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ARTICLES

THE ONE PERCENT PROBLEM

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Parties frequently seek exemption from regulation on the ground that they contribute only a very small share to a problem. These “one percent arguments” are not inherently questionable; it can be efficient to exclude relatively small contributors. These arguments also garner broad acceptance in part because they exploit cognitive biases that induce individuals to discount or ignore small values. But, when a regulatory problem can be solved only by regulating small contributors, accepting one percent arguments creates what we call the one percent problem. This Article shows that this general problem for regulation has particularly damaging effects on climate change policy: The global character of the climate change problem allows many sources of carbon emissions to make one percent arguments, but the climate problem cannot be solved without attending to these sources. This Article then isolates a gap in U.S. climate policy that is a critical barrier to addressing the one percent problem for climate change. Specifically, Congress currently legislates and appropriates without calculating the emissions consequences of its actions or adhering to an emissions budget. Both are necessary. Congress has long responded to one percent problems in managing the federal deficit by requiring cost disclosures and budget offsetting. Requiring Congress to disclose the carbon emissions arising from legislation will treat carbon costs on par with financial costs, and bring Congress’s emissions disclosure duties in line with those that already apply to federal agencies and many industrial sources. Adopting a budgeting precommitment strategy of last resort—a carbon pay-as-you-go rule—will directly confront the analytic slippage exploited by one percent arguments.

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INTRODUCTION

Parties commonly justify exemption from regulation by claiming to be only one percent of a problem. Companies make this argument when seeking to avoid liability for disposal site cleanup costs.¹ Consumer advocates make it when seeking to deflect requirements to improve household energy efficiency.² Industrial sectors make it when seeking to avoid sec-

1. See, e.g., *United States v. Kramer*, 757 F. Supp. 397, 423 (D.N.J. 1991) (striking “de minimis” defense to Superfund claim).

2. See, e.g., *Consumer Protection Provisions in Climate Legislation: Hearing Before Subcomm. on Energy & Env’t of the H. Comm. on Energy and Commerce*, 111th Cong. 87

tor-wide economic, worker safety, health, and environmental regulations.³ Federal agencies make this argument to avoid detailed analysis of the potential for environmental disasters, such as the recent BP Gulf of Mexico well blowout.⁴ Nations make it when seeking to avoid international fishing restrictions⁵ and carbon emissions targets.⁶ We call the claim that a relatively small contributor should be exempt from regulation a “one percent argument.”⁷

One percent arguments are not inherently questionable. Where relatively large sources contribute to a problem, efficiency considerations often justify excluding small contributors from regulatory requirements. At a basic economic level, if the marginal cost of regulatory compliance by relatively small, one percent contributors exceeds the marginal benefits, exempting one percent contributors may be advisable.⁸ Not surprisingly, many statutes and regulations include exemptions for small actions or entities;⁹ the common law *de minimis* doctrine also provides a rule of reason that prevents liability based on trifles.¹⁰

(Mar. 12, 2009), available at <http://www.umc-gbcs.org/> (on file with the *Columbia Law Review*) (statement of John S. Hill, Director for Environmental Justice, United Methodist Church) (“Those least responsible . . . are most vulnerable to its effects. Let us not perpetuate further this injustice by forcing those same individuals to shoulder additional and disproportionate costs of proposed solutions.”).

3. See, e.g., Letter from James C. May, President and CEO, Air Transp. Ass’n of Am., to Todd Stern, Special Envoy for Climate Change, U.S. Dep’t of State (Oct. 29, 2009), available at http://airlines.org/PublicPolicy/ATALetters/Pages/letters_10-29-09.aspx (on file with the *Columbia Law Review*) (noting “U.S. airlines account for less than 2 percent of the U.S. GHG inventory”).

4. See, e.g., 1 Minerals Mgmt. Serv., U.S. Dep’t of the Interior, Gulf of Mexico OCS Oil and Gas Lease Sales: 2007–2012, at xiii (2006), available at <http://www.gomr.boemre.gov/PDFs/2006/2006-062-Vol1.pdf> (on file with the *Columbia Law Review*) (“The effect of proposed-action-related oil spills . . . is expected to cause less than a 1 percent decrease in . . . standing stocks of any population, commercial fishing efforts, landings, or value of those landings.”).

5. See, e.g., Final Rule on International Fisheries Regulations, 74 Fed. Reg. 65,460, 65,463 (Dec. 10, 2009) (to be codified at 50 C.F.R. pts. 300, 665) (“Multilateral action is essential to ensure that overfishing of bigeye tuna in the Pacific Ocean ends, although U.S. fisheries comprise a very small portion of Pacific-wide bigeye tuna harvests (less than 3 percent in 2004).”).

6. See, e.g., *Massachusetts v. EPA*, 549 U.S. 497, 544 (2007) (Roberts, C.J., dissenting) (concluding “petitioners’ desired emission standards might reduce only a fraction of 4 percent of global emissions”).

7. We use the term *one percent* as a shorthand for relatively small shares including those slightly above and far below one percent. See *infra* Part I.A.

8. See *infra* Part I.A (describing exemptions from regulatory compliance for those whose contributions to regulated issue appear to be relatively insignificant).

9. See *infra* text accompanying notes 30–46 (noting specific exemptions).

10. The maxim *de minimis non curat lex*, “[t]he law does not concern itself with trifles,” Black’s Law Dictionary 496 (9th ed. 2009), applies at common law to deny liability for very small injuries. See, e.g., *F.A.D. Andrea, Inc. v. Dodge*, 15 F.2d 1003, 1005 (3d Cir. 1926) (“It is the growing policy of the law not to take notice of trifling matters. ‘De minimis non curat lex’ is a maxim which has greater force to-day than ever.”); *Fullam v. Stearns*, 30 Vt. 443, 455 (1857) (“The maxim ‘*de minimis non curat lex*,’ I apprehend, whenever it is

The one percent problem results, however, when the acceptance of one percent arguments impedes or increases the cost of achieving socially desirable outcomes. Our concern is with the strong form of the one percent problem: when the one percent argument is made in circumstances where small contributors account for so much of a regulatory problem that the social goal cannot be met without regulating many one percent sources.¹¹ It is one thing to exempt relatively small contributors when large contributors account for the vast majority of the problem; it is quite another when the social goal cannot be achieved without regulating small contributors. One percent arguments can be particularly difficult to solve in part because of their intuitive appeal. As research on the behavioral effects of information framing suggests, in some situations individuals have a tendency to treat very small percentages and probabilities as if they were zero.¹² When all or many of the contributors are relatively small ones, however, the aggregation of one percent arguments leaves the problem without a solution.

The one percent problem is a general one affecting many areas of regulation, but it has particularly acute effects with regard to the largest-scale environmental problem of our day: the potential for catastrophic climate change. The structure of the climate challenge invites one percent arguments and makes its one percent problem particularly pernicious. One percent arguments necessarily depend upon framing a denominator or relative group for comparison; the broader the problem's framing—the air quality in a city, a region, or the global atmosphere—the more sources or contributors become candidates for one percent arguments. With regard to climate change, it is natural to frame the problem in global terms; it is a global problem. But once it is framed that way, the size of the denominator—all activities that produce greenhouse gases (GHGs), viewed globally—is staggering, and this framing makes almost any source of emissions, including entire industrial sectors within a given country, or even entire countries, candidates for one percent arguments.

Framing the climate problem at a global level makes it difficult to see the importance of including any particular emissions source in the regu-

applied correctly to take away a right of recovery, has reference to the injury, and not to the resulting damage.”). The Supreme Court has embraced *de minimis* as a default rule of construction, applicable to statutory claims absent a clear statement to the contrary: “[T]he venerable maxim *de minimis non curat lex* . . . is part of the established background of legal principles against which all enactments are adopted, and which all enactments (absent contrary indication) are deemed to accept.” *Wis. Dep’t of Revenue v. William Wrigley, Jr., Co.*, 505 U.S. 214, 231 (1992). We discuss how *de minimis* risk thresholds differ from the one percent problem below. See *infra* note 47.

11. We describe the weaker form of the one percent problem in Part I.A, and distinguish it from the stronger form, which is our central concern.

