report.pdf [https://perma.cc/6JJT-WXJG].

163. *Climate Change Program*, CDP, https://www.cdp.net/en-US/Programmes/Pages/CDP-Investors.aspx [https://perma.cc/XKB4-QQBN] (last visited June 15, 2015).

164. *See* CDP, USE OF INTERNAL CARBON PRICE BY COMPANIES AS INCENTIVE AND STRATEGIC PLANNING TOOL 9 (Dec. 2013), *available at* https://www.cdp.net/CDPResults/companies-carbon-pricing-2013.pdf [https://perma.cc/G8X2-S9F4]. The CDP reports that 403 of the Global 500 participate, as do 334 of the S&P 500. *See* CDP, INVESTMENT, TRANSFORMATION AND LEADERSHIP: CDP S&P 500 CLIMATE CHANGE REPORT 2013 (2013), *available at* https://www.cdp.net/CDPResults/CDP-SP500-climate-report-2013.pdf [https://perma.cc/9UTH-BN4K].

165. *See* CDP USE OF INTERNAL CARBON PRICE BY COMPANIES AS INCENTIVE AND STRATEGIC PLANNING TOOL, *supra* note 164 at 8; *see also* Tyson, *supra* note 142 (emphasizing the influence of reputational considerations on corporate actions regarding supply chains).

166. *See* Stecker, *supra* note 140.

discussed in more detail in the supply chain section below, the CDP could continue to expand supply chain reporting efforts as a way to extend pressure to tens of thousands of small- and medium-sized firms around the world.

b. Investor and Lender Carbon Footprints

A related set of carbon disclosure initiatives target investors (including investment firms as well as pension funds, university endowments, foundations, religious organizations, and other organizations that have large stock holdings) and lenders. NGOs have developed campaigns to induce investors to disclose the carbon footprint of their investments. In turn, this has created opportunities for new types of private businesses, such as TruCost, a U.K. firm that assesses corporate carbon footprints and has released an analysis of the carbon footprint of investment firms' portfolios.[167]

Disclosure campaigns are often coupled with pressure to divest,[168] and in the last several years investors have pledged to divest more than $50 billion in assets from the fossil fuel sector.[169] In addition, at least one NGO has participated in the formation of a low-carbon index fund.[170] These initiatives may

167. *See* TRUCOST, CARBON COUNTS 2007: THE CARBON FOOTPRINTS OF UK INVESTMENT FUNDS (2007), *available at* http://www.trucost.com/published-research/19/carbon-counts-2007-the-carbon-footprints-of-uk-investment-funds [http://perma.cc/CF5V-GCJC].

168. *See What Is Fossil Fuel Divestment?*, FOSSIL FREE, http://gofossilfree.org/what-is-fossil-fuel-divestment/ [http://perma.cc/76X2-WXS7] (last visited June 15, 2015); Mike Scott, *Pension Funds Face New Era of Disclosure on Climate Risks*, FORBES (Feb. 3, 2014, 12:16 PM), http://www.forbes.com/sites/mikescott/2014/02/03/pension-funds-face-new-era-of-disclosure-on-climate-risks/ [http://perma.cc/7YHC-GZ5J] (highlighting disclosure efforts of CDP and Asset Owners Disclosure Project, an Australia-based NGO).

169. *See* John Schwartz, *Rockefellers, Heirs to an Oil Fortune, Will Divest Charity of Fossil Fuels*, N.Y. TIMES, Sept. 22, 2014, at A3; Logan Yonavjak, *Divesting from Fossil Fuels Means a Cleaner, Safer, and More Resilient Future*, FORBES (July 29, 2013, 1:00 AM), http://www.forbes.com/sites/ashoka/2013/07/29/divesting-from-fossil-fuels-means-a-cleaner-safer-and-more-resilient-future/ [http://perma.cc/VSS3-D24J]; *Stanford to Divest from Coal Companies*, STANFORD NEWS SERVICE (May 6, 2014) http://news.stanford.edu/pr/2014/pr-divest-coal-trustees-050714.html [http://perma.cc/K34X-MPKD].

170. *See, e.g.*, Mike Scott, *Fossil Fuel-Free Index Will Help Investors Manage Climate Risk*, FORBES (May 1, 2014, 7:44 AM), http://www.forbes.com/sites/mikescott/2014/05/01/fossil-fuel-free-index-will-help-investors-manage-climate-risks/ [http://perma.cc/YWK9-GHHH].

not involve sufficiently large amounts to adversely affect share prices, but they send normative signals that may influence corporate behavior in the near term, and they could affect share prices in the long term if they gain momentum.[171]

Less commonly discussed are new efforts by NGOs to estimate and disclose the carbon footprint of lenders' loan portfolios. These initiatives are designed to motivate lenders to reduce their direct emissions and the emissions of their corporate borrowers. For instance, the Rainforest Action Network has estimated and disclosed the carbon footprints of the five largest Canadian banks' lending portfolios.[172] Similarly, two Australian NGOs conducted a campaign in 2014 to induce retail consumers to move their bank accounts from several banks with large carbon footprints.[173] Disclosure campaigns also may have played a role in several banks' decision not to fund a new coal port in Australia.[174] These lender initiatives are nascent efforts, and lender carbon disclosure represents a promising area for new private initiatives.[175]

c. Project Carbon Footprints

Other private initiatives have focused on disclosure at the project level. For example, advocacy groups have targeted major banks with naming and shaming campaigns based on

171. *See* Eric Hendey, *Does Divestment Work?*, HARV. POL. REV., http://www.iop.harvard.edu/does-divestment-work [http://perma.cc/44MP-C5EC] (last visited June 15, 2015); Jacob Park & Sonia Kowal, *Socially Responsible Investing 3.0*, 18 GEO. PUB. POL'Y REV. 17, 18 (2013) (noting that socially-responsible investors account for over $3.7 trillion).

172. *See* RAINFOREST ACTION NETWORK, FINANCING GLOBAL WARMING: CANADIAN BANKS AND FOSSIL FUELS (2008), *available at* http://ran.org/sites/default/files/financing_global_warming.pdf [http://perma.cc/CZV8-JJWD].

173. *Id. See* UTOPIES, SUSTAINABLE DEVELOPMENT LABELING OF BANKING PRODUCTS 3 (June 2008), *available at* https://www.financite.be/sites/default/files/references/files/719.pdf [https://perma.cc/YY28-SEXZ]; Oliver Milman, *Fossil Fuel Divestment: Climate Change Activists Take Aim at Australian Banks*, THE GUARDIAN (Oct. 17, 2014, 7:51 PM), http://www.theguardian.com/environment/2014/oct/18/fossil-fuel-divestment-climate-change-activists-take-aim-at-australias-banks [http://perma.cc/LSJ3-H7KD].

174. *See Campaigners Urge Consumer Divestment from Australian Big Banks*, CLIMATEWIRE, Oct. 21, 2014, http://www.eenews.net/climatewire/stories/1060007611/feed [http://perma.cc/5833-RE9C].

175. For an overview, see Vandenbergh, *supra* note 3, at 151–52.

the environmental effects of the banks' project finance lending in the developing world.[176] The efforts of the advocacy groups, with support from the World Bank and International Monetary Fund, contributed to the formation of the Equator Principles, a private standard that requires participants to disclose the environmental harms of the projects funded through project finance loans. The vast majority of the project finance lending at a global level is now conducted by banks that have agreed to comply with the Equator Principles. As with many private governance initiatives, the effects of the project-level disclosure on carbon emissions are unclear, but the types of projects subject to Equator Principles disclosure (e.g., pipelines and other major infrastructure projects), suggest large effects if the disclosure affects decision making.[177]

In addition, in 2008 several leading banks in the U.S. partnered with electric utilities and NGOs to form the Carbon Principles, private standards that require participating banks to include carbon emissions in the due diligence and disclosure processes involved in the financing of new U.S. power plants.[178] The signatory banks pledge to adopt a rigorous environmental diligence process,[179] to evaluate clients' management of carbon emissions and climate-change risks, to consider issues that could arise from future climate regulations, and to decline financing if potential clients fail to provide the requested

176. *See* TRUCOST, *supra* note 167.

177. *See* Ariel Meyerstein, *Transnational Private Financial Regulation and Sustainable Development: An Empirical Assessment of the Implementation of the Equator Principles*, 45 N.Y.U. J. INT'L L. & POL. 487 (2013); Andrew Hardenbrook, Note, *The Equator Principles: The Private Financial Sector's Attempt at Environmental Responsibility*, 40 VAND. J. TRANSNAT'L L. 197 (2007).

178. Press Release, CitiGroup Inc., The Carbon Principles, Leading Wall Street Banks Establish the Carbon Principles (Feb. 4, 2008), *available at* http://www.citigroup.com/citi/news/2008/080204a.htm [http://perma.cc/FJH4-ZKGB]. As of 2014, three others have adopted the Carbon Principles. *Three Major Banks Adopt Carbon Principles*, 21 ELECTRICITY J. 5 (2008). Signatories issue periodic reports demonstrating implementation. *Id.*; *see also* Benjamin J. Richardson, *Reforming Climate Finance Through Investment Codes of Conduct*, 27 WIS. INT'L L.J. 483, 499 (2009).

179. *Fossil Fuel Generation Financing Enhanced Environmental Diligence Process*, THE CARBON PRINCIPLES, http://www.morganstanley.com/about/press/files//1500519_carbon_principles_diligence_2.pdf [http://perma.cc/F6PF-ACF9] (last visited June 15, 2015).

information.[180] The banks also commit to assess clients' efforts to reduce carbon emissions and to promote energy efficiency and renewable energy production.[181]

Although these provisions do not prohibit funding of fossil fuel-fired power plants, they signal to utilities that lenders anticipate future restrictions on carbon emissions and will give serious consideration to the climate implications of plant emissions in the lending process. The Carbon Principles are limited to electric power generation within the United States, but there is room for growth: this type of initiative could be expanded to include additional lenders and additional countries, and to focus on other carbon-intensive industries.

d. Product Carbon Footprints

Private product carbon labeling is another area that is ripe for expansion.[182] Government-sponsored carbon labeling systems exist in several countries, but a government carbon labeling program in the U.S. is probably no more likely in the near term than a national carbon price.[183] Private carbon labeling systems have been attempted in several countries, however, and could extend their reach by targeting firms that stand to gain the most from demonstrating that their goods are low-carbon as compared to competitors. Climate considerations are included in several general eco-labels, but there is a risk that climate concerns will be under-valued in general eco-labeling systems, and product carbon disclosure has lagged behind corporate carbon footprint disclosure. This is due in

180. *See* Richardson, *supra* note 178, at 499.

181. Richardson, *supra* note 180, at 499.

182. Michael P. Vandenbergh, Thomas Dietz & Paul C. Stern, *Time to Try Carbon Labelling*, 1 NATURE CLIMATE CHANGE 4, 4–6 (2011), *available at* http://www.nature.com/nclimate/journal/v1/n1/full/nclimate1071.html [http://perma.cc/RG2Q-D3MJ]; Cohen & Vandenbergh, *supra* note 119.