12. See *infra* Part I.B (discussing behavioral anomalies regarding perception of small numbers and probabilities).

latory program. With regard to a source of carbon emissions¹³ such as the U.S. lead industry, which amounts to roughly .00001 of global emissions,¹⁴ or .0001 of national emissions,¹⁵ urgency (and willingness to act to reduce emissions) is lost by orders of magnitude. In the most extreme example, if an individual reduces emissions by one ton of carbon dioxide, the reduction will only account for a .0000000000015 (eleven zeros) °C reduction in temperature.¹⁶ Yet the risk of catastrophic climate change may be impossible to reduce unless billions of these individuals change their behavior.¹⁷

The ability to treat almost any carbon source as a one percent source facilitates a one percent problem because the climate challenge cannot be solved without requiring reductions from sources that can frame their contributions in one percent terms. To avoid possible climate tipping points, after which catastrophic climate change may occur and human efforts to mitigate climate change will be futile,¹⁸ climate scientists and

13. We use the term “carbon” not to refer to the specific element carbon but to refer generally to all six of the greenhouse gases subject to targets in the Kyoto Protocol (carbon dioxide (CO₂); methane (CH₄); nitrous oxide (N₂O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulphur hexafluoride (SF₆)). These six greenhouse gases are often expressed in carbon dioxide equivalents (CO₂-e). Piers Forster et al., Intergovernmental Panel on Climate Change, Changes in Atmospheric Constituents and in Radiative Forcing, in *Climate Change 2007: The Physical Science Basis* 131, 137–43 (Susan Solomon et al. eds., 2007), available at http://www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html (on file with the *Columbia Law Review*).

14. See Env't. Prot. Agency, EPA 430-R-10-006, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2008, at ES-5 tbls.ES-2 & ES-7 (2010) [hereinafter EPA, Inventory], available at http://epa.gov/climatechange/emissions/usgginv_archive.html (on file with the *Columbia Law Review*) (noting U.S. lead industry emissions for 2008 were 0.3 Tg CO₂-e, which is .0000098759, or approximately .00001, of total global emissions at 30,337 Tg CO₂-e).

15. See id. at ES-3, ES-5 tbl.ES-2 (noting U.S. lead industry emissions for 2008 were 0.3 Tg CO₂-e, which is .00014, or approximately .0001, of total U.S. emissions at 6,956.8 Tg CO₂-e).

16. See H. Damon Matthews et al., The Proportionality of Global Warming to Cumulative Carbon Emissions, 459 *Nature* 829, 829–30 (2009) (analyzing relationship between carbon emissions and global warming). For a discussion of the implications of the Matthews et al. study, see Carbon Emissions Linked to Global Warming in Simple Linear Relationship, *ScienceDaily* (June 11, 2009), <http://www.sciencedaily.com/releases/2009/06/090610154453.htm> (on file with the *Columbia Law Review*) (“These findings mean that we can now say: if you emit that tonne of carbon dioxide, it will lead to 0.0000000000015 degrees of global temperature change.”).

17. See, e.g., Thomas Dietz, Gerald T. Gardner, Jonathan Gilligan, Paul C. Stern & Michael P. Vandenbergh, Household Actions Can Provide a Behavioral Wedge to Rapidly Reduce U.S. Carbon Emissions, 106 *Proc. Nat'l Acad. Sci. U.S.* 18,452, 18,452–53 (2009) (demonstrating how behavioral wedge of carbon emissions reductions can be achieved by U.S. households); Michael P. Vandenbergh & Anne C. Steinemann, The Carbon-Neutral Individual, 82 *N.Y.U. L. Rev.* 1673, 1709–28 (2007) [hereinafter Vandenbergh & Steinemann, Carbon-Neutral] (proposing norms-based strategies for household emissions reductions).

18. We discuss the possibility of avoiding climate tipping points, but we recognize that it may not be possible to avoid crossing one or more tipping points at this late date. See

policymakers have advocated emissions reductions that begin in the near term and reduce global carbon emissions by 50 to 80% from 1990 levels by 2050, with steep additional reductions thereafter.¹⁹ Yet, at the international and domestic levels emissions, sources that can make the one percent argument produce 20 to 40% of all emissions, making the emissions reduction targets very expensive if not impossible to achieve without including the one percent sources.²⁰

This Article provides the first conceptualization of the one percent problem and its impact on climate change law and policy, and defends a regulatory regime to respond to it in the domestic sphere. A central thrust of the Article is diagnostic: We identify a general regulatory obstacle, and we illustrate why it is a particularly significant and cross-cutting difficulty for climate change policy. Climate change policy is a classic example of the challenge posed by one percent problems: The economic intuitions invoked by one percent arguments, the behavioral tendency to treat very small shares as zero, and the susceptibility of sources to be framed in one percent terms, are a recipe for inaction. Part I provides a general account of the one percent problem, and Part II illustrates why the climate change problem cannot be solved without regulating one percent sources. Beyond diagnosis, the Article defends a response tailored to address the analytic slippage exploited by one percent arguments and a gaping hole in current climate change policy. The one percent problem for climate emerges from treating each case individually, irrespective of the cumulative effects on the whole. To address climate change, however, the nation must begin to reduce its cumulative emissions in the relatively near term. Yet the body most responsible for setting that course—Congress—legislates and appropriates without any requirement to estimate the carbon emissions consequences of its actions, much less adhere to an emissions budget. Both are necessary.

As we argue in Part III, the absence of a legislative disclosure requirement is striking. Federal agencies and a vast swath of the private sector calculate the carbon emissions of their actions. Not so with Congress. Without a carbon emissions disclosure rule, the emissions consequences of federal legislation are not well understood and currently not even subject to debate when Congress considers new laws and appropriations. This creates a risk not only of a lack of information, but also of misinformation: Specific provisions in legislation that will reduce carbon emissions may be emphasized while the vastly more important carbon effects of other aspects of the legislation go unnoticed, leaving a false impression about the net effects of the legislation. As we show, the 2009 American

generally Jody Freeman & Andrew Guzman, *Climate Change and U.S. Interests*, 109 *Colum. L. Rev.* 1531 (2009) (discussing modeling of catastrophic climate change).

19. See *infra* Part II.A.1.

20. See *infra* Part II.B.

Reinvestment and Recovery Act,²¹ known as the stimulus bill, is a case in point.²² Moreover, Congress has imposed comparable analysis requirements on its legislative activity in other areas. Our carbon disclosure proposal draws on the extensive congressional experience with calculating and disclosing the fiscal cost of legislation (and the costs imposed on nonfederal entities), as required under budgeting legislation and rules.²³ A similar requirement to estimate the carbon emissions of bills and legislation is not only feasible, but also would facilitate the type of cumulative priority setting that financial cost estimates foster.

Once a legislative carbon disclosure regime is in place, the next, more ambitious, and necessary step is to subject federal legislation and appropriations to emissions budgeting. In Part IV, we defend a precommitment strategy of last resort for fiscal budgeting: a Pay-As-You-Go (PAYGO) rule similar to the PAYGO rules that have applied in recent years to federal legislation and spending.²⁴ Under this regime, the net effects of legislation approved in any congressional term must fall within an established emissions budget, just as the net effect of federal spending must fall within particular deficit reduction goals under budgetary versions of PAYGO. The strong parallels between the political dynamics of federal budgeting and those of the carbon problem recommend this turn to the strong medicine of a PAYGO rule. The political costs of both deficit and emissions reductions are near-term, specific to identifiable interest groups, and easy to quantify, but the benefits of both are long-term, diffuse, and difficult to quantify. Both are particularly vulnerable to one percent arguments, since both federal expenditures and global emissions provide a huge denominator, enabling advocates to argue that the adverse impacts of their legislative measure will be insignificant.

The PAYGO strategy acknowledges that our ordinary political process may not be up to the task of addressing the climate change problem or finding the most efficient ways to achieve emissions reductions.²⁵ In

21. Pub. L. No. 111-5, 123 Stat. 115 (2009) (to be codified in scattered titles of U.S.C.).

22. See *infra* text accompanying notes 161–167 (noting net effects of stimulus bill on carbon emissions).

23. See, e.g., 2 U.S.C. § 653(1) (2006) (requiring Congressional Budget Office (CBO)'s estimate of bills' cost to be included in committee reports when practicable); *Id.* § 658b(c) (requiring CBO estimates of cost of unfunded federal mandates to be included, when practicable, in committee reports). See generally *infra* Part III.B.1 (providing account of budgeting disclosure rules for legislatives process). For a discussion characterizing congressional budget rules as “[t]he most influential and ubiquitous procedural framework” for information disclosure in Congress, see Elizabeth Garrett & Adrian Vermeule, *Institutional Design of a Thayerian Congress*, 50 *Duke L.J.* 1277, 1307 (2001).

24. The current PAYGO legislation is the Statutory Pay-As-You-Go Act of 2010, Pub. L. No. 111-139, 124 Stat. 8 (to be codified in scattered sections of 2 U.S.C.) which we discuss below. See generally *infra* Part IV.C.1 (providing account of pay-as-you-go budgeting).

25. For a discussion of the effects of offset requirements on fiscal issues, see Elizabeth Garrett, *Harnessing Politics: The Dynamics of Offset Requirements in the Tax Legislative*

light of this impasse, a pragmatic approach is to embrace a second-best strategy that has proved useful with fiscal budgeting: requiring that to the extent a new statute or appropriation increases carbon emissions, equal or greater emissions reductions be found elsewhere from within the wingspan of Congress. This strategy produces neither the most efficient emissions reductions (as a carbon tax or cap and trade could) nor all the emissions reduction necessary, but it launches emissions budgeting at the federal legislative level in a way that begins to address the one percent problem. With PAYGO, it does not matter whether a source affected by legislation is one percent or less; what matters (for legislation as well as for the atmospheric concentrations) is the net change in emissions arising from the legislation.²⁶

We are not naïve about the need for a greater sense of public urgency and priority regarding climate change before the more costly aspects of our proposals could be adopted. But recent regulatory failures on the global and federal levels suggest that more conventional proposals, such as carbon taxes and cap and trade programs, also are not feasible in the current political climate. It is also important to note at the outset that we do not attempt to defend here the climate science that calls for near-term reductions in GHG emissions. A wide variety of scientific sources have recommended 50% global emissions reductions by 2050, including 80% emissions reductions from the United States and other developed countries by 2050, and further steep reductions from 2050 to 2100, to reduce the likelihood of catastrophic climate effects.²⁷ Others have carefully examined and explained those conclusions, which have been relatively stable for almost a decade.²⁸ In this Article, we take these results as a given. Assuming there is a need to begin dramatic reductions in our carbon emissions, we take our task to be designing inno-

Process, 65 U. Chi. L. Rev. 501, 515–43 (1998) [hereinafter Garrett, Harnessing]. For examples of other legislative and executive precommitment climate strategies, see Richard J. Lazarus, *Super Wicked Problems and Climate Change: Restraining the Present to Liberate the Future*, 94 Cornell L. Rev. 1153, 1205–31 (2009); see also J.B. Ruhl & James Salzman, *Climate Change, Dead Zones, and Massive Problems in the Administrative State: A Guide for Whittling Away*, 98 Calif. L. Rev. 59, 94–98 (2010) [hereinafter Ruhl & Salzman, *Climate Change*] (identifying administrative strategies for addressing climate change); David A. Super, *From the Greenhouse to the Poorhouse: Carbon-Emissions Control and the Rules of Legislative Joinder*, 158 U. Pa. L. Rev. 1093, 1121–43, 1157–96 (2010) (proposing legislative tools for regulating carbon emissions).

26. Cf. Vandenbergh & Steinemann, *Carbon-Neutral*, *supra* note 17, at 1717–22 (noting individuals may be unable to determine effects of their efforts to reduce carbon emissions on overall climate problem but can be confident they are not contributing to problem if they have no net emissions).

27. For a review of emissions targets, see Michael P. Vandenbergh, Brooke A. Ackerly & Fred E. Forster, *Micro-Offsets and Macro-Transformation: An Inconvenient View of Climate Change Justice*, 33 Harv. Envtl. L. Rev. 303, 315–17 (2009) [hereinafter Vandenbergh et al., *Micro-Offsets*].

28. *Id.*; see also Jonathan B. Wiener, *Think Globally, Act Globally: The Limits of Local Climate Policies*, 155 U. Pa. L. Rev. 1961, 1977 (2007) (discussing global targets and difficulty of achieving international agreement).

vative strategies that may increase the sense of urgency and priority regarding carbon emissions in the near term and that lay the foundation for other, more demanding policies.

I. THE ONE PERCENT PROBLEM

We first provide a general account of the one percent problem, and then in the next Part explain its particular impact on climate change policy. The one percent problem can arise in almost any regulatory area. Simply stated, the one percent problem arises when the relatively small size of low-percentage contributors is taken as a reason for exempting those contributors from regulation despite the fact that the regulatory problem cannot be solved without regulating those sources. At an abstract level, the one percent problem is a special case of collective free riding. If too many parties free ride, public goods are imperiled. So too with the one percent problem: If too many parties are exempted based on their relatively small size, then the goods the regulations seek to protect will not be created or protected.

What distinguishes the one percent problem from other forms of free riding is the interaction between particular economic efficiency arguments, cognitive biases, and the structure of certain social problems. At its core, the one percent problem is generated by accepting efficiency arguments under conditions where they are not justified. The way individuals perceive information, and in particular very low numbers, compounds this effect. Section A addresses the economic grounding of the one percent problem, and section B addresses its basis in how individuals perceive very small numbers.

A. *The Economics of Small Percentages*

To understand the one percent problem, it makes sense to begin with one percent arguments. These are arguments for avoiding regulation based on one's relatively small contribution to a problem, whether that contribution is above or below one percent. We use "one percent" as a shorthand for very small-share contributors, whether they are actually one percent, a bit more, or less.

One percent arguments for exemption are frequently justified in basic economic terms. For decision makers, whether private businesses or government regulators, it is often more efficient to focus on the most significant contributors to a problem. If transportation amounts to 35% of a business's costs, or a single source contributes 40% of the pollutants in a river, it often makes sense for the business manager seeking to reduce costs or the environmental regulator seeking to improve water quality to focus on those high-percentage contributors. The reason is that it is only cost-effective to focus on the factors where the cost of doing so is less than the benefit. Where the costs of addressing any particular one percent source (or source category) exceed the benefits of doing so, it often does not make sense to regulate that source. Given economies of scale, it

is often the case that with small-percentage contributors the costs of regulation exceed the benefits.²⁹ As a result, a focus on high-percentage factors often concentrates effort and resources on the sources that may make the most difference at the least expense.

This logic of high percentages has a corollary principle: So long as there are high-percentage contributors, it does not make sense to concern oneself with regulation of (relatively) small or (relatively) insignificant matters. Of course, to know whether a source is relatively small requires a definition of the boundaries of the problem and a comparison. But once that boundary definition is set, so long as there are significant contributors, efficiency frequently directs attention away from small-percentage contributors; for them, the costs of regulating the source are presumed to exceed the benefits.

The law exempts small contributors and entities from regulation in a wide range of areas. Although each exemption reflects considerations specific to its particular area, these exemptions are grounded in part on the assumption that extending regulation or liability to entities or actions below a particular size threshold is not justified. Consider the following examples:

Securities. — Section 3(b) of the Securities Act of 1933 provides the Securities and Exchange Commission (SEC) the power to exempt transactions from the Act's disclosure requirements "by reason of the small amount involved or the limited character of the public offering."³⁰ Under this authority, the SEC exempts securities offerings of less than \$1 million

29. This is distinct from the problem of spending disproportionate amounts on remedying the last 10% of a problem when the marginal costs escalate and benefits are close to zero. See Stephen Breyer, *Breaking the Vicious Circle: Toward Effective Risk Regulation* 12 (1993) (noting problem of spending 90% of program costs to eliminate last 10% of risk). A 2007 White Paper by the House of Representatives Commerce Committee Staff concerning cap and trade legislation discusses at length the administrative burden rationale for excluding large numbers of small source emitters, each of which would likely contribute one percent or less to the overall climate change problem. The White Paper expresses support for regulating greenhouse gas emissions, but argues that regulatory benefits must be balanced with "the need to have a workable program" and further argues there are "practical limits to the number and type of entities that can be directly regulated." Staff of H. Comm. on Energy & Commerce, Subcomm. on Energy & Air Quality, *Climate Change Legislation Design White Paper: Scope of a Cap-and-Trade Program 2* (2007) [hereinafter *Scope of a Cap-and-Trade Program*], available at [http://www.fws.gov/filedownloads/ftp_nctccsp/Climate%20Change%20Jumpdrive/References%20and%20Resources/Policy/White_Paper.100307\(2\).pdf](http://www.fws.gov/filedownloads/ftp_nctccsp/Climate%20Change%20Jumpdrive/References%20and%20Resources/Policy/White_Paper.100307(2).pdf) (on file with the *Columbia Law Review*) (providing analysis of policy options for carbon mitigation). Thus, for example, the White Paper recommends not regulating the agriculture sector "because of . . . the large number of sources each with low emissions." *Id.* at 22. For the electricity generation sector, which the White Paper found accounted for one third of all U.S. greenhouse gas emissions, *id.* at 11, the White Paper recommends—also on administrative burden grounds—that private parties should be regulated only if they meet a threshold of 10,000 tons of CO₂. *Id.* at 21.