183. *See, e.g.*, *Carbon Footprints: Following the Footprints*, THE ECONOMIST, July 2, 2011, *available at* http://www.economist.com/node/18750670 [http://perma.cc/H2DC-A4TZ] (analyzing government-sponsored carbon labeling programs in U.K. and Japan and a private system in France). The most recent U.S. development in government-sponsored carbon labeling is an effort to label gas pumps by Berkeley, California. *See* Samantha Clark, *Berkeley Considering Climate Change Labels at Gas Pumps*, OAKLAND TRIBUNE (June 20, 2014, 5:44 AM), http://www.contracostatimes.com/news/ci_25996416/berkeley-considering-global-warming-labels-gas-pumps [http://perma.cc/S8QF-KHFW].

part to the technical challenges of calculating product-specific labels for products that have complex or varying supply chains, but these challenges can be overcome for many products.[184] For example, although some products have complex and varying inputs, others have well-understood carbon footprints. These footprints often differ dramatically from their substitutes (e.g., the carbon footprint of beef is often several times that of chicken), and the differences can be communicated through a well-designed label.[185]

A common assumption is that labeling will only reduce emissions if it affects the direct purchasing behavior of retail consumers. If so, the prospects are limited. Although some consumers are willing to pay more for goods labelled as low carbon, many are not.[186] Not surprisingly, this leads to pessimism about the effects of carbon labels.[187]

Although consumer willingness to pay is important, carbon labeling may reduce emissions for a less intuitive reason: firms may reduce the carbon footprint of existing products and alter the selection of products they offer to consumers in anticipation of product carbon footprint disclosure. Food labeling studies suggest, for example, that consumers only respond to a limited extent to labels, but food labeling appears to change the products that food companies and restaurants offer to consumers, even if the direct consumer response is limited.[188]

184. Sharon Shewmake et al., *Carbon Triage: A Strategy for Developing a Viable Carbon Labeling System, in* HANDBOOK ON RESEARCH IN SUSTAINABLE CONSUMPTION (Lucia Reisch & John Thøgersen eds., forthcoming 2014); Cohen & Vandenbergh, *supra* note 119, at S60–S63.

185. *Id.*; *see also* N. Pelletier & P. Tyedmers, *Forecasting Potential Global Environmental Costs of Livestock Production 2000-2050*, 107 PROC. NAT'L ACAD. SCI. 18371 (2010).

186. *See, e.g.*, J.K. Vanclay et al., *Customer Response to Carbon Labeling of Groceries*, 34 J. CONSUMER POL'Y 153 (2011) (discussing literature and presenting results of empirical study); M.F. Teisl et al., *Non-Dirty Dancing? Interactions Between Eco-Labels and Consumers*, 29 J. ECON. PSYCHOL. 140 (2008) (presenting results of empirical study).

187. *See* HAILES, *supra* note 129, at 1.

188. *See* Shewmake et al., *supra* note 184, at 10 (citing studies). This has been attributed to the "Tell-Tale Heart Effect," an unrealistically high perception of the likelihood of detection. George Loewenstein et al., *Disclosure: Psychology Changes Everything, in* HANDBOOK ON RESEARCH IN SUSTAINABLE CONSUMPTION (Lucia Reisch & John Thøgersen eds., 2014). *See also* Jane Black, *Chain Restaurants Such as KFC, Uno and Starbucks Are Finding That Calories Count*, WASH. POST, Jan. 6, 2010, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2010/01/05/

In short, when retail food companies and restaurants know that they will be disclosing nutritional information, they appear to change the content and mix of products offered to consumers. In a similar way, firms may respond to private carbon labeling initiatives by looking for ways to reduce the carbon content of products or by changing the selection of products offered to consumers.

Many firms will not participate in a voluntary private carbon labeling initiative, but carbon labeling will be attractive to firms that anticipate competitive advantages from assessing and disclosing the carbon footprint of their products. For instance, a firm that offers fruit, vegetables, meat, or dairy products with a lower carbon footprint than competitors and sells through organic food stores may opt into a private carbon labeling program. Other firms may participate because of more generalized concerns about their reputation with consumers, investors, or lenders.

iii. Supply Chain Contracting

Supply chain contracting requirements can extend the reach of the carbon disclosure initiatives discussed above and can serve as a private governance initiative in their own right. Supply chains account for roughly three quarters of the carbon emissions associated with goods in the U.S,[189] so the technical potential for effective supply chain efforts is enormous. The behavioral plasticity is also high in many cases. Many corporations already include environmental provisions in supply chain contracts, and one study concluded that more than half of the largest firms in eight sectors required their corporate suppliers to meet environmental requirements imposed by the buying firm.[190] In some cases these provisions simply require compliance with applicable environmental laws,

AR2010010500841.html [http://perma.cc/RU7D-HZUJ] ("Restaurant chains across the country are reformulating fat- and calorie-laden items and introducing lighter, more healthful options in preparation for federal menu labeling requirements.").

189. *See* H. Scott Matthews et al., *The Importance of Carbon Footprint Estimation Boundaries*, 42 ENVTL. SCI. & TECH. 5839, 5840 (2008) (noting that direct emissions and purchased energy emissions account for roughly twenty-six percent of carbon emissions).

190. *See* Michael P. Vandenbergh, *The New Wal-Mart Effect: The Role of Private Contracting in Global Governance*, 54 UCLA L. REV. 913, 916–17 (2007).

but in others they require actions—such as achieving energy efficiency or carbon emissions reductions—not required by government regulations. Firms may impose these requirements on suppliers for a variety of reasons. For instance, energy efficiency or carbon emissions reduction requirements may enable a firm to demand lower prices from suppliers, may improve other aspects of supply chain management, or may enable a firm to prepare for a future government carbon price. Firms also may be concerned about reputational harms that may arise from being held socially, if not legally, accountable for the emissions of their suppliers in developed and developing countries.

a. Developed Countries

In recent years, a number of environmental NGOs have worked with large firms in developed countries to adopt corporate carbon supply chain requirements.[191] Not surprisingly, consumer-facing corporations have engaged in much of the early activity. An example is Wal-Mart's 2010 joint announcement with the Environmental Defense Fund, in which Wal-Mart committed to reduce CO_2 emissions from its global supply chain by 20 million tons.[192] Similarly, the Natural Resources Defense Council ("NRDC") has an initiative underway to reduce the energy consumption of clothing retailer H&M,[193] as well as to reduce the overall environmental impact

191. *See* CDP, COLLABORATIVE ACTION ON CLIMATE RISK: SUPPLY CHAIN REPORT 2013–14 (2014), *available at* https://www.cdp.net/CDPResults/CDP-Supply-Chain-Report-2014.pdf [https://perma.cc/U67P-X7JT]; THE CARBON TRUST, CARBON FOOTPRINTS IN THE SUPPLY CHAIN: THE NEXT STEP FOR BUSINESS 14–20 (2006), *avaliable at* http://www.carbontrust.com/resources/reports/footprinting/carbon-footprints-in-the-supply-chain-the-next-step-for-business [http://perma.cc/R626-VDL9].

192. *Walmart Announces Goal to Eliminate 20 Million Metric Tons of Greenhouse Gas Emissions from Global Supply Chain*, WALMART (Feb. 25, 2010), http://news.walmart.com/news-archive/2010/02/25/walmart-announces-goal-to-eliminate-20-million-metric-tons-of-greenhouse-gas-emissions-from-global-supply-chain [http://perma.cc/GSH8-QN59]; Vandenbergh, *supra* note 3, at 158 (comparing reductions to roughly half of iron and steel sector emissions).

193. Frances Beinecke, *Wal-Mart and H&M Commit to Greening Their Textile Supply Chain*, NATURAL RESOURCES DEFENSE COUNCIL (Sept. 22, 2010) http://switchboard.nrdc.org/blogs/fbeinecke/wal-mart_and_hm_commit_to_gree.html [http://perma.cc/6ZBV-3P6N].

of Apple's suppliers.[194] In 2007, Coca-Cola and WWF launched an initiative aimed at reducing the environmental impact of Coca-Cola's global production chain, with a primary goal of reducing the carbon embedded in Coca-Cola drinks by twenty-five percent by 2020.[195] WWF also has worked with LEGO to reduce LEGO's supply chain carbon emissions.[196]

Supply chain initiatives also have extended beyond consumer-facing companies to some extent. For instance, in 2012 Cisco released its first Corporate Social Responsibility Supply Chain Report, which notes that Cisco asked suppliers to participate in the CDP's carbon emissions surveys. In the first year, 50% of preferred suppliers responded to that request, and Cisco has announced a goal of 100% participation by preferred

194. Linda Greer, *NRDC Work on Apple Computer's Supply Chain*, NATURAL RESOURCES DEFENSE COUNCIL (Feb. 22, 2012) http://switchboard.nrdc.org/blogs/lgreer/nrdc_work_on_apple_computers_s.html [http://perma.cc/9WG6-6DCQ]. NRDC has been active in the "cloud of commitments" initiative associated with Rio+20. *See Commitments*, CLOUD OF COMMITMENTS, http://www.cloudofcommitments.org/commitments/ [http://perma.cc/TZC2-76QP] (last visited June 15, 2015). NRDC also publishes issue reports on carbon-saving opportunities in various industries along with advice for firms. *See, e.g.*, KAREN LAW & MICHAEL CHAN, NATIONAL RESOURCES DEFENSE COUNCIL, CARBON REDUCTION OPPORTUNITIES IN THE CALIFORNIA PETROLEUM INDUSTRY (2013), *available at* http://www.nrdc.org/energy/files/california-petroleum-carbon-reduction-IB.pdf [http://perma.cc/C7CY-K6QH].

195. *Partnerships: Coca-Cola*, WORLD WILDLIFE FOUNDATION, http://www.worldwildlife.org/partnerships/coca-cola [http://perma.cc/B8YP-QJJJ] (last visited June 15, 2015).

196. Morten Vestberg, *LEGO Group Partners with WWF and Focuses on Suppliers to Reduce Climate Impact*, WORLD WILDLIFE FOUNDATION (Nov. 27, 2013), http://awsassets.panda.org/downloads/the_lego_group_climate_savers_partnership_27112013.pdf [http://perma.cc/2ZNY-HYK4]. LEGO has announced a goal of reducing its non-supply chain emissions by 10% (or 10,000 tons) from the 2012 levels, but roughly 90% of LEGO's emissions arise from its supply chain. *Id.* For additional examples, see *Volvo Group and WWF Expand Climate Partnership*, WORLD WILDLIFE FOUNDATION (Feb. 17, 2012), http://wwf.panda.org/?203564/Volvo-Group-and-WWF-expand-climate-partnership [http://perma.cc/Q6V3-FTPE]; *Nike Partners with WWF and Center for Energy and Climate Solutions to Reduce Greenhouse Gas Emissions*, WORLD WILDLIFE FOUNDATION (Oct. 2, 2001), https://www.worldwildlife.org/press-releases/nike-partners-with-wwf-and-center-for-energy-and-climate-solutions-to-reduce-greenhouse-gas-emissions [https://perma.cc/Y52E-BMLY]; *L'Oreal Group: Using CDP to Sustainably Manage Supply Chains and Reduce Carbon Emissions Across the Product Lifecycle*, CDP, https://www.cdp.net/en-US/WhatWeDo/Pages/case-study-loreal.aspx [https://perma.cc/4729-FBHQ] (last visited June 15, 2015); *WWF Climate Savers Partner Yingli Green Energy Goes Beyond Targets for Reducing Emissions*, WORLD WILDLIFE FOUNDATION (JAN. 9, 2015), http://wwf.panda.org/?236730/Climate-Savers-Yingli-targets [http://perma.cc/DS5F-XSUD].

suppliers. Cisco also has asked suppliers to set reduction targets for GHG emissions and begin achieving those goals.[197]

Supply chain contracting initiatives could be expanded in several ways. As discussed above, in the U.S., suppliers account for most of the GHG emissions associated with consumer products, so the technical potential of domestic supply chain contracting initiatives is substantial.[198] Incentives for supply chain contracting turn in part on whether a firm discloses the emissions of its suppliers, and the CDP could increase its emphasis on including supply chain emissions in the carbon disclosures of large corporations. An important step in this direction is to extend the corporate carbon reporting managed by CDP and other private organizations. Reporting currently includes the emissions from corporations' facilities (often called Scope 1 emissions) and the power plants that supply energy to the facilities (Scope 2 emissions), but expanding it to the corporations' suppliers (Scope 3 emissions) would increase incentives for corporations to reduce their suppliers' emissions.[199]

Efforts to extend reporting to supply chains can require complex assessments to calculate and allocate emissions, but initial efforts demonstrate that doing so is often feasible. Dell Computer's recent experience is an example. Several years ago Dell joined CDP's supply chain program as part of Dell's effort to achieve forty percent absolute carbon emissions reductions by 2015. As part of this effort, Dell adopted baseline expectations for suppliers in 2007. Suppliers were already expected to comply with environmental management standards, but Dell asked suppliers to include GHG emissions in their quarterly reviews. By 2009, over eighty percent of Dell's suppliers were meeting this requirement, and Dell then added new guidelines for suppliers, including reporting of emissions to CDP, setting of public goals to reduce operational GHG impacts, and, for Tier 1 suppliers, establishing GHG

197. CISCO, 2012 CISCO CSR REPORT, *avaliable at* http://www.cisco.com/assets/csr/pdf/CSR-Report-2012-Supply-Chain.pdf [http://perma.cc/3C28-HF5H].