30. 15 U.S.C. § 77c(b) (2006).

by non-reporting issuers³¹ from the mandatory disclosure obligations, including registration, associated with public offerings.³²

The SEC adopted these exemptions to eliminate the “disproportionately burdensome” expense of registration for “small[] issuers that are not subject to the public disclosure requirements.”³³ Because the initial registration for securities involves fixed costs to the issuer, “for relatively small offerings, the cost of registration is proportionately too great compared to the benefit.”³⁴ Section 504 recognizes that in contrast to other issuers, the benefit of compliance does not exceed the cost for these small issuers.³⁵

Superfund. — The Comprehensive Environmental Response, Compensation and Liability Act of 1980 (often referred to as the Superfund statute) creates a liability scheme to deter releases of hazardous substances and to fund site cleanups.³⁶ Although in theory the release of one molecule of a hazardous substance could trigger strict, joint and several liability for Superfund site response costs,³⁷ for many minor contributors (in terms of the volume or toxicity of the materials disposed of at the site) the costs of negotiating a settlement can be many times the expected liability.³⁸

In 1986, Congress amended the statute to encourage the Environmental Protection Agency (EPA) to settle the liability of “de minimis” parties.³⁹ Congress did not set an explicit percentage for eligibility for a de minimis settlement, but the EPA in enforcement guidance noted that the median settling party contributed 1% or less of the materials containing hazardous substances to a Superfund site.⁴⁰ In addition,

31. 17 C.F.R. § 230.504(b)(2) (2011).

32. 15 U.S.C. § 77e.

33. Securities Act Release No. 6339, [1981–1982 Transfer Binder] Fed. Sec. L. Rep. (CCH) ¶ 83,014, at 84,457 (Aug. 7, 1981).

34. C. Steven Bradford, *Transaction Exemptions in the Securities Act of 1933: An Economic Analysis*, 45 Emory L.J. 591, 602–14 (1996).

35. See Mark A. Sargent, *The New Regulation D: Deregulation, Federalism and the Dynamics of Regulatory Reform*, 68 Wash. U. L.Q. 225, 279–81 (1990) (describing Rule 504 as intended to reduce small entities’ compliance costs). The exemption from federal regulation does not, however, mean that these issuances are free of all regulatory burdens; they still must comply with state securities laws.

36. 42 U.S.C. §§ 9601–9675 (2006).

37. See, e.g., *B.F. Goodrich Co. v. Murtha*, 754 F. Supp. 960, 968–72 (D. Conn. 1991) (discussing liability for municipal garbage).

38. See, e.g., Carol Dinkins, *Settlement Issues in Federal Enforcement Actions 4* (June 2005) (unpublished manuscript), available at [http://www.velaw.com/uploadedFiles/VE site/Overview/Dinkins_Settlement_Issues.pdf](http://www.velaw.com/uploadedFiles/VE%20site/Overview/Dinkins_Settlement_Issues.pdf) (on file with the *Columbia Law Review*) (discussing possibility of “negotiation transaction costs . . . exceed[ing] . . . actual liability”).

39. See 42 U.S.C. § 9622(g) (authorizing de minimis settlements); see also Superfund Program; Revised Model De Minimis Contributor Consent Decree and Administrative Order on Consent, 60 Fed. Reg. 62,849, 62,853 (Dec. 7, 1995) (suggesting model consent decree with contribution protection clause).

40. See Bruce Diamond, Dir., Office of Waste Programs Enforcement & William White, Enforcement Counsel for Superfund Office, Office of Enforcement, OSWER

more recent amendments to the statute have provided liability relief for parties who have made even smaller contributions. Section 107(o) provides an exemption from liability for “de micromis” parties, defined as those who can demonstrate that “the total amount of the material containing hazardous substances . . . was less than 110 gallons of liquid materials or 200 pounds of solid materials” and can meet other criteria.⁴¹ These exclusions reflect an assumption that larger contributors are available to bear the lion’s share of the site clean-up costs.

Lobbying. — The Lobbying and Disclosure Act of 1995 aims to provide effective “public disclosure of the identity and extent of the efforts of paid lobbyists to influence Federal officials in the conduct of Government actions” in hopes it “will increase public confidence in the integrity of Government.”⁴² Among other things, the Act requires lobbyists to register with the Clerk of the House of Representatives and the Secretary of the Senate,⁴³ but it does not require registration for relatively low-value lobbying efforts.⁴⁴ In particular, the Act exempts from registration and other filing requirements a person or entity whose “total income for matters related to lobbying activities on behalf of a particular client (in the case of a lobbying firm) does not exceed and is not expected to exceed \$5,000” or whose total expenses for lobbying activities do not exceed \$20,000.⁴⁵

These exemptions, and others like them,⁴⁶ reflect pragmatic, economic accommodations. The threshold requirement for regulation—whether in securities, environmental regulation, or lobbying—stands as a very rough proxy for the point at which the costs of compliance are likely to exceed the benefits. What drives these exemptions is the relative cost of compliance and the relatively small scope of the activities subject to the exemptions. But this cost-benefit calculation should shift depending on the proportion of activities that fall within the exemptions. While we might quibble with the precise line at which these exemptions should be triggered, the cost of these exemptions should be offset by the benefits of compliance by other, larger contributors. The important point for our

Directive 9834.7-1D, Streamlined Approach for Settlements with De Minimis Waste Contributors Under CERCLA Section 122(g)(1)(A), at 2 & n.5, 3 (July 30, 1993), available at <http://www.epa.gov/compliance/resources/policies/cleanup/superfund/app-deminimis-rpt.pdf> (on file with the *Columbia Law Review*) (noting EPA required no “set percentage” for de minimis settlements, but that median amount of waste contributed was one percent).

41. 42 U.S.C. § 9607(o) (creating “de micromis exception” to CERCLA liability).

42. 2 U.S.C. § 1601 (2006).

43. *Id.* § 1603(a)(1).

44. *Id.* § 1603(a)(3)(A).

45. *Id.*

46. 6 C.F.R. § 27.204(a)(1) (2011) (excluding toxic release of chemical in concentration of less than 1% of mixture by weight from quantification requirements applicable in facility-based screening); 29 C.F.R. § 1926.1101(k)(8)(vi)(B) (2011) (exempting labeling of products containing asbestos if they contain less than 1% concentrations).

purposes is that the point at which the exemptions are made (or even if they are made at all) should depend upon the value of compliance by those who remain non-exempt. One percent arguments can provide an economic basis for exclusion, but the validity of that basis depends critically on the surrounding landscape, and in particular on the relative contributions of other potentially regulated parties.

The one percent problem results from embracing one percent arguments outside of the conditions that justify accepting them. In the weak form of the problem, a regulatory objective (say, cleaning up a Superfund site) is achieved, but the exclusion of one percent sources increases the net costs of the regulatory action or imposes an unfair distribution of costs on larger contributors. Even though the marginal benefits of regulating one percent sources may exceed the marginal costs, one percent sources may still not be regulated if the notion that a one percent party is inherently insignificant influences public opinion, political debates, and the policymaking process. This weak form of the problem is potentially widespread and important, but we have bigger fish to fry.