198. *See, e.g.*, C. HENDRICKSON, LESTER LAVE & H.S. MATTHEWS, ENVIRONMENTAL LIFE CYCLE ASSESSMENT OF GOODS AND SERVICES: AN INPUT-OUTPUT APPROACH (2006).

199. *See* CDP, SUPPLY CHAIN REPORT, *supra* note 191, at 6–8.

management and reporting requirements for the suppliers' supply chains. Although these guidelines were not legally-enforceable requirements, Dell communicated to suppliers that "[f]ailure to meet these requirements can impact your supplier ranking and potentially diminish your ability to compete for Dell's business." With this warning, the supplier response rate was ninety-four percent.[200]

b. Developing Countries

In addition to extending emissions reduction pressure to smaller firms in developed countries, initiatives that increase supply chain carbon disclosure and contracting requirements also may be an important way to create incentives for emissions reductions from China, India, and other developing countries.[201] For instance, China's exports to the U.S. and Europe account for a large share of China's emissions.[202] Many Chinese suppliers are now faced with corporate buyers who are insisting on carbon reductions in supply chain contracting. The massive scale of global supply chains (for example, Wal-Mart has 10,000 suppliers in China alone), and inefficiencies among suppliers in many developing countries suggest that the technical potential and behavioral plasticity are high.[203]

Supply-chain pressures also can create constituencies in developing countries that support policies to reduce carbon emissions. If suppliers have incentives to sell goods that have a lower carbon footprint to corporate buyers, they also are

200. *Collaboration Delivers Targets and Mutually Beneficial Energy Savings*, CDP, https://www.cdp.net/en-US/WhatWeDo/Pages/Case-Study-Dell.aspx [https://perma.cc/Y6N4-UUR9] (last visited June 15, 2015).

201. *See* Vandenbergh, *supra* note 27, at 905–10.

202. *See* Bin Shui & Robert C. Harriss, *The Role of CO_2 Embodiment in US-China Trade*, 34 ENERGY POL'Y 4063, 4066 (2006). In 2007, a quarter of China's carbon emissions were due to exports to the U.S. and Europe. *See* Jeremy Lovell, *Quarter of China's Carbon Emissions Due to Exports*, REUTERS (Oct. 19, 2007, 5:46 AM), http://www.reuters.com/article/2007/10/19/environment-climate-china-exports-dc-idUSL1874784520071019/ [http://perma.cc/8TRV-BKLM]. Chinese domestic consumption has increased in recent years as a proportion of its GDP, suggesting that Chinese exports are likely to be shrinking as a share of China's total carbon emissions.

203. Vandenbergh, *supra* note 190, at 938–40; *see also* Stephanie Rosenbloom, *Wal-Mart Unveils Plan to Make Supply Chain Greener*, N.Y. TIMES, Feb. 25, 2010, at B3; Wan Xu & David Stanway, *Wal-Mart, in China, Pushes Suppliers Down Green Path*, REUTERS (Oct. 25, 2012, 4:57 AM), http://www.reuters.com/article/2012/10/25/us-walmart-china-idUSBRE89O0CE20121025 [http://perma.cc/5D5C-ECWQ].

likely to have incentives to support low-carbon sources of electricity and other inputs into their products, and to lobby their governments to support public investments in these areas. Their governments, in turn, will face fewer barriers to making emissions reduction commitments in international agreements,[204] and movement by developing countries can increase the pressure on reluctant developed countries.[205]

Supply chain contracting initiatives also can address an important equity issue: supply chain contracting can be a way to reduce the emissions from developing countries that arise from making goods for use in developed countries. Some developed countries have reduced emissions by off-shoring the most carbon-intensive production to developing countries. For example, the U.K. has reduced its GHG emissions below 1990 levels if only emissions from sources within the country are included, but if emissions attributable to the goods consumed in the U.K. are included, total GHG emissions have increased.[206] Supply chain contracting and carbon disclosure initiatives may reduce incentives for off-shoring carbon-intensive production and may increase the flow of low-carbon technologies, financial resources, and practices to suppliers in developing countries.[207]

In short, corporate global supply chain initiatives have the potential to turn the growth of global trade into an advantage, extending the influence of consumer, investor, lender and other pressure for emissions reductions from firms in developed countries to suppliers in developing countries. The initiatives also can provide a vehicle for retail consumers and corporate

204. Vandenbergh, *supra* note 27, at 909–10.

205. Sovereignty and equity issues are concerns, but they may be less problematic for private initiatives than for international public governance requirements. A private supply chain contract does not implicate the sovereignty issues of the home country of either party, reducing concerns arising from national interests and identity. Similarly, if a rich country demands emissions reductions from a poor country, equity concerns are more central than if two private parties are contracting over the carbon footprint of goods.

206. DAVID WATSON & STEPHAN MOLL, ENVIRONMENTAL BENEFITS AND DISADVANTAGES OF ECONOMIC SPECIALISATION WITHIN GLOBAL MARKETS, AND IMPLICATIONS FOR SCP MONITORING 2 (2008), *available at* http://scp.eionet.europa.eu/publications/SCORE/wp/score_paper [http://perma.cc/58J9-QSHW].

207. Efforts to discourage leakage through border allowances and similar measures face constraints from the global trade regime. Cohen & Vandenbergh, *supra* note 119, at S58–S62.

buyers in developed countries to take responsibility for the emissions associated with producing the goods they buy from developing countries.

iv. Benefit Corporations

A new form of corporation has emerged in the last decade that offers additional opportunities for private climate governance. In more than two dozen states, new laws allow the formation of benefit corporations, which can be incorporated with the express goal of pursuing environmental or other social goals in addition to profits.[208] A number of benefit corporations already are pursuing carbon emissions reductions. An example is Method, a consumer products company that is organized as a benefit corporation and has made substantial commitments to carbon emissions reductions.[209] Method's products are sold at Target and other major retailers.

Only limited research is available on the effects of the benefit corporation form of organization on firm behavior, but the explicit inclusion of environmental objectives as a firm goal may induce benefit corporations to be more responsive to carbon disclosure efforts than other firms. Private climate governance initiatives could induce existing benefit corporations to pursue carbon emissions reductions. In addition, new firms may be formed as benefit corporations in sectors where pursuit of the profit maximization goal has particularly large effects on carbon emissions. For instance, business and social entrepreneurs could form new benefit corporations to sell products that compete with products whose emissions arise in part from planned obsolescence (e.g., consumer products ranging from laptops and cell phones to socks) or from freshness dates that are designed more to move

208. *See State by State Legislative Status*, BENEFIT CORP INFORMATION CENTER, http://benefitcorp.net/state-by-state-legislative-status [http://perma.cc/5Z3Z-AQD7] (last visited June 15, 2015); Kyle Westaway & Dirk Sampselle, *The Benefit Corporation: An Economic Analysis with Recommendations to Courts, Boards, and Legislatures*, 62 EMORY L.J. 999 (2013); William H. Clark, Jr. & Elizabeth K. Babson, *How Benefit Corporations Are Redefining the Purpose of Business Corporations*, 38 WM. MITCHELL L. REV. 817 (2012); Dana Brackman Reiser, *Benefit Corporations – A Sustainable Form of Organization?*, 46 WAKE FOREST L. REV. 591 (2011).

209. *See* METHOD, http://methodhome.com [http://perma.cc/47JJ-HWWH] (last visited June 15, 2015).

products than to ensure health or quality.[210] The new virtuous fast food movement could include benefit corporations that offer low-carbon fast food, since local and organic food may or may not also be low carbon.[211] New benefit corporations also could be formed to compete with firms that operate in high-emitting sectors and that lobby heavily against government emissions reduction efforts, such as fossil fuels and electric utilities.

v. Magnitude

What is the magnitude of the potential emissions reductions that could be achieved from the corporate sector? All of the emissions reductions provided in this Article are intended to be rough, back-of-the-envelope examples of the potential for private climate governance, not specific estimates. Nevertheless, they can provide a sense of the plausible reductions achievable from a vigorous effort to buy a decade with private governance initiatives. Although the totals have varied from year to year, a recent CDP report suggested that participating firms reduced emissions by almost 500 million tons of CO_2e in 2012.[212] Reports by other NGOs have indicated comparable levels of emissions reductions.[213] Some of these reductions may not be the result of private climate initiatives or may be overstated, but the CDP report includes reductions by only several hundred firms, and the CDP has only taken initial steps to extend reporting to suppliers.

The CDP emissions reductions include non-energy and non-CO_2 emissions. We estimate that eighty percent (400 million

210. Hope Reeves, *In the Old Days, You'd Smell the Milk*, N.Y. TIMES, Nov. 10, 2013, at MM16; *see also* THE DAILY TABLE, http://www.thedailytable.org [http://perma.cc/T4U3-NQRR] (last visited June 15, 2015).

211. *See* Julie Moskin, *Hold the Regret? Fast Food Seeks Virtuous Side*, N.Y. TIMES, July 26, 2014, at A1. For a discussion of private food quality regulation, see TIMOTHY D. LYTTON, KOSHER: PRIVATE REGULATION IN THE AGE OF INDUSTRIAL FOOD (2013).

212. *See* CDP, CARBON ACTION REPORT 3 (2013) (stating that "companies reported reductions of 497 million tonnes of CO_2e as a result of emission reduction activities totaling US$ 11 billion in 2012"), *available at* https://www.cdp.net/CDPResults/CDP-Carbon-Action-Report-2012.pdf [https://perma.cc/2UKB-GQU9].

213. *See* CERES, GAINING GROUND: CORPORATE PROGRESS ON CERES ROADMAP FOR SUSTAINABILITY (2014), *available at* http://www.ceres.org/resources/reports/gaining-ground-corporate-progress-on-the-ceres-roadmap-for-sustainability/view [http://perma.cc/48XB-4XJA] (providing percentages on company participation).

tons) or more of the emissions reductions represent CO_2 from fossil fuel consumption.[214] It is reasonable to assume that a major new effort by CDP and other NGOs could expand the number of large firms, could include smaller firms, and could extend these efforts to additional suppliers in developed and developing countries. Additional emissions reductions could be achieved through expansion of product carbon labeling and efforts directed at benefit corporations. A reasonable estimate for all of these activities combined would be an additional 500 million ton reduction of annual CO_2 emissions, somewhat more than doubling the CDP participants' previous reductions.

Assessments of possible emissions reductions by private sector firms find opportunities to reduce CO_2 emissions by more than five times this amount using only measures that would yield net savings.[215] These assessments have met with skepticism from many economists, who believe that firms must already have taken any cost-saving actions. More sophisticated treatments accept that there may be cost-saving opportunities to reduce emissions but argue that "energy-cost myopia" leads

214. CDP, INVESTMENT, TRANSFORMATION, AND LEADERSHIP, *supra* note 164, at 20 (reporting that out of 129 million metric tons of CO_2e emissions reductions by S&P500 firms in 2013, 13 million were from process emissions reductions and 3 million from fugitive emissions reduction). Much of the remaining 113 million tons (88%) was due to energy efficiency improvements and installation of low-carbon energy sources. Considerable uncertainty remains, however, as almost half of the emissions reductions are lumped together as "Other." Because most non-agricultural emissions of non-CO_2 greenhouse gases are process and fugitive emissions from the fossil fuel and chemical industries, we estimate that the non-CO_2 greenhouse gas emissions reductions included under "Other" are less than the reductions of process and fugitive emissions. We further assume that the composition of emissions reductions in the S&P 500 is representative of emissions reduction by all firms. Therefore, we argue that assigning twenty percent of reported emissions reduction to non-CO_2 emissions is a conservative estimate. Nonetheless, we recommend treating this estimate with caution.

215. *See, e.g.*, MCKINSEY CO., PATHWAYS TO A LOW-CARBON ECONOMY, at 85, 90–91, 108–09 (2009) (finding that improving energy efficiency in the iron and steel industry could reduce CO_2 emissions by 550 million tons per year by 2020 with net savings of $1.4 billion (550 tons times 2 Euro per ton at an exchange rate of $1.25 per Euro); the energy efficiency, co-generation of heat and power, and switching from fuel oil to natural gas in the chemical industry could reduce emissions by more than 600 million tons per year with net savings of $2.2 billion (600 million tons times 3 Euro per ton); and energy efficiency measures in commercial and residential buildings could reduce emissions 1.6 billion tons by 2020 with net savings of $50 billion (1.6 billion tons times 25 Euro per ton)); MCKINSEY CO., IMPACT OF THE FINANCIAL CRISIS ON CARBON ECONOMICS (2010) (updating the previous report for the impact of the global economic crisis).

decision makers to focus on up-front capital costs while ignoring subsequent reductions in operating costs.[216] Although economists acknowledge that this myopia can lead to irrational decisions, some argue that there must be some reason for a firm to not make investments in emissions reductions that would repay the original investment many times over.[217] We argue that such opportunities exist but are often overlooked, and, although firms ultimately may identify these efficiencies on their own, private initiatives that call attention to the opportunities and create additional incentives to pursue them may accelerate the process.[218] Thus, we believe that firms could easily implement measures to reduce their annual fossil-fuel CO_2 emissions by 500 million metric tons.

How significant are emissions reductions of this magnitude? The 500 million ton annual total is one eighth of the 4,000 million tons needed to buy a decade of emissions reductions. It is also equal to a regulatory approach that would reduce the emissions of the U.S. transportation sector by a third, and it is the equivalent of assembling a club of countries comprising Brazil, Canada, Indonesia, and Mexico (all of which are in the top fifteen emitters of fossil-fuel CO_2) that all commit to reduce fossil fuel-based CO_2 emissions by an amount equal to twenty-five percent of 2012 levels.[219]

B. Households

Private climate initiatives also are reducing household emissions in the U.S. and abroad. Efforts to target households

216. NORDHAUS, *supra* note 22, at 267–71 (noting that consumers frequently resist spending more for energy efficiency, even when it produces savings whose discounted net present value is much greater than the initial cost).

217. *Id.* at 270 ("A finance specialist might tell me that I am behaving myopically . . . [but] I have a long list of reasons for my behavior.").

218. A well-known example is Nortel, which discovered only after regulations required it to replace chlorofluorocarbon chemicals in its manufacturing process that investing $1 million in reconfiguring its manufacturing process could save $4 million per year in chemical purchase and disposal costs. *See* RICHARD E. BENEDICK, OZONE DIPLOMACY 232 (1998).

219. *See* C. Le Quéré et al., GLOBAL CARBON BUDGET 2014 7, EARTH SYSTEMS SCI. DATA DISCUSSIONS 521–610 (2014); *Data*, GLOBAL CARBON BUDGET [hereinafter "GLOBAL CARBON BUDGET"], http://cdiac.ornl.gov/ftp/Global_Carbon_Project/Global_Carbon_Budget_2014_v1.0.xlsx [http://perma.cc/J4TJ-7RN9] (last visited June 15, 2015).

may seem trivial on the surface, but households account for more than a third of U.S. carbon emissions, an amount that is equal to the contribution from the U.S. industrial sector and is larger than the total emissions of all of the nations of Central America, South America, and Africa combined.[220] As a result, an initiative that achieves even a one percent reduction in U.S. household carbon emissions will reduce emissions roughly equivalent to reducing all emissions from a medium-sized country such as Kenya or from an important U.S. industry sector such as the ammonia industry.[221] The examples presented below demonstrate the feasibility of household initiatives but do not suggest that the opportunity has been fully exploited. The important conceptual moves are to view households as a discrete source category, to direct a level of effort toward the household sector that is appropriate given the magnitude of the opportunity, and to be rigorous in evaluating technical potential, behavioral plasticity, and policy plasticity.[222]

i. Behavioral Wedge

Many of the most promising approaches to household emissions target behavioral failures. A study of the technical potential and behavioral plasticity of seventeen household actions concluded that by 2020 behavioral initiatives could achieve a "behavioral wedge" of emissions reductions, lowering U.S. household annual emissions by twenty percent, an amount equal to the total annual emissions of France.[223] The estimate of twenty percent emissions reductions by 2020 assumes state-of-the-art behavioral interventions but does not assume new regulatory activity and only evaluates the opportunity in the U.S., not the global opportunity. Even with this constraint, it projects that the reasonably achievable emissions reductions by

220. *See* Vandenbergh & Steinemann, *supra* note 14, at 1673.

221. *See id.*; MCKINSEY, PATHWAYS TO A LOW-CARBON ECONOMY, *supra* note 215, at 13 (reporting that "[i]n an optimistic case—and there is a high degree of uncertainty in these estimates—[behavioral change] could yield . . . another 3.5-5.0" billion tons per year reduction in CO_2 emissions).

222. *See* Vandenbergh & Steinmann, *supra* note 14, at 1680–715.

223. *See* Dietz et al., *supra* note 13, at 18455–56 (noting reductions of 123 million metric tons of carbon, and each ton is roughly 3.67 tons of CO_2).

2020 are more than 450 million tons of fossil fuel CO_2 per year.[224]

The actions included in the behavioral wedge approach include the purchase of more efficient home appliances, motor vehicles, and heating and cooling equipment, as well as home weatherization. The behavioral wedge actions also include better use of existing technologies, such as more efficient driving behavior, home thermostat use, and laundry temperature settings.[225] Policy plasticity is often high because the behavioral wedge initiatives that target these actions are the types of low-cost, non-coercive interventions that can be conducted by private organizations.

A number of private governance responses that target behavioral wedge-type actions are already underway.[226] For instance, new corporations such as Opower now offer behavioral science-driven programs to electric utilities seeking to reduce electricity demand from households, including monthly feedback that compares a households' energy use to others in the community. Empirical studies suggest that these interventions have reduced electricity use by one to three percent.[227]

NGOs also have developed initiatives that target households. The Union of Concerned Scientists' Cooler Smarter campaign encourages individuals to reduce their carbon emissions by twenty percent in twenty days through twenty personalized actions.[228] The campaign asks participants to provide

224. This is an amount equal to the combined emissions of the U.S. petroleum refining, iron and steel, and aluminum smelting industries. *See* Dietz et al., *supra* note 13. Over the long term, interventions that affect consumption and carbon emissions in the emerging middle class households in China and India may present the greatest opportunities. *See, e.g.*, SIQI ZHENG ET AL., THE GREENNESS OF CHINA: HOUSEHOLD CARBON DIOXIDE EMISSIONS AND URBAN DEVELOPMENT 24–25 (Nat'l Bureau of Econ. Research, Working Paper No. 15621, 2009).

225. Dietz et al., *supra* note 72, at tbl.1.

226. Many NGOs developed documents to assist in the design of household initiatives. *See, e.g.*, AMERICAN COUNCIL FOR ENERGY EFFICIENT ECONOMIES, http://www.aceee.org/ [http://perma.cc/6N6C-H84K] (last visited June 15, 2015).

227. *See* ED CARROLL ET AL., FRANKLIN ENERGY, RESEARCH STUDY: RESIDENTIAL ENERGY USE BEHAVIOR CHANGE PILOT (2009), *available at* http://www.climateaccess.org/sites/default/files/Carroll_Residential%20Energy%20Use%20Behavior%20Change%20Pilot.pdf [http://perma.cc/WF3N-RVQW].

228. UNION OF CONCERNED SCIENTISTS, http://www.coolersmarter.org [http://perma.cc/A3CY-VZHJ] (last visited June 15, 2015).

information on personal transportation and consumption patterns, and participants receive a personalized list of twenty carbon-reducing actions.[229] The list includes behavior changes ranging from eating fewer high carbon foods to taking public transportation.[230] The Cooler Smarter campaign also contains an information guide illustrating the potential large-scale effects from small-scale GHG emissions reductions, although the effects of the campaign are unclear.[231]

Other NGOs promote household carbon reductions through steps such as disseminating emissions-reducing tips.[232] Examples include the Greenpeace Guide to Greener Electronics, which ranks corporations in the consumer electronics sector based on their GHG emissions reductions,[233] the NRDC Green-e Energy and Green-e Marketplace programs, which provide independent third-party verification of companies that utilize renewable energy technology,[234] and the Environmental Working Group's Meat Eater's Guide to Climate Change and Health, which provides individuals with food carbon footprints.[235] NRDC, along with the U.S. Green Building Council ("USGBC"), a private, non-profit organization, publishes a guide about a private certification system for energy efficient homes.[236]

229. *Id.*

230. *Id.*

231. *Id.*

232. *How to Reduce Your Energy Consumption*, NATURAL RESOURCES DEFENSE COUNCIL, http://www.nrdc.org/air/energy/genergy.asp [http://perma.cc/4JJU-8M3A] (last visited June 15, 2015). The NRDC also publishes an Energy Efficiency guide, which encourages individuals to look for Energy Star labeled home appliances and choose appliances that utilize natural gas over electricity. *Efficient Appliances Save Energy—and Money*, NATURAL RESOURCES DEFENSE COUNCIL, http://www.nrdc.org/air/energy/fappl.asp [http://perma.cc/373P-RRGE] (last visited Apr. 22, 2015).

233. GREENPEACE, GUIDE TO GREENER ELECTRONICS (2012), *available at* http://www.greenpeace.org/international/Global/international/publications/climate/2012/GuideGreenerElectronics/Guide-Ranking-Criteria-v18.pdf [http://perma.cc/AB4K-WXWZ].

234. *Green-e National Standards and Governing Documents*, GREEN-E, http://www.green-e.org/getcert_re_stan.shtml [http://perma.cc/7TPF-W9HL] (last visited June 15, 2015).

235. *Meat Eater's Guide to Climate Change and Health*, ENVIRONMENTAL WORKING GROUP, http://www.ewg.org/meateatersguide/helpful-tips-for-meat-eaters/ [http://perma.cc/CXP4-YRBN] (last visited June 15, 2015).