In the strong form of the one percent problem, which is our focus, the exclusion of one percent sources leaves the regulatory problem unsolved. The dynamic is straightforward. Although it may be cost-justified to exclude small contributors from regulation when there are other larger contributors, that calculus should shift if small contributors make up a substantial share of the total contribution. Accepting one percent arguments for exemption in those circumstances can sacrifice the net benefits of the regulation.⁴⁷ Though relatively straightforward to define, one percent problems are difficult to solve. Part of the difficulty is that one percent arguments invoke seemingly incontestable heuristic principles. No one stands for treating trifles as anything but. The key is to see that defining something as a trifle depends on an assessment of the surrounding landscape. The one percent problem results from taking conclusions about the value of compliance for small contributors under conditions in which there are a significant number of larger contributors to a setting in which there are not. Small potatoes might be discarded (or

47. It is important to distinguish one percent problems and the concept of *de minimis* risk used in regulation. *De minimis* risk is a threshold “below which we would be indifferent to changes in the level of risk,” and as a consequence the risk is excluded from inquiry and regulation. Joseph Fiksel, *De Minimis Risk: From Concept to Practice*, in *De Minimis Risk* 3, 4 (Chris Whipple ed., 1987); see also Joshua Menkes & R. Scott Frey, *De Minimis Risk as a Regulatory Tool*, in *De Minimis Risk*, supra, at 9, 9. There is no necessary connection between a one percent problem and a *de minimis* risk threshold. A *de minimis* risk threshold pertains to levels of harm. In contrast, the one percent problem describes a particular type of regulatory failure resulting from the exclusion of many small contributors. Important instances of one percent problems, like climate change policy, concern risks that are not *de minimis*. The closest point of connection between *de minimis* risks and the one percent problem is that the one percent problem results from acceptance of many individual contributors’ claims that their contributions are so small as to not merit regulation, or “*de minimis*,” when in the aggregate those contributions pose nontrivial risks.

discardable), but the calculation for doing so changes if there are only small potatoes.

B. *Perception of Small Percentages*

While economic grounds define the one percent problem, the difficulty of confronting the problem is compounded by the way in which individuals perceive very small numbers and low probabilities. Cognitive psychologists have long understood that “[t]he way in which information is . . . framed . . . influences how it is perceived and used.”⁴⁸ This section describes several psychological studies that show that individuals have difficulty making sense of low values and, in particular, low-value probabilities. It then explains how these effects fuel the appeal of one percent arguments.

1. *Insensitivity to Low Probabilities.* — A significant body of research demonstrates that people have difficulty making sense of low-probability risks and are insensitive to changes even in the orders of magnitude in low probabilities.⁴⁹ In a leading study, Howard Kunreuther, Nathan Novemsky, and Daniel Kahneman demonstrated that individuals are unresponsive to changes in probability magnitudes of 1 in 100,000, 1 in 1 million, and 1 in 10 million,⁵⁰ and also insensitive to the differences between risks of 1 in 650, 1 in 6,300, and 1 in 68,000.⁵¹

Kunreuther and his co-authors reached these conclusions through use of a sequence of contingent valuation experiments. They presented individuals with a scenario in which an accident at a chemical plant would pose risks to nearby residents of 1 death per 100,000, 1 million, or 10 million, and examined the subjects’ willingness to pay insurance premiums at each of these risk levels. As a point of comparison, the subjects were informed that the probability of an individual dying in a car accident is 1 in 6,000.⁵² The subjects showed virtually no greater willingness

48. Eric R. Stone, J. Frank Yates & Andrew M. Parker, Risk Communication: Absolute Versus Relative Expressions of Low-Probability Risks, 60 *Organizational Behav. & Hum. Decision Processes* 387, 387 (1994).

49. See Cass R. Sunstein, Probability Neglect: Emotions, Worst Cases, and Law, 112 *Yale L.J.* 61, 70 (2002) [hereinafter Sunstein, Probability Neglect] (noting many studies show insensitivities to variations in low probabilities); Cass R. Sunstein, Terrorism and Probability Neglect, 26 *J. Risk & Uncertainty* 121, 123 (2003) [hereinafter Sunstein, Terrorism] (“It is . . . well known that people are insensitive to variations in *low* probabilities.”).

50. Howard Kunreuther, Nathan Novemsky & Daniel Kahneman, Making Low Probabilities Useful, 23 *J. Risk & Uncertainty* 103, 107–08 (2001) [hereinafter Kunreuther et al., Low Probabilities]. De minimis risk thresholds themselves raise a host of theoretical and practical problems. See Matthew D. Adler, Why De Minimis? 30–31 (Inst. for Law & Econ., Univ. Pa. Law Sch., Research Paper No. 07-12, 2007), available at <http://ssrn.com/abstract=992878> (on file with the *Columbia Law Review*) (arguing de minimis risk criteria are not justified in ideal moral theory, and are justified, if at all, only on nonideal grounds such as bounded rationality of government actors).

51. Kunreuther et al., Low Probabilities, *supra* note 50, at 108–09.

52. *Id.* at 106.

to pay to avoid the higher risks than the lower risks, despite the fact that the size of the risks differed from one another by orders of magnitude.⁵³ To test when sensitivity to probabilities would be triggered, Kunreuther and his collaborators devised a second experiment using the same chemical plant scenario but with probabilities of death of 1 in 650, 1 in 6,300, and 1 in 68,000.⁵⁴ This experimental study revealed virtually the same insensitivity to low-value probabilities as the first study.⁵⁵

Other studies have also found that individuals have a difficult time evaluating and making use of very low-value probabilities. One study found that although individuals were willing to pay a premium for produce that was safer, the amount they were willing to pay was insensitive to variations in lifetime cancer risk of between 3 to 50 additional cancer cases per 50,000 consumers.⁵⁶ Another study showed similarly small variation in individuals' willingness to pay to reduce the risk of illness from oysters.⁵⁷ Still others have illustrated similar insensitivities.⁵⁸

The conclusion that individuals have a difficult time evaluating low probabilities should not be surprising: Individuals have little experience with events that are by their nature very unlikely. Without a basis in experience or a strong comparison point, these differences, even in orders of magnitude, are difficult to register. "For most of us, most of the time," as Cass Sunstein writes, "the relevant differences—between, say, 1/100,000 and 1/1,000,000—are not pertinent to our decisions, and by experience we are not well equipped to take those differences into account."⁵⁹

2. *Editing Small to Zero.* — One possible explanation for insensitivity to low-probability figures is the "editing hypothesis."⁶⁰ This hypothesis posits that individuals extract the "gist of information" and make decisions, when possible, on the basis of that gist.⁶¹

How individuals discern that "gist" is a complex matter. Studies have shown that individuals have a "strongly bimodal" response to low-

53. Id. at 107–08.

54. Id. at 109.

55. Id.; see also Sunstein, *Terrorism*, supra note 49, at 123 (describing study as illustrating "striking form of probability neglect").

56. Young Sook Eom, *Pesticide Residue Risk and Food Safety Valuation: A Random Utility Approach*, 76 *Am. J. Agric. Econ.* 760, 764, 769 (1994) ("The price premium [for safer produce] was insensitive to the amounts of risk reduction evaluated.").

57. C.-T. Jordan Lin & J. Walter Milon, *Contingent Valuation of Health Risk Reductions for Shellfish Products*, in *Valuing Food Safety and Nutrition* 83, 90–93 (Julie A. Caswell ed., 1995).

58. See, e.g., Michael W. Jones-Lee, Graham Loomes & P.R. Philips, *Valuing the Prevention of Non-Fatal Road Injuries: Contingent Valuation vs. Standard Gambles*, 47 *Oxford Econ. Papers* 676, 688–89 (1995) (showing willingness to pay only 20% more to reduce risk from 12 in 100,000 to 4 in 100,000).

59. Sunstein, *Probability Neglect*, supra note 49, at 74.

60. Stone et al., supra note 48, at 395.

61. Id.

probability risks:⁶² They tend either to dismiss low-probability risks⁶³ or overreact to them,⁶⁴ depending on a mix of factors. These factors include, among others, emotion,⁶⁵ the familiarity of the risk,⁶⁶ the vividness of the adverse outcome,⁶⁷ and the presentation of the risk information.⁶⁸

At the low end of this bimodal response, studies show there are circumstances in which individuals read the “gist” of the low-probability risk as amounting to “essentially nil,” and thus not worth effort (or payment) to prevent. In one classic study, Paul Slovic and co-authors examined individuals’ willingness to insure against low-probability but high-loss events.⁶⁹ The study showed that 80% of the subjects were not willing to take out any insurance to prevent a loss with a probability of .001 (1 in 1,000), even though the losses were relatively high-value.⁷⁰

Others have shown a similar effect, although the cut-off point for treating a risk as “essentially nil” is variable. For instance, in one study, a quarter of the subjects were unwilling to pay anything to eliminate a low-probability risk with an incident rate of .000006 or .000003.⁷¹ In another study, more than a quarter of the subjects were unwilling to pay anything

62. See Wesley A. Magat, W. Kip Viscusi & Joel Huber, Risk-Dollar Tradeoffs, Risk Perceptions, and Consumer Behavior, *in* Learning about Risk: Consumer and Worker Responses to Hazard Information 83, 91 (W. Kip Viscusi et al. eds., 1987) (noting study participants “tend either to overreact to the risky event or to ignore it”); Gary H. McClelland, William D. Schulze & Don L. Coursey, Insurance for Low-Probability Hazards: A Bimodal Response to Unlikely Events, 7 *J. Risk & Uncertainty* 95, 108–09 (1993) (finding bimodal response).