236. *See* NATURAL RESOURCES DEFENSE COUNCIL, A CITIZEN'S GUIDE TO LEED FOR NEIGHBORHOOD DEVELOPMENT: HOW TO TELL IF DEVELOPMENT IS SMART AND GREEN

NGOs also have used social media campaigns and community based initiatives to engage citizens in small energy-saving actions that may result in large-scale GHG emissions reductions. The "MomentUs" effort of ecoAmerica, an NGO, draws on a sophisticated understanding of marketing techniques to promote individual behavior change.[237] Various community-based campaigns also have been popular in the U.S. and Europe, including Carbon Rationing Action Groups ("CRAGs"), Green Streets, and EcoTeams.[238] Some of these community-based initiatives claim to have produced a twenty percent average reduction in carbon emissions and energy use within one year, but additional research is needed to verify these claims and to understand the extent to which they persist in future years.[239]

Major environmental groups and automakers also have developed a joint effort to shift driving behavior to improve fuel economy and reduce carbon emissions.[240] This eco-driving effort provides information on how drivers can reduce fuel consumption by taking easy steps, including limiting sudden braking and acceleration, maintaining consistent driving

2, *available at* https://www.nrdc.org/cities/smartgrowth/files/citizens_guide_LEED-ND.pdf [https://perma.cc/D97T-GH6C] (last visited June 15, 2015). The publication provides households with information on community features that reduce GHG emissions, including walk-able streets and others. *Id.* at 3.

237. *See* ECOAMERICA, http://ecoamerica.org/ [http://perma.cc/V5FB-D7XL] (last visited June 15 2015). The MomentUs overview document includes a national campaign to "to build a values majority of support among Americans for effective action on climate that leads to national, state, and local institutional, individual, and public policy action." *See* ECOAMERICA, MOMENTUS DESIGN DOCUMENT, *available at* http://ecoamerica.org/wp-content/uploads/reports/MomentUs_overview.pdf [http://perma.cc/ERH2-EEVL] (last visited June 15, 2015).

238. EUROPEAN ENVIRONMENTAL AGENCY, ACHIEVING ENERGY EFFICIENCY THROUGH BEHAVIOR CHANGE: WHAT DOES IT TAKE? 24–25 (2013).

239. *Id.*

240. *See* Jack N. Barkenbus, *Eco-Driving: An Overlooked Climate Change Initiative*, 38 ENERGY POL'Y 762, 765 (2010). A number of national and state governments also have developed eco-driving programs. *See* Thomas D. Wuertenberger, *The Regulation of CO_2 Emissions Caused by Private Households*, 16 MO. ENVTL. L. & POL'Y REV. 1, 45 (2009); SUSAN A. SHAHEEN ET AL., MINETA TRANSP. INST., ECODRIVING AND CARBON FOOTPRINTING: UNDERSTANDING HOW PUBLIC EDUCATION CAN REDUCE GREENHOUSE GAS EMISSIONS AND FULE USE 9 (2012), *available at* http://transweb.sjsu.edu/PDFs/research/2808-ecodriving-greenhouse-gas-emissions-fuel-use-public-education.pdf [http://perma.cc/T3CB-QNXR].

speeds, and removing excess weight from vehicles.[241] Preliminary research suggests that drivers who adopt eco-driving practices are able to reduce fuel consumption by up to fifteen percent.[242] As with many of these programs, only limited research has been done to date, but one analysis of eco-driving programs suggests that adoption of those practices on a national basis could lower annual CO_2 emissions by 100 million tons and result in annual household savings of $214–428.[243]

Although the actions included in the behavioral wedge approach are among the most promising options, many other opportunities exist. For example, several of the eco-driving practices discussed above were included in the behavioral wedge approach, but many were not. Expansion of eco-driving programs thus could yield results beyond those already included in the behavioral wedge emissions reduction estimate.

The importance of behavioral wedge initiatives is easy to miss. Although behavioral initiatives are becoming more common, they are not yet a central feature of NGOs' or corporations' climate activities. NGOs have not made a systematic effort to identify and pursue the most promising behavioral opportunities or to assess and compile the results of existing programs. The lack of information makes it difficult to understand the opportunity, but this is a weakness in thinking about climate governance, not an indication that these programs should not be a core part of a climate strategy. The discussion below identifies additional ways to stimulate emissions reductions from the behavioral wedge actions and from other household opportunities.

ii. Myth Busting

One example of an under-explored category of opportunities in the household sector is myth busting—areas where incorrect

241. *See* THE AUTO ALLIANCE, THE ECODRIVER'S MANUAL 3 (2008), http://www.fs.fed.us/sustainableoperations/documents/TheEcoDriversManual.pdf [http://perma.cc/2K3Y-B9FU].

242. *Id.* at 2–3. Many corporate climate programs also include eco-driving for trucks and other vehicles. *See* Ronald Killian, *Ecodriving: The Science and Art of Smarter Driving*, 281 TRANSP. RES. MAG. 34, 38 (2012), *avaliable at* http://onlinepubs.trb.org/onlinepubs/trnews/trnews281ecodriving.pdf [http://perma.cc/QER9-JVAW].

243. Barkenbus, *supra* note 240, at 764.

beliefs induce individuals to act in ways that are not in their interest and that generate large carbon emissions. Behavior change often requires sophisticated techniques, but myth-driven behaviors should be more amenable to change than many other behaviors because they do not require an individual to act altruistically, just to update beliefs and stop acting against his or her own interests.[244] Many types of myth-busting opportunities exist, but two serve as initial examples: motor vehicle idling and hot water hand-washing.[245] The technical potential for idling interventions is large: motor vehicle idling accounts for roughly one percent of U.S. CO_2 emissions.[246] Behavioral plasticity may be high as well. A recent empirical study indicates that most people believe that they should idle their cars for more than three minutes rather than turn them off if their goal is to save money or reduce emissions, when the actual time is ten to thirty seconds.[247]

This idling myth can be attacked with information efforts (public information campaigns and targeted information provided in car manuals, on dashboard displays, or at drive-through lines and other locations where idling is common) and does not depend upon altruism or climate concern.[248] Even if idling in traffic is set aside so that only unnecessary idling during motor vehicle start-up and waiting is included in the analysis, the opportunity for a private governance initiative is large. If individuals can be induced to act consistent with updated beliefs, the savings could be in the range of 16 million tons of CO_2 and almost $6 billion dollars.[249] This is an amount equal to the combined emissions from the U.S. soda ash,

244. *See, e.g.*, Julia B. Corbett, *Altruism, Self-Interest and the Reasonable Person*, 26 SCI. COMM. 368, *available at* http://site.iugaza.edu.ps/tissa/files/2010/02/Altruism,_Self-Interest,_and_the_Reasonable_Person_Model_of_Environmentally_Responsible_Behavior.pdf [http://perma.cc/YFB6-CH47] (finding that the single biggest predictor of the behavior in question (walking instead of driving) was self-interest about air pollution). The finding is based on a model by Kaplan. Stephen Kaplan, *Human Nature and Environmentally Responsible Behavior*, 56 J. SOC. ISSUES 491 (2000).

245. *See, e.g.*, Attari et al., *supra* note 104, at 16055 (noting that individuals underestimate the energy use of clothes driers by a factor of forty).

246. *See* Carrico et al., *supra* note 101, at 2881.

247. *Id.*

248. Anti-idling efforts have been included in a leading eco-driving program. *See* THE AUTO ALLIANCE, *supra* note 241, at 5.

249. Carrico et al., *supra* note 101, at 2884. Habits are a barrier that will need to be overcome in some cases. *See* Bell & Weber, *supra* note 138.

aluminum, and limestone industries (all of which are among highest-emitting industrial sectors). Recent anti-idling efforts provide models to enable prompt development of large-scale anti-idling initiatives.[250]

Similarly, many individuals hold a myth that the use of warm or hot (not just comfortable) water during hand washing is more effective at reducing disease transmission than comfortable water.[251] Individuals who hold this myth tend to use hot or warm water more often when washing hands, and many businesses require employees to wash hands with hot or warm water. This myth has important effects: more than 8 billion hand washes occur annually in the U.S., and households and businesses emit roughly 6 million tons of CO_2 annually to heat water for hand washing.[252] Heating this water wastes millions of dollars. Although some water heating is necessary to achieve comfortable temperatures, an estimate of the reasonably achievable reduction in the U.S. is one million tons of CO_2. This is an amount equal to all of the emissions from the U.S. lead and zinc industry. Information campaigns targeted at water users, building owners and private building standards programs could be developed and implemented quickly and at low cost.[253]

iii. Home Energy Disclosure

A related target of opportunity is home energy disclosure. As opposed to the misinformation or myths that idling and hand-washing programs address, home energy disclosure initiatives often address a lack of information about energy use. The focus in this discussion is on buyers of residential properties, but comparable issues arise with rental properties. Information about home energy use could drive a wide range of emissions reduction activities, including some that already are included

250. *See* Michael P. Vandenbergh, Jonathan Gilligan & Jack Barkenbus, *Climate Change: The Low-Hanging Fruit*, 55 UCLA L. REV. 701 (2008).

251. Amanda R. Carrico et al., *The Environmental Cost of Misinformation: Why the Recommendation to Use Warm Water for Handwashing is Problematic*, 37 INT'L J. OF CONSUMER STUD. 433 (2013).

252. *Id.* at 436 (expressing results as over 6 million tons of CO_2e, but as Table 4 shows, non-CO_2 emissions are trivial (less than one percent) so there are more than 6 million tons of CO_2 from fossil fuel combustion).

253. *Id.* at 435.

in the behavioral wedge approach (e.g., purchase of efficient heating and cooling systems) and others that are not (e.g., installation of geothermal or solar systems). Although numerous government and private home energy auditing programs are available, far less than half of all homes have been audited and many homes have not adopted basic efficiency upgrades, suggesting that the technical potential for home energy efficiency initiatives is high. The behavioral plasticity for many home energy efficiency investments is also high. Many investments in home heating and cooling systems and appliances have positive returns, and studies suggest that high scores in home energy rating systems correlate with higher home values.[254]

Interventions may need to overcome behavioral failures such as steep discount rates, as well as market failures such as the split incentives between renters and landlords and the quick turnover times for many owners of residential properties. State-of-the-art information programs can be designed to address these failures and drive many types of home energy efficiency actions. The challenge is to identify programs that can be can be scaled up to make major reductions and can be implemented quickly and cheaply. Voluntary government programs have improved home energy disclosure in recent years,[255] but expansion of many government programs may be subject to the pervasive government gridlock.

Recent efforts by private organizations have demonstrated how private institutions can bypass government gridlock regarding home efficiency. For example, programs have encouraged sellers of new and existing homes to post home energy efficiency data in widely-used home multiple listing services ("MLS").[256] Most of the 850-plus regional MLS

254. *See* Sharon Shewmake & W. Kip Viscusi, *Producer and Consumer Responses to Green Housing Labels* (Vanderbuilt University Law School Law and Economics Research Paper No. 14–19, 2014) (evaluating home rating system in Austin, Texas).

255. The Energy Star program is an example. NATIONAL HOME PERFORMANCE COUNCIL, UNLOCKING THE VALUE OF AN ENERGY EFFICIENCY HOME: A BLUEPRINT TO MAKE ENERGY EFFICIENCY IMPROVEMENTS VISIBLE IN THE REAL ESTATE MARKET 10 (2013), *available at* http://www.elevateenergy.org/wp-content/uploads/Unlocking_the_Value_of_an_Energy_Efficient_Home_FINAL.pdf [http://perma.cc/79XQ-KWVX].

256. *See Value for High Performance Homes*, ELEVATE ENERGY http://www.elevateenergy.org/value-high-performance-homes/ [http://perma.cc/LGE9-KUPY] (last visited Apr. 22, 2015). The MLS facilitates the majority of real estate

databases within the United States do not include energy or carbon data in property listings,[257] but organizations including the National Association of Realtors ("NAR"), the Appraisal Institute, the National Association of Home Builders, Elevate Energy, the National Home Performance Council, and USGBC have initiatives underway to add energy efficiency data to the MLS.[258] Thus far, over 125 MLS systems have implemented green data entry fields to increase realtor access to green property data.[259] The inclusion of green data in the MLS should allow for more accurate assessments of property values and facilitate consumer interest in efficiency in the real estate market.[260]

Another example is the formation of private standards and certification programs to reward efficient homes.[261] Home

transactions within the United States. NATIONAL HOME PERFORMANCE COUNCIL, *supra* note 255, at 6.

257. NATIONAL HOME PERFORMANCE COUNCIL, *supra* note 255, at 6.

258. *See, e.g.*, *Appraisal Institute Praises 'Green' Multiple Listing Service Tool Kit*, THE APPRAISAL INSTITUTE (April 21, 2010), http://www.appraisalinstitute.org/appraisal-institute-praises-green-multiple-listing-service-tool-kit/ [http://perma.cc/UEZ9-FVFP]; JOHN STOVALL, ET AL., NATIONAL HOME PERFORMANCE COUNCIL, UNLOCKING THE FULL VALUE OF GREEN HOMES: WHY GREEN MULTIPLE LISTING SERVICES ARE THE KEY TO RESIDENTIAL ENERGY EFFICIENCY 3 (2011), *available at* http://www.nhenergycode.com/live/code_docs/Green%20MLS%20White%20Paper.pdf [http://perma.cc/HD2W-6PYZ]; NATIONAL ASSOCIATION OF REALTORS, GREEN MLS IMPLEMENTATION GUIDE 1, 3 (2014), http://greenresourcecouncil.org/sites/default/files/2014%20NAR%20Green%20MLS%20Implementation%20Guide.pdf [http://perma.cc/KR2J-6YBP]; *see also* HIGHLIGHT GREEN HOMES, U.S. GREEN BUILDING COUNCIL 1 (2012), *available at* http://www.usgbc.org/Docs/Archive/General/Docs10917.pdf [http://perma.cc/284H-AWZY].

259. As of January 2012, almost ten percent of MLS databases included environmental listings, with dozens more in transition. HIGHLIGHT GREEN HOMES, *supra* note 258.

260. NATIONAL HOME PERFORMANCE COUNCIL, *supra* note 255, at 25. The Green MLS Implementation Guide recommends that MLS systems distinguish green features within seven categories (e.g., energy efficiency, water conservation). NATIONAL ASSOCIATION OF REALTORS, *supra*, note 258, at 30. Although many of these categories will lead to lower carbon emissions, it may be important for private climate initiatives to develop disclosure methods that give primacy to energy or carbon to ensure that buildings are not awarded a high score unless they have low carbon emissions. This would avoid a situation in which a building might receive a high overall score because of factors such as indoor air quality, but may have a large carbon footprint.

261. For example, standards developed by the Real Estate Standards Organization ("RESO") and the Building Performance Institute ("BPI") would allow for verification of green data to maintain the accuracy and integrity of green property listings. *See* NATIONAL HOME PERFORMANCE COUNCIL, *supra* note 255, at 15.

certification under the USGBC's LEED for Homes program provides verification of a property's potential energy efficiency and estimated cost savings for potential homebuyers.[262] Standardized labeling and certification programs can provide information to realtors and homebuyers unfamiliar with energy efficient features, but these programs are not yet available for many homes. Certification systems have often focused on rewarding high-performance new homes, but new homes represent a small share of the housing inventory in any given year, and only a small subset of homes will qualify for a green certification.[263] As a result, a simple disclosure in MLS rankings of the energy efficiency of each listed home, whether new or existing, and whether high performing or not, might reach many more homes.[264] By creating widespread market incentives to invest in energy efficient equipment and use existing equipment more efficiently, home energy disclosure initiatives have the potential to reach households at large scale and to yield prompt, large emissions reductions.[265]

iv. Immediate Feedback

The home energy disclosure programs discussed above reduce carbon emissions principally by creating incentives for sellers of new and existing homes to invest in energy efficiency

262. *See Guide to Certification: Homes*, USGBC, http://www.usgbc.org/cert-guide/homes [http://perma.cc/5XW8-JLSY] (last visited Apr. 22, 2015).

263. Roughly twenty percent of newly constructed homes are green projects, and green homes tend to sell for five to ten percent more than traditional homes. NATIONAL ASSOCIATION OF REALTORS, *supra* note 258, at 72.

264. Energy efficiency performance scores focus on two main types: asset and operational. ENERGY TRUST OF OREGON, INC., HOME ENERGY PERFORMANCE SCORES: EFFORTS TO DATE WITH MODELING TOOL COMPARISON AND SUMMARY OF KEY ISSUES 3 (2012), *available at* http://energytrust.org/About/PDF/Jan23EPSReport.pdf [http://perma.cc/6C3V-4C47].

265. For instance, looking only at manufactured homes (often called "mobile homes") energy-use labeling could reveal opportunities to save money on energy bills and reduce emissions. A typical manufactured home could achieve net savings of $279 per year (accounting for the cost of energy-efficient construction), with total national net savings of $1.7 billion dollars per year and a reduction of 23 million tons per year of CO_2 if all buyers of new and used manufactured homes took advantage of energy efficiency measures that produced net savings. *See* JACOB TALBOT, MOBILIZING ENERGY EFFICIENCY IN THE MANUFACTURED HOUSING SECTOR, AMERICAN COUNCIL FOR AN ENERGY EFFICIENT ECONOMY 19–23 (2012), *available at* http://www.workingre.com/wp-content/uploads/2013/08/Mobilizing-Energy-Efficiency-in-Manufactured-Housing.pdf [http://perma.cc/B4MD-D4WJ].

improvements. The programs typically seek to steer behavior by providing aggregate data from extended periods of time (e.g., annual or monthly electricity usage). In contrast, immediate feedback programs provide information at the time of use. Homeowners often do not take advantage of energy-efficiency measures that could save hundreds of dollars a year, however, due to the energy-cost myopia phenomenon discussed above.[266]

Private climate initiatives could address energy cost myopia by drawing on a significant body of research on best practices dating back to the 1970s.[267] Public information campaigns that provide information far from the time of decision often have limited effects,[268] but providing information at the time and at the locus of an action is more likely to be effective.[269] Although programs that provide monthly feedback (e.g., information in monthly billing statements) have yielded one to three percent energy use reductions, efforts that provide immediate feedback regarding the amount or cost of electricity are also promising.[270] Households with devices that provide occupants with immediate feedback have been found to reduce energy use

266. *See* discussion, *supra* note 216; *see also* Robert Stavins & Richard Newell, *Evaluating the Energy Efficiency Gap*, DUKE UNIVERSITY ENERGY INITIATIVE, http://energy.duke.edu/research/efficiency_project [http://perma.cc/6C3S-CTUS] (last visited Apr. 22, 2015) (describing research project); Michael Levi, *Gas Price Worries and Climate Myopia*, COUNCIL ON FOREIGN RELATIONS, Apr. 28, 2011, http://blogs.cfr.org/levi/2011/04/28/gas-price-worries-and-climate-myopia/ [http://perma.cc/ZL97-2F8V] (identifying the problem as a significant obstacle to reducing emissions by pricing carbon).

267. *See, e.g.*, Stern et al., *supra* note 135, at 4847–48 (assessing the potential for measures that address energy-cost myopia and noting best practices).

268. *See* Wokje Abrahamse et al., *A Review of Intervention Studies Aimed at Household Energy Conservation*, 25 J. ENVTL. PSYCH. 273 (2005).

269. *See* Andrea H. McMakin et al., *Motivating Residents to Conserve Energy Without Financial Incentives*, 34 ENVTL. BEHAV. 848 (2002); John E. Petersen et al., *Dormitory Residents Reduce Electricity Consumption When Exposed to Real-Time Visual Feedback and Incentives*, 8 INT. J. SUST. HIGH EDUC. 16 (2007); L. McClelland & S.W. Cook, *Energy Conservation Effects of Continuous In-Home Feedback in All-Electric Homes*, 9 J. ENVTL. SYS. 169 (1979); ELECTRIC POWER RESEARCH INSTITUTE (EPRI), RESIDENTIAL ELECTRICITY USE FEEDBACK: A RESEARCH SYNTHESIS AND ECONOMIC FRAMEWORK (2009).

270. *See* Vandenbergh et al., *supra* note 106, at 740–41 (citing studies).

by four to twelve percent,[271] and the cost of these devices often can be recouped in a few years or less.

The policy plasticity of these types of private initiatives is likely to be high because they can address a market failure involving utility incentives. Smart meter programs demonstrate the problem. Utilities have spent millions of dollars on smart meter campaigns in many regions, and one might assume that smart meters provide immediate feedback to the consumer, but they typically do not. The market failure arises because under current rate structures utilities will profit if they shift demand to times when electricity is cheaper to produce, but they will lose revenue if they sell less electricity overall.[272] As a result, most utilities have incentives to shift the time of electricity use to avoid the high cost of providing peak power, but they do not have incentives to reduce overall electricity use. Utilities describe net energy use reduction in vivid terms, referring to "demand destruction" or "revenue erosion," and raising concerns about a "death spiral."[273] Not surprisingly, smart meters often communicate with the utility to facilitate shifting demand to times of low-cost generation, but they typically do not provide immediate, real-time, easy-to-access information to consumers.[274]

Although most utilities do not have incentives to promote immediate feedback devices, private initiatives can do so. Meters with in-home displays cost in the $100–250 range and provide immediate, easy-to-read information.[275] An individual simply needs to plug in the unit to learn real-time household electricity usage and to observe changes in electricity use as appliances, lights, and heating and cooling systems are turned on and off. A simpler option is a twenty dollar device available

271. *See* KAREN EHRHARDT-MARTINEZ ET AL., ADVANCED METERING INITIATIVES AND RESIDENTIAL FEEDBACK PROGRAMS: A META-REVIEW FOR HOUSEHOLD ELECTRICITY-SAVING OPPORTUNITIES 74 (2010).

272. Michael P. Vandenbergh & Jim Rossi, *Good for You, Bad for Us: The Financial Disincentive for Net Demand Reduction*, 65 VAND. L. REV. 1527 (2012).

273. *Id.* at 1529.

274. Research suggests that interposing even just a few low-cost steps between an individual and an outcome will substantially reduce participation. *See* Vandenbergh et al., *supra* note 104, at 740–41 (citing studies).

275. Tamar Krishnamurti et al., *Preparing for Smart Grid Technologies: A Behavioral Decision Research Approach to Understanding Consumer Expectations About Smart Meters*, 41 ENERGY POL'Y 790, 791–92 (2012).

in many stores that provides real-time data on the electricity use of particular appliances.[276] The device must be plugged in between the appliance and the socket, but it also provides real-time data of value to a household. By providing data at the point of decision, initiatives that promote uptake of immediate feedback devices can enable households to save money and act on preferences to reduce energy use and carbon emissions.

v. Employee Programs

In addition to NGO-sponsored household initiatives, a new type of hybrid corporate-household initiative has emerged in recent years: corporate programs designed to induce employees to reduce their household emissions. In some cases the corporation simply provides information, but in others the corporation provides a subsidy to employees to fund home improvements or purchases that will lead to more efficient energy use.

For example, WSP, a for-profit corporation, has developed a program that companies have used to motivate their employees to reduce their household carbon footprints. The program is called PACT: Personal Allowance Carbon Trading.[277] The project allows employees at user companies to cap their yearly carbon emissions. The employees enter their activities onto a website that tracks their monthly totals.[278] In addition to calculating the user's carbon footprint, PACT also provides tips on how to reduce carbon emissions and provides discounts for products from eco-friendly stores.[279] If the employee's emissions are below the cap, they receive an annual bonus in their paycheck. According to the program designer, about seventy percent of members hit their targets. PACT has over 4,000 members, including nonprofits, governments, and

276. *See, e.g.*, Kill A Watt®, P3INTERNATIONAL.COM, http://www.p3international.com/products/p4400.html [http://perma.cc/G2VV-W3B9] (last visited June 15, 2015) (noting retail prices).

277. David Symons, *PACT—Making Sustainable Living Engaging And Easy For All* (2013), *available at* http://content.yudu.com/Library/A2kkfg/OurPACTsustainableli/resources/index.htm [http://perma.cc/WG7G-SF7M] (last visited June 15, 2015).