63. See, e.g., Howard Kunreuther et al., Disaster Insurance Protection: Public Policy Lessons 185–86 (1978) (“[P]eople refuse to attend to or worry about losses whose probability is below some threshold . . . Probabilities below the threshold are essentially treated as zero.”).

64. See Sarah Lichtenstein et al., Judged Frequency of Lethal Events, 4 *J. Experimental Psychol.* 551, 552 (1978) (“Rare events may be overestimated because their appearances are well spread and distinct.”); Magat et al., *supra* note 62, at 96 (concluding based on study that consumers overestimate likelihood of low-probability injuries); M. Granger Morgan et al., On Judging the Frequency of Lethal Events: A Replication, 3 *Risk Analysis* 11, 11 (1983) (“The results, which have been widely reproduced in the risk-perception literature, show a tendency . . . to overestimate the incidence of rare causes of death.”).

65. See George F. Loewenstein et al., Risk as Feelings, 127 *Psychol. Bull.* 267, 274 (2001) (showing emotional reactions to risk diverge from cognitive assessments).

66. See Paul Slovic, The Perception of Risk 14 (2000) (finding individuals’ choices to insure are greatly affected by recent experiences, such as with floods and earthquakes).

67. See Paul Slovic, John Monahan & Donald C. MacGregor, Violence Risk Assessment and Risk Communication, 24 *Law & Hum. Behav.* 271, 290 (2000) (attributing greater response to risk in frequency format (e.g., “1 in 10”) than probability format (e.g., “10%”)).

68. See Stone et al., *supra* note 48, at 395 (finding individuals are more responsive to relative comparisons than to absolute probabilities).

69. Paul Slovic et al., Preference for Insuring Against Probable Small Losses: Insurance Implications, 44 *J. Risk & Ins.* 237 (1977).

70. *Id.* at 243.

71. Stone et al., *supra* note 48, at 401.

to protect against a risk with a much higher probability, .01%.⁷² Although more research needs to be done to discern the triggers that cause people to ignore rather than to overestimate risks,⁷³ what is important for our purposes is that in some contexts, individuals treat low probabilities as essentially zero probabilities.

3. *Perception and the One Percent Problem.* — This research on risk perception sheds light on why one percent arguments can be so intuitively appealing and why one percent problems are particular difficult to overcome. When individuals respond to a low probability as if it is essentially zero, one percent arguments may have powerful effects in policy debates, even when they relate to small contributions to a problem as opposed to small probabilities.

One way to see this is to consider how regulatory decisions, and in particular decisions about whether to exempt a source or set a regulatory threshold, can be framed. An exemption for a particular entity based on it being a small part of the problem can be stated as accepting a small increase in the probability of a particular undesired outcome. If, for example, my company's water discharge amounts to only 1% of the discharge of a pollutant into a river, then providing an exemption to my company is roughly equivalent to saying that a small increase in the probability of the contaminants in water reaching a certain level is acceptable.

If one percent arguments for exemption have effects similar to arguments about the acceptability of very small increases in risks, then research on risk perception should provide guidance on one percent problems. It makes sense that the same effects that lead to insensitivity in perception of small risks also would lead to insensitivity in the perception of small contributions to a larger problem. In both cases, individuals are confronted with numbers that are difficult to evaluate; and in both cases, a course of action will have a very small and difficult-to-evaluate change in the likelihood of events. If it is difficult for individuals to make sense of differences stated in terms of risk, it also may be difficult for individuals to make sense of differences stated in terms of equivalently small contributions to a problem.

Indeed, it may well be that the dynamic of individuals reading small probabilities as amounting to zero is even stronger in regulatory contexts. The benefits of regulation frequently do not follow for some time. Moreover, the benefits of regulations are often public goods. Where regulations produce public goods in the future, small increases in the likelihood of low-probability events may be particularly difficult for individuals to evaluate.

72. McClelland et al., *supra* note 62, at 103 (1993).

73. See, e.g., Kunreuther et al., *Low Probabilities*, *supra* note 50, at 117 (suggesting that risk perception is "highly context dependent" and calling for further research beyond experimental tests using insurance premiums).

Psychologists themselves are not immune from these types of perception effects,⁷⁴ and there is no reason to believe that policymakers are either. Policymaking is also influenced by public perception. For example, studies suggest that the allocation of risk reduction resources by the EPA more closely tracks public perceptions of risk than experts' views.⁷⁵ Biases in public perceptions are thus likely to affect policies even where policymakers and other experts are able to avoid these biases. Part of the difficulty in addressing one percent problems is overcoming the intuitive appeal of disregarding what we assume to be small potatoes.

II. THE ONE PERCENT PROBLEM AND CLIMATE CHANGE

The one percent problem has particularly detrimental effects on climate change policy. Solving the climate change problem will be far more difficult, if not impossible, without addressing sources that could frame themselves as one percent contributors. At a global level, countries that individually contribute less than one percent of global emissions collectively account for roughly 30 to 40% of total current emissions and a large share of projected future emissions. Many economic sectors at the global and national level can also be framed as contributing one percent or less of global emissions. The drastic reductions in emissions that climate science calls for will not be practically achievable without including reductions from many sources that can be framed in one percent terms. One percent arguments are frequently voiced to evade costly emissions reductions, and appear to be influential in climate change debates. In this Part, we explain why one percent sources are critical to solving the climate change problem and then demonstrate the range and currency of one percent arguments—in legislative and regulatory spheres—that create the one percent problem for climate change.

A. *Climate Change and One Percent Sources of Carbon Emissions*

1. *The Climate Change Problem.* — To understand the importance of one percent sources to climate change policy, it is necessary to understand the structure of the climate change problem. Climate scientists have concluded that tipping points exist for atmospheric concentrations of carbon. Once these tipping points are passed, efforts to reduce carbon emissions may be swamped by natural emissions and we may not be able to avoid catastrophic climate change. Although, as a general rule, reduc-

74. Cf. Amos Tversky & Daniel Kahneman, Belief in the Law of Small Numbers, 76 Psychol. Bull. 105, 110 (1974) (concluding psychologists are subject to behavioral anomalies regarding small numbers).

75. See Sci. Advisory Bd., Evtl. Prot. Agency, Reducing Risk: Setting Priorities and Strategies for Environmental Protection 12 (1990) ("Federal environmental laws are more reflective of public perceptions of risk than of scientific understanding."); Evtl. Prot. Agency, Unfinished Business: A Comparative Assessment of Environmental Problems 96 (1987) ("EPA's priorities appear more closely aligned with public opinion than with estimated risks.").

ing anthropogenic carbon emissions will reduce global average temperatures over the long run, once emissions push temperatures past particular levels—levels that are very difficult, if not impossible, to identify in advance—any of several feedback effects may occur (e.g., releases of carbon from drying Amazonian and other tropical forests, reductions in reflectivity, or albedo, from melting ice and snow,⁷⁶ releases of methane from thawing Arctic and Subarctic tundra, releases of methane clathrates from warming ocean sediments and continental deposits).⁷⁷ These feedback effects may lead to the release of massive amounts of carbon from natural sources, which will further increase temperature and trigger additional feedback effects. And so on. Once these feedback effects begin, increases in natural carbon emissions may exceed any plausible reductions in anthropogenic emissions.

These feedback effects suggest that identifying and achieving a social goal for carbon emissions that is below the difficult-to-identify tipping points is particularly important. Yet current economic integrated assessment models have difficulty accounting for these climate tipping points.⁷⁸ Achieving a carbon emissions target that appears on the surface to be socially optimal because the estimated costs of reducing emissions are less than the estimated benefits of reducing climate change harms may still lead to catastrophic climate change if the target is higher than a threshold or tipping point for feedback effects.

Even if catastrophic climate change occurs, some might argue, the costs could be less than the costs of anthropogenic carbon emissions re-

76. The feedback effects in the Arctic arising from reduced albedo are the subject of debate in the scientific literature. See Steven C. Amstrup et al., Greenhouse Gas Mitigation Can Reduce Sea-Ice Loss and Increase Polar Bear Persistence, 468 *Nature* 955, 957–58 (2010) (discussing albedo effects of carbon mitigation on polar bear populations).

77. For a discussion of feedback effects, see Mark Lynas, *Six Degrees: Our Future on a Hotter Planet* (2008); see also Working Grp. II, Intergovernmental Panel on Climate Change, Fourth Assessment Report: Summary for Policymakers 19 (M.L. Parry et al. eds., 2007) [hereinafter Summary for Policymakers], available at <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-spm.pdf> (on file with the *Columbia Law Review*) (discussing feedback effects).

78. See Freeman & Guzman, *supra* note 18, at 1554 (examining how economic models fail to account fully for catastrophic climate outcomes); Jonathan S. Masur & Eric A. Posner, Climate Regulation and the Limits of Cost-Benefit Analysis, 99 *Calif. L. Rev.* (forthcoming 2011) (manuscript at 19, 23–24), available at <http://ssrn.com/abstract=1662147> (on file with the *Columbia Law Review*) (noting that leading models of climate policy costs and benefits “may be underestimating the probability of catastrophic events by significant margins” and thus understating benefits of emissions reductions); Vandenbergh et al., *Micro-Offsets*, *supra* note 27, at 317–19 (discussing unreliability of atmospheric target assumptions in leading proposed policies); Martin L. Weitzman, On Modeling and Interpreting the Economics of Catastrophic Climate Change, 91 *Rev. Econ. & Stat.* 1, 2 (2009) (examining how climate models fail to account for fat-tailed risks); Martin L. Weitzman, A Review of the Stern Review on the Economics of Climate Change, 45 *J. Econ. Literature* 703, 704–05 (2007) (“[S]tandard approaches to climate change . . . fail to account fully for the implications of large consequences with small probabilities . . .”).

ductions, or could occur so far out in the future that we simply do not or should not care about the costs. Paleoclimatologists have identified climate, sea level, and ocean acidification shifts during periods in geologic history, however, that, if they recur, could cause widespread, systemic harms that are beyond current methods of cost calculation and are not accounted for in the most widely used economic models.⁷⁹ For example, a recent study in a leading peer-reviewed journal raises the possibility that heat waves could place in doubt the ability of large percentages of humans to survive outdoors in large areas of the world in roughly three centuries.⁸⁰ It is not possible to quantify the likelihood of these catastrophic outcomes, but they are disturbingly plausible, largely irreversible, and not subject to adaptation in any meaningful sense.⁸¹ In short, if the one percent problem induces a failure to reduce emissions below tipping points, the resulting conditions may not allow a simple economic reevaluation to impose new limits on small emissions sources at a later date based on a new calculus that the marginal benefit appears to be greater than the marginal cost. Instead, the result may be a climate catastrophe that is beyond regulation by the time it is recognized.⁸²

To reduce the likelihood that the feedback effects associated with catastrophic climate change will occur, a consensus has emerged that the global average temperature increase above pre-industrial levels should not exceed 2°C (3.6°F).⁸³ To limit to 50% the likelihood that the 2°C threshold will be exceeded, many climate scientists have concluded that carbon dioxide atmospheric concentrations should not exceed 450 parts

79. For a description of some of these economic models, see Masur & Posner, *supra* note 78, (manuscript at 17–19).

80. See Steven C. Sherwood & Matthew Huber, An Adaptability Limit to Climate Change Due to Heat Stress, 107 *Proc. Nat'l Acad. Sci. U.S.* 9552, 9552 (2010) (“[R]ecent estimates of the costs of unmitigated climate change are too low unless the range of possible warming can somehow be narrowed.”); see also Anthony J. McMichael & Keith B.G. Dear, Climate Change: Health, Heat, and Longer Horizons, 107 *Proc. Nat'l Acad. Sci. U.S.* 9483, 9483–84 (2010) (commenting on Sherwood and Huber study).

81. See, e.g., Nicholas Stern, The Economics of Climate Change, 98 *Am. Econ. Rev.* 1, 5 *tbl.1* (2008) (providing likelihoods of temperature increases based on studies conducted by Hadley Center and published in Stern Review). For a discussion of irreversible harms, see generally Cass R. Sunstein, Irreversible and Catastrophic, 91 *Cornell L. Rev.* 841 (2006).

82. See Susan Solomon et al., Irreversible Climate Change Due to Carbon Dioxide Emissions, 106 *Proc. Nat'l Acad. Sci. U.S.* 1704, 1704 (2009) (“[T]he climate change that takes place due to increases in carbon dioxide concentration is largely irreversible for 1,000 years after emissions stop.”).

83. See, e.g., Summary for Policymakers, *supra* note 77, at 16 *fig.2* (charting temperature targets and atmospheric concentrations); see also U.N. Human Development Report 2007/2008, *Fighting Climate Change: Human Solidarity in a Divided World* 26, 46 (2007) [hereinafter U.N. Development Report], available at http://hdr.undp.org/en/media/HDR_20072008_EN_Complete.pdf (on file with the *Columbia Law Review*) (describing 2°C as “potential ‘tipping point’ for long-run catastrophic outcomes”).

per million (ppm).⁸⁴ The 50% chance of 2°C at 450 ppm CO₂ is not a guarantee. Even 450 ppm of CO₂, leaves an uncomfortably large likelihood of temperature increases far above 2°C.⁸⁵ As a result, some have suggested that 350 ppm CO₂ is the better target.⁸⁶ For the purposes of this Article, however, we assume a 450 ppm target. The conclusions we reach are all the more relevant if the appropriate target is 350 ppm as opposed to 450 ppm.

To achieve a 450 ppm target will require leveling off global emissions in the near future, and global emissions reductions of 50% or more from 1990 levels by 2050.⁸⁷ This 50% emissions reduction must be achieved against a backdrop of a doubling of global emissions under projected business-as-usual scenarios.⁸⁸ Most of the emissions growth will occur in developing countries that have the strongest need to alleviate poverty and have played a small role in creating the current climate crisis.⁸⁹ Given the disparity in poverty and development levels around the world, and the historical contributions to atmospheric carbon concentrations of many developed countries, climate change researchers have set a goal for the United States and other developed countries of leveling off or reducing emissions during this decade, with 80% emissions reductions from 1990 levels by 2050.⁹⁰ Because a substantial proportion of the carbon dioxide released today will remain in the atmosphere hundreds of years from

84. Working Grp. III, Intergovernmental Panel on Climate Change, Fourth Assessment Report: Summary for Policymakers 15 tbl.5 (2007), available at <http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-spm.pdf> (on file with the *Columbia Law Review*).

85. See Stern, *supra* note 81, at 5 tbl.1 (providing likelihoods of temperature increases at various atmospheric concentrations of carbon dioxide equivalents).

86. See James Hansen et al., Dangerous Human-Made Interference with Climate: A GISS ModelE Study, 7 *Atmospheric Chemistry & Physics* 2287, 2304–08 (2007) (“[A] CO₂ level exceeding ~450 ppm is almost surely dangerous, and the ceiling may be even lower.”); James Hansen et al., Target Atmospheric CO₂: Where Should Humanity Aim?, 2 *Open Atmospheric Sci. J.* 217, 217–18, 226 (2008) [hereinafter Hansen et al., Target] (“An initial CO₂ target of 350 ppm, to be reassessed as effects on ice sheet mass balance are observed, is suggested.”).

87. U.N. Development Report, *supra* note 83, at 48.

88. See S. Pacala & R. Socolow, Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies, 305 *Science* 968, 968–69 (2004) (describing 2050 emissions projections and targets under business-as-usual trajectory, i.e., those “likely to occur in the absence of a focus on carbon”).

89. See Roadmap to Copenhagen—Driving Towards Success: Hearing Before the H. Select Comm. on Energy Independence & Global Warming, 111th Cong. 9, 13 (2009) (statement of Todd Stern, Special Envoy for Climate Change, U.S. Department of State), available at http://globalwarming.house.gov/files/HRG/FullTranscripts/111-9_2009-09-10.pdf (on file with the *Columbia Law Review*) (noting “97 percent of the projected increase in global emissions between now and 2030 will come from developing countries,” which “tend to see a problem not of their own making that they are being asked to fix”).