278. *Id.* at 7.

279. *Id.* at 10–12 .

companies, and the program can operate in thirty-five countries.[280]

In 2007, Swiss Re, a large reinsurance company, launched an employee program called COYou2.[281] The program allows employees to claim subsidies for investments including electric cars, public transport passes, energy efficient home appliances, solar panels, and others. The subsidies cover fifty percent of the investment costs up to a maximum of 5,000 Swiss Francs.[282] Sony Pictures launched a similar program in 2008 that offers subsidies to employees who purchase a qualifying hybrid or electric vehicle or install photovoltaic solar panels.[283] Other programs have been launched recently by 3M, Kimberly-Clarke, and other companies.[284] Research is needed on the effects of these programs and corporations' motivations for offering them, but these corporate-household hybrids are a promising new development.

280. *Id.* at 14–16. WSP reports that members typically reduce their carbon footprint by ten percent in their first year as a participant in PACT. *Id.* at 14.

281. Swiss Re launched the program with the help of Off4Firms, which specializes in designing employee programs, along with South Pole Carbon, and Wageningen University. *See* Johannes Manser et al., *Accelerating CO_2 Emissions Reductions Via Corporate Programmes* 7 (Off4Firms Working Paper D2b.1, 2013), *available at* http://www.off4firms.ethz.ch/wp-content/uploads/2012/04/Off4Firms-Working-Paper-2b-1.pdf [http://perma.cc/5XP4-NMAD].

282. Although the first five years only resulted in 4,000 investments, a few minor adjustments increased the investments to 1,700 in the sixth year of the program. On the whole, the program has been very popular among employees, although the carbon emissions reductions are unclear. *Id* at 17.

283. Sony Pictures Digital Productions Inc., *Employee Eco-Incentives*, SONY PICTURES A GREENER WORLD, http://www.sonypictures.com/green/act/employee-involvement/employee-incentives.php [http://perma.cc/JE9F-FGRC] (last visited June 15, 2015). Since the inception of the program, Sony claims that over 300 employees have participated, resulting in savings of over 200,000 gallons of gas and generating over 500,000 kWh of clean power. Sony offers other incentives to employees who commit to a greener daily commute, including preferred parking, access to charging enabled parking spaces, transit pass discounts and secure bike racks. In 2012 Sony launched a new interactive web-based platform called Practically Green, which provides small everyday activities employees can undertake to reduce their carbon footprints. Sony Pictures Digital Productions Inc., *Small Acts: Greening Employees Everyday Actions*, SONY PICTURES A GREENER WORLD, http://www.sonypictures.com/green/act/employee-involvement/commit-acts.php [http://perma.cc/4Y8Y-VQBH] (last visited June 15, 2015).

284. *See* Cardwell, *supra* note 122.

vi. Magnitude

What is the magnitude of the potential emissions reductions from private governance initiatives directed at households? The behavioral wedge approach suggests that by 2020 annual emissions reductions of over 450 million tons of fossil fuel CO_2 could be achieved in the U.S. alone.[285] Further reductions from the seventeen behavioral wedge actions could be achieved in other countries.

In addition, although the initiatives discussed above include several that would simply implement the behavioral wedge actions, they also include others that were not included in the behavioral wedge analysis (e.g., idling myth-busting and the actions targeted by many employee programs), and these actions could yield additional emissions reductions over the 450 million ton total. A lack of resources or expertise could lead to reductions that are less than the 450 million ton estimate for the U.S., but there are also indications that much greater reductions could be achieved: McKinsey estimates that installing energy-efficient lighting, electronics, and appliances could reduce household emissions worldwide by more than a gigaton per year with net savings of more than $30 billion per year.[286] Behavior change in energy use could increase the savings even more.[287] NGOs could undertake a new effort to expand the number of households targeted by these initiatives and could include state-of-the-art interventions directed at actions with the highest technical potential and behavioral

285. *See* SARA HAYES ET AL., CHANGE IS IN THE AIR: HOW STATES CAN HARNESS ENERGY EFFICIENCY TO STRENGTHEN THE ECONOMY AND REDUCE POLLUTION (2014), *available at* http://aceee.org/research-report/e1401 [http://perma.cc/9Q4V-LHX7].

286. MCKINSEY & CO., *supra* note 215 at 107–09. Home energy efficiency measures could reduce emissions by 2.4 billion tons per year, "twice as much total abatement opportunity as the commercial segment," and "approximately 75% of the total abatement potential . . . shows net economic benefits, with the remainder available at very low cost." *Id.* Combined energy efficiency improvements in commercial and residential buildings could reduce emissions by 1.6 billion tons per year by 2020 with net savings of $50 billion. *Id.* Because 2/3 of the emissions reduction opportunity is in residential buildings, it seems reasonable to ascribe 2/3 of the projected emissions reduction and savings to residential buildings: roughly 1.1 billion tons per year emissions reduction and $34 billion per year net savings. *Id.*

287. *Id.* at 108 (noting that "[b]ehavioral change from building occupants could reduce carbon emissions significantly beyond the abatement cost-curve model").

plasticity.[288] The new efforts also could be extended to additional actions and countries.

Taken together, these considerations suggest that the total potential annual emissions reductions during the 2016–2020 period from private governance initiatives directed at households could easily exceed 500 million tons worldwide and might even exceed a gigaton. Even the lower end of this range is roughly equivalent to a regulation that reduced fossil fuel CO_2 emissions from the U.S. industrial sector by two-thirds. The total is also the equivalent of assembling a second club of countries (comprising Australia, the U.K., Saudi Arabia, and Italy, all among the top twenty emitters in the world) that all commit to a reduction in annual fossil fuel CO_2 emissions by an amount equal to twenty-five percent of 2012 levels.[289]

C. Aggregate Effects

How significant are the reasonably achievable emissions reductions when we include both household and corporate private climate governance? When combined with the 500 million tons available from corporate initiatives, the 500 million tons of household emissions reductions yield roughly a gigaton of annual emissions reductions. This is roughly equivalent to a regulatory approach that eliminated all U.S. industrial CO_2 emissions or half of all U.S. CO_2 emissions from electricity generation. It is also equivalent to a club of eight of the twenty greatest emitters of fossil fuel CO_2 (Australia, Brazil, Canada, Indonesia, Italy, Mexico, Saudi Arabia, and the U.K.) reducing their annual emissions by twenty-five percent of 2012 levels.

All of these measures only require taking actions that can be done easily and cheaply, using readily available commercial technology. Only conceptual and behavioral inertia and access to commercial and philanthropic capital stand in the way of these measures. The cost of borrowing is extremely low around the world, so inertia appears to be the principal obstacle. Thus, we believe that effective private governance could achieve rapid implementation of these measures. They would not represent

288. *See infra* Part V.C.

289. GLOBAL CARBON BUDGET, *supra* note 219.

absolute reduction of emissions: economic growth would continue to raise global CO_2 emissions. But these measures could slow emissions growth sufficiently to achieve one quarter of the four gigatons needed to buy a decade.

V. CONCEPTUAL HURDLES

Private governance initiatives face questions not only about whether they exert significant influence on household and corporate behavior, but also whether, if they do, most of the available reductions have already been achieved. In other words, have all of the opportunities been exploited already, leaving little room for new initiatives? The answer involves time. Opportunities for private governance are not achieved instantaneously. Some types of corporate and household efficiencies are likely to be achieved over time even without private governance initiatives. Economists like to say that there are no twenty dollar bills lying on the sidewalk, and that may be true over a period of minutes or hours. But for climate change the speed with which those twenty dollar bills are picked up matters—every decade of delay increases costs by forty percent—and private governance can accelerate the process.[290]

The other major hurdle is conceptual. Experts not only downplay concerns about the policy plasticity of a carbon price, but also over-value comprehensive remedies and assume that alternatives to a carbon price, such as private governance initiatives, will have negative spillover effects. Part V examines these problems and concludes by identifying concrete steps that can be taken to implement the private climate governance strategy.

A. Panacea Bias

A carbon price is attractive to scholars and policymakers not only because it offers the prospect of low-cost emissions reductions, but also because it appears to offer a single, comprehensive response that will solve the climate problem. The attraction of having one measure that promises a

290. *See* discussion, *supra* Part II.A.

comprehensive response to a problem is so compelling that it can induce experts to treat other strategies as distractions or competitors.[291] This panacea bias—preferring comprehensive but infeasible responses over piecemeal but feasible responses—is pervasive, and until recently it discouraged thinking about complementary or alternative approaches.[292] Ostrom suggested that analysts who prefer "a single prescription" imposed by "unified authorities" mistake their simple models for messy reality, thus missing "the diverse institutional arrangements that operate in practice."[293]

On a related note, experts and advocates also often succumb to the one percent problem, dismissing small sources and the initiatives that address them, even though a large share of all GHG emissions arises from small contributors.[294] For instance, roughly a third of global emissions arise from the 100-plus countries that contribute one percent or less of the global total, and most U.S. industrial sectors can argue that they contribute far less than one percent of the world total, as well as only several percent of the U.S. total.[295] The rejection of one percent measures occurs even though the policies and programs available to address many small sources may be more politically feasible and more cost-effective than more comprehensive policies. Although excluding one percent sources will produce efficient policies in some situations, the tendency to dismiss these sources regarding climate change

291. *See, e.g.*, NORDHAUS, *supra* note 22, at 266–67 (claiming that "alternatives to carbon pricing . . . are generally more expensive[,] . . . unlikely to achieve ambitious [emissions reduction] targets[,] . . . [and can be] extremely expensive or even counterproductive"). Some economists have examined the political feasibility of a carbon price. *See, e.g.*, Joseph E. Aldy & Robert Stavins, *The Promise and Problems of Pricing Carbon: Theory and Experience*, 21 J. ENV'T & DEV. 152 (2012) (evaluating political feasibility); Guzman, *supra* note 23, at 228 (noting that "[b]y comparison, cap-and-trade is less potentially toxic" than a carbon tax).

292. *See* Elinor Ostrom, *A Diagnostic Approach for Going Beyond Panaceas*, 104 PROC. NAT'L ACAD. SCI. 15181, 15182 (2007); Gilligan & Vandenbergh, *supra* note 24, at 6.

293. OSTROM, *supra* note 4, at 21–23.

294. Kevin A. Stack & Michael P. Vandenbergh, *The One Percent Problem*, 111 COLUM. L. REV. 1385, 1401 (2011).

295. *Id.*

feeds opposition to second-best approaches by scholars and policymakers.[296]

B. Spillover Bias

A second conceptual hurdle is linked to the panacea bias: if comprehensive solutions are favored, it is easy to fall into the trap of assuming that other options will delay or block adoption of the desired response. Statements to this effect are common in media accounts[297] and popular books.[298] This view is a barrier to pursuit of private governance initiatives and other mitigation options that are perceived to compete with a carbon price.

Although the term spillover is used in many ways, it can refer to the effects of a first behavior on the likelihood or extent of a second behavior.[299] The second behavior can be one that has direct effects on carbon emissions, such as driving or use of an appliance, or it can involve policy views and support, such as support for a carbon tax or cap-and-trade legislation. A

296. For example, in the leading Supreme Court decision on climate change, Chief Justice Roberts's dissent dismissed the U.S. motor vehicle fleet's contribution to global carbon emissions because the fleet only contributes six percent of global CO_2 emissions and four percent of GHGs, and the rules in question would only reduce a "a fraction of four percent" of global GHG emissions. Massachusetts v. EPA, 549 U.S. 497, 544 (2007) (Roberts, C.J., dissenting). If the fuel economy regulation that was at stake in the case reduces motor vehicle emissions by only twenty-five percent (a conservative assessment), however, the reduction will be one percent of global emissions, which is more than the total emissions of over 100 countries. *See* World Resources Institute, CAIT Climate Data Explorer, WGI.ORG, http://www.wri.org/our-work/project/cait-climate-data-explorer [http://perma.cc/5NH2-VF4C] (last visited June 15, 2015).

297. John Tierney, *When Energy Efficiency Sullies the Environment*, N.Y. TIMES, Mar. 8, 2011, at D1 (stating that "there could even be more emissions as a result of some improvements in energy efficiency" and that "if your immediate goal is to reduce greenhouse emissions, then it seems risky to count on reaching it by improving energy efficiency. To economists worried about rebound effects, it makes more sense to look for new carbon-free sources of energy, or to impose a direct penalty for emissions, like a tax on energy generated from fossil fuels"); Gernot Wagner, *Going Green but Getting Nowhere*, N.Y. TIMES, Sept. 8, 2011, at A29 (arguing that "[t]he changes necessary are so large and profound that they are beyond the reach of individual action").

298. GERNOT WAGNER, BUT WILL THE PLANET NOTICE? HOW SMART ECONOMICS CAN SAVE THE WORLD 6–7 (2011) (concluding that "[a]ll these steps may well be counterproductive"); NORDHAUS, *supra* note 22, at 272–73 (arguing that "alternatives to carbon pricing . . . [are] extremely expensive or even counterproductive").

299. *See* Heather Barnes Truelove et al., *Positive and Negative Spillover of Pro-Environmental Behavior: An Integrative Review and Theoretical Framework*, 29 GLOBAL ENVTL. CHANGE 127, 128–32 (2014).

commonly discussed form of spillover regarding energy is called the rebound effect. Economists note that the energy savings from using a more efficient car or appliance can lead an individual to use the item more or to buy other items, reducing the efficiency benefits of the first item. Rebound is a genuine concern, and rebound effects should be accounted for in assessments of private governance initiatives. In an extreme form rebound can become backfire, in which the additional energy use exceeds the initial savings.[300] A recent analysis concluded, however, that backfire is rare, and that direct rebound effects typically erode only five to ten percent of the gains from efficiency initiatives.[301]

The spillover assumption that poses the greatest challenge to private governance initiatives and other second-best options can be thought of as policy spillover. Negative policy spillover occurs if the pursuit of one policy adversely effects the likelihood of a second policy. As with behavioral spillover, policy spillover is a genuine concern. If resources are diverted from advocacy efforts for a carbon price to other climate initiatives, this could slow the adoption of a carbon price. Negative spillover also could occur if pursuit of other initiatives induces the public or experts to believe that the problem has been solved, leading to reduced support for a carbon price. Psychologist Elke Weber has noted that farmers who take climate mitigation steps exhibit what she calls a single action bias: they become less supportive of climate mitigation policies, even though the likelihood of climate effects did not change because of their actions.[302]

To serve as a valuable gap-filler, private governance initiatives must not reduce the likelihood of a more effective

300. *See, e.g.*, Michael Schellenberger & Ted Nordhaus, *The Problem with Energy Efficiency*, NY TIMES, Oct. 9, 2014, at A35 (stating that "energy saving technologies may backfire [because] higher efficiency may in fact result in higher energy consumption"); JESSE JENKINS ET AL., BREAKTHROUGH INSTITUTE, ENERGY EMERGENCE: REBOUND AND BACKFIRE AS EMERGENT PHENOMENA (2011).

301. *See* Kenneth Gillingham et al., *The Rebound Effect Is Overplayed*, 493 NATURE 475, 476 (2013) (concluding that "rebound effects are small and are therefore no excuse for inaction"). Negative spillover can also occur at a macroeconomic level. *See id.* at 476.

302. Elke U. Weber, *Perception and Expectation of Climate Change: Precondition for Economic and Technological Adaptation*, *in* PSYCHOL. PERSP. TO ENVTL. & ETHICAL ISSUES IN MGMT 314, 341 (M.H Bazerman et al., eds. 1997).

government action and must complement, or at least not interfere with, public climate measures. Although negative spillover effects are possible, the risk of displacing major federal or international climate initiatives is low. National and international carbon pricing initiatives face the barriers discussed in Part II. Although government household efficiency might appear on the surface to be an area where federal legislation is possible, political barriers limit household opportunities at the federal level to a surprising extent. Even seemingly non-controversial, bipartisan energy efficiency legislation has bogged down in Congress, suggesting that there is limited appetite for legislation that would support these types of efforts.[303] Government behavioral approaches that might be attractive on the surface to moderates, conservatives, and libertarians have not been embraced when initiated by governments, but instead have been criticized as "mind control."[304]

As a result, although advocacy efforts that promote viable government measures are often worth pursuing, it is unclear whether negative policy spillover effects will arise from re-directing a portion of advocacy resources toward private initiatives. Funding for public and private climate initiatives also may not be a zero-sum game. Private governance initiatives may attract new funding and new participants to the climate mitigation effort, rather than competing for existing resources. Positive spillover effects also could arise from private initiatives if they create new constituencies that support climate mitigation, lower the anticipated costs of a carbon price to companies and households, or reduce the size of the carbon price needed to achieve an emissions target. In short, the consideration of spillover effects becomes a spillover bias when advocates of a carbon price focus only on negative effects and do not also weigh the likelihood and extent of positive spillover effects. Consideration of spillover effects is critical to development of a rational response to climate change, but it is important to avoid spillover bias, which can lead to an unthinking rejection of potentially viable complements or alternatives.

303. *See* Juliano, *supra* note 96.

304. *See* Vandenbergh et al., *supra* note 104, at 755.

C. Concrete Steps

The principal assertion of this Article is that a conceptual shift should occur among scholars, philanthropists, and business and NGO managers regarding the role of private climate governance over the next decade. This conceptual shift has the potential to galvanize support for existing private governance initiatives and lead to the formation of new initiatives. Although the examples discussed above demonstrate the extent of current private climate initiatives and identify new initiatives, it is fair to ask whether additional concrete steps can be taken to implement a private climate governance strategy.

One option is to form a new NGO or endowment that could implement or fund specific new initiatives such as the prediction market and legacy registry.[305] The new organization also could promote other cross-cutting initiatives, such as collecting and disclosing the total emissions reductions achieved from private climate governance efforts each year at the U.S. and global levels.[306] The tracking and disclosure of emissions reductions attributable to private governance may be necessary to demonstrate the efficacy of the strategy and reveal the level of additional effort needed.[307] Although it is tempting to suggest that formation of a new organization is the best way to promote a coherent, effective private climate governance strategy, it is not clear that the benefits of a new organization would exceed the costs of forming and staffing yet another NGO. Any of the leading NGOs, or a cooperative effort among them, could take on this role. Whether the organizational form

305. Government can act in a number of ways to enhance, or at least avoid undermining, the private climate governance strategy. Recent efforts to make government data available to the public on corporate emissions, climate science, and other topics may facilitate the development of private climate governance initiatives. *See* WHITE HOUSE, *The President's Climate Data Initiative: Empowering America's Communities to Prepare for the Effects of Climate Change*, Mar. 19, 2014, *available at* http://www.whitehouse.gov/the-press-office/2014/03/19/fact-sheet-president-s-climate-data-initiative-empowering-america-s-comm [http://perma.cc/XPT9-NKL6].

306. Note the importance of accounting for the gains from bottom-up approaches. Stewart et al., *supra* note 93, at 273–74.

307. An annual quantification of the emissions reductions attributable to private initiatives might reward participants and increase the sense of efficacy that NGOs, corporations, and individuals have when undertaking these efforts.

is a new NGO, an endowment, or a new alliance among existing NGOs and corporations, however, in the absence of some type of driving force, the opportunity may melt into the large number of other climate efforts that square more neatly with existing institutional arrangements and conventional views of governance.

Another potential concrete step would be simply to increase the resources directed toward evaluating and documenting the effects of existing private carbon emissions reduction initiatives. An effort that documents these reductions and estimates the potential for new efforts may attract new resources from those who already support climate mitigation. In addition, moderates, conservatives, and libertarians who have been hesitant to support government climate mitigation may be willing to add new resources and advocacy if the activity includes private governance and if the effort can be demonstrated to have a substantial effect on emissions.[308] For some initiatives, new resources could be invested directly in emissions reduction programs and hardware (e.g., home energy feedback devices), bypassing the transaction costs and other concerns that can arise with advocacy campaigns.

Perhaps most important, shifting the question from "what can government do?" to "what can any institution do?", and shifting the goal from solving the climate problem to buying a decade, can lead to additional fresh thinking about climate mitigation in many sectors. Despite the exhaustive list of private governance initiatives reviewed in this Article, many more exist, including commodity roundtables, additional standards and certification efforts or modifications to existing efforts to prioritize carbon reductions, programs that reduce emissions from fracking,[309] efforts that target default

308. *See* Vandenbergh & Steinemann, *supra* note 14, at 1714–16 (noting that conservatives may respond to campaigns that emphasize personal responsibility for emissions reductions).

309. *See* Amanda C. Leiter, *Fracking, Federalism and Private Governance*, 38 HARV. ENVTL. L. REV. (forthcoming 2014); David A. Dana & Hannah J. Wiseman, *A Market Approach to Regulating the Energy Revolution: Assurance Bonds, Insurance, and the Certain and Uncertain Risks of Hydraulic Fracturing*, 99 IOWA L. REV. 1523 (2014); Thomas W. Merrill & David M. Schizer, *The Shale Oil and Gas Revolution, Hydraulic Fracturing, and Water Contamination: A Regulatory Strategy*, 98 MINN. L. REV. 145 (2013).

settings,[310] additional myth-busting efforts, and re-direction of recycling campaigns to focus on those areas that have the greatest effect on carbon emissions, such as aluminum recycling. Additional institutional targets also exist, such as the large number of private organizations that emit substantial amounts of carbon but are neither households nor corporations, including universities, hospitals, religious organizations, and charitable organizations.[311] Additional institutional participants also exist, including the insurance industry, private offset markets, and others.[312]

VI. CONCLUSION

A carbon price is widely regarded as the optimal response to climate change, but a national and international carbon price is unlikely to be adopted and implemented in the next decade. Executive branch efforts that target power plants and motor vehicles will reduce emissions in the U.S. in the near term, as will efforts by state, local, and foreign governments. These efforts are important, but they will fall far short of the levels necessary to reduce the likelihood of the most damaging aspects of climate change.

This Article argues that private climate governance initiatives can bypass government gridlock and buy time for the development of the political support necessary for adoption and implementation of a carbon price. Numerous examples demonstrate that private initiatives are already reducing emissions from corporations, households and other sources. In addition, substantial new opportunities for emissions reductions have not been exploited.

The private governance approach developed in this Article starts with a conceptual shift: private initiatives can drive a large share of new emissions reductions. Although

310. *See* Cass R. Sunstein & Lucia A. Reisch, *Automatically Green: Behavioral Economics and Environmental Protection*, 38 HARV. ENVTL. L. REV. 127 (2014).

311. For example, annual university sustainability rankings could give primacy to net annual carbon emissions. Under current methodologies, a university may be able to score well even if its annual carbon emissions increase.

312. *See, e.g.*, Michael P. Vandenbergh et al., *Micro-Offsets and Macro-Transformation: An Inconvenient View of Climate Change Justice*, 33 HARV. ENVTL. L. REV. 303, 310–48 (2009) (proposing carbon micro-offset markets).

governments are in gridlock, private governance initiatives can address public perceptions of climate science and motivations to reduce emissions, and can stimulate prompt, low-cost emissions reductions from corporations and households. In fact, reductions in the range of a gigaton per year, roughly a quarter of what is needed to buy a decade, are possible. The private climate governance strategy developed in this Article is not a substitute for a national and international carbon price, but it can generate significant emissions reductions until more complete responses become possible.