90. See, e.g., Cal. Exec. Order No. S-3-05 (June 1, 2005), available at <http://www.dot.ca.gov/hq/energy/ExecOrderS-3-05.htm> (on file with the *Columbia Law Review*) (adopting California goal of 80% emissions reductions from 1990 levels by 2050); U.N. Development Report, *supra* note 83, at 111–17 (calling for 80% reduction from 1990 levels

now,⁹¹ the recent delays in achieving policies that will reduce emissions by 2020 have increased the stringency of the emissions reductions that will need to occur by 2050. After 2050, global emissions will need to continue to decline, ultimately approaching near-zero anthropogenic emissions levels.⁹²

2. *Sources of Carbon Emissions.* — The one percent problem is particularly acute for climate change because a substantial share of all carbon emissions arises from sources that can easily be framed as contributing one percent or less to the total. We examine the data on carbon emissions through the lens of the various types of one percent arguments that are available to carbon sources (e.g., less than 2%, less than 1.5%, etc.). For example, Figure 1 demonstrates that only seven countries had an individual share of 2% or more of all anthropogenic global carbon dioxide equivalent (CO₂-e) emissions in 2006.⁹³

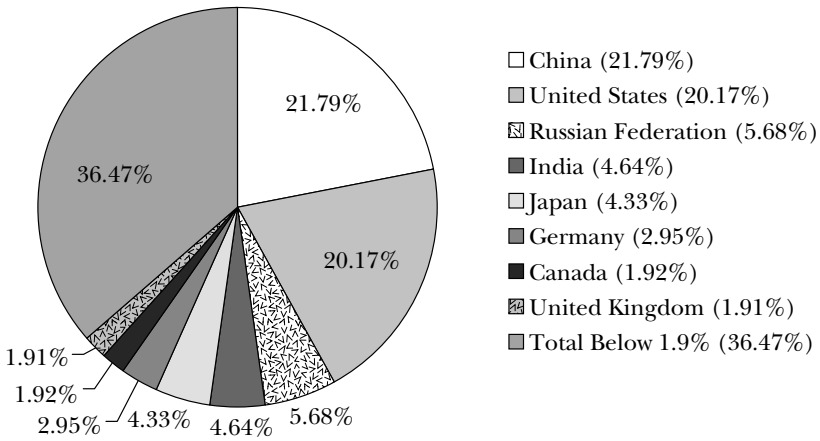
by rich countries by 2050 and noting targets already set by some nations and their political subdivisions).

91. See Nathan S. Lewis & Daniel G. Nocera, *Powering the Planet: Chemical Challenges in Solar Energy Utilization*, 103 *Proc. Nat'l Acad. Sci. U.S.* 15,729, 15,730 (2006) (“[W]hatever environmental effects might be caused by this atmospheric CO₂ accumulation over the next 40–50 yr will persist globally for the next 500–2,000 yr or more.”).

92. See, e.g., Pacala & Socolow, *supra* note 88, at 968–69 (describing potential steps to reduce carbon emissions over next 50 years).

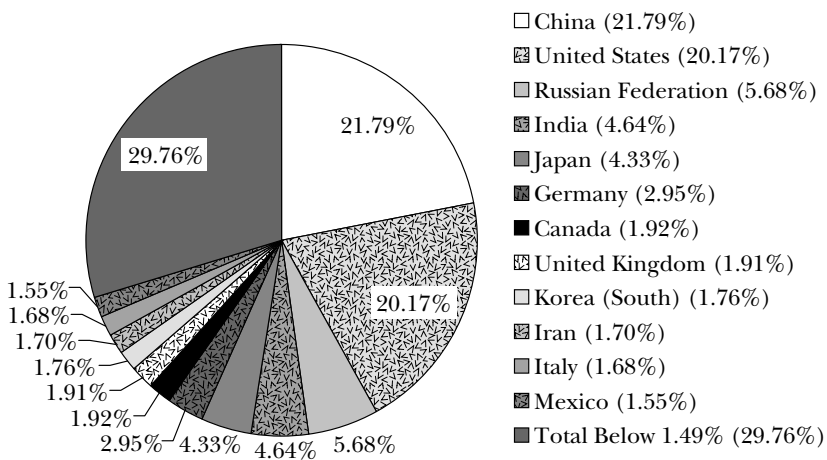
93. World Res. Inst., *Climate Analysis Indicators Tool (CAIT), Total GHG Emissions in 2006 Per Country* (2010), <http://cait.wri.org/cait.php?page=yearly&mode=view> (on file with the *Columbia Law Review*). For this analysis, the data are presented based on a threshold of 1.99%. The CO₂-e emissions totals exclude emissions from land use. See U.S. Energy Info. Admin. (EIA), *World Carbon Dioxide Emissions from the Use of Fossil Fuels*, <http://www.eia.doe.gov/iea/carbon.html> (on file with the *Columbia Law Review*) (last visited Aug. 26, 2011) (providing tables of world carbon dioxide emissions from use of fossil fuels). For a discussion of CO₂-e as a unit of measurement, see *supra* note 13.

FIGURE 1: SHARE OF GLOBAL CARBON EMISSIONS, BY COUNTRY⁹⁴



In other words, only seven countries, representing roughly 64% of global CO₂-e emissions, cannot argue they contribute less than 2% of global emissions. Almost 180 countries, representing more than 36% of all emissions, can make this form of the one percent argument. As Figure 2 demonstrates, of these 180 countries, all but four can argue not just that they contribute less than 2%, but also that they contribute less than 1.5% of global emissions.

FIGURE 2: SHARE OF GLOBAL CARBON EMISSIONS, BY COUNTRY



The twelve countries whose individual contribution is more than 1.5% of emissions only account for roughly 70% of emissions. The other

94. World Res. Inst., supra note 93. For this analysis, we treat a country as having 1% or less if its percentage would be rounded to 1% using standard rounding norms (i.e., if it is 1.49% or less of the global total).

30% of all global CO₂-e emissions are produced by the 173 countries that can make this form of the one percent argument.

If the goal is to reduce global emissions by 50% by 2050, it is mathematically possible to achieve that goal if the countries that can make one percent arguments are excluded, but it will be remarkably costly and probably not politically feasible. The emissions from countries that cannot make the one percent argument would need to be decreased by 75 to 90%, yet the list of these countries includes several for which, at least for the next few decades, there is no reasonable prospect for reductions from current levels, much less from 1990 levels. Examples include India, which has per capita emissions of roughly two tons per year, and China, at roughly five tons per year, as compared to roughly twenty tons per year for the United States and roughly ten tons for Japan and many European countries.⁹⁵ Furthermore, if the global emissions reduction goal is an 80% reduction by 2050, as some have argued,⁹⁶ it is mathematically impossible to achieve the goal without the countries that can make the one percent argument.

A second framing of the relevant contributions from each nation further demonstrates the point. Many developing countries argue that the appropriate criterion for evaluating responsibility for reducing emissions is not annual emissions or “flows” of carbon into the atmosphere, but the total amounts or “stocks” that remain in the atmosphere based on the total national emissions since the start of the industrial revolution.⁹⁷ This argument essentially asserts that developed nations benefited disproportionately from the industrial revolution and should therefore bear a larger share of the burden of reducing prospective emissions. Moreover, although some carbon is removed from the atmosphere through natural processes (e.g., through dissolution into the oceans, uptake by plants, and other processes), a substantial percentage of total carbon emissions will remain in the atmosphere for 100 or even 1,000 years.⁹⁸

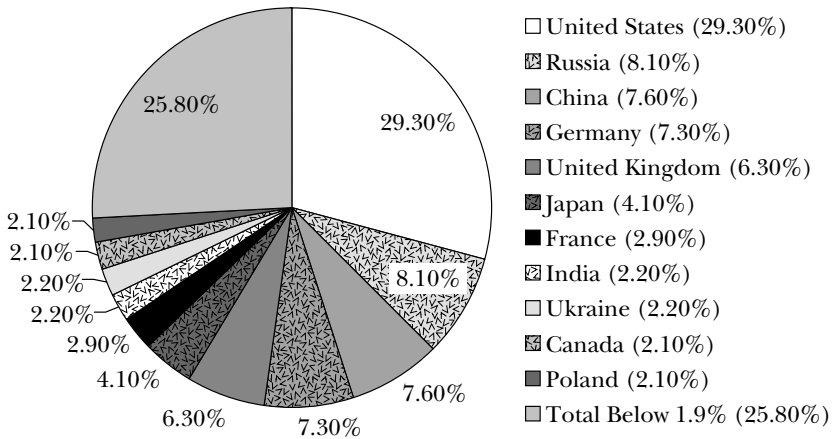
Figure 3 demonstrates that the one percent problem also arises if we examine relative contributions in terms of a country’s share of stocks of carbon dioxide in the atmosphere.

95. See Vandenberg et al., *Micro-Offsets*, *supra* note 27, at 323–24 (discussing per capita emissions).

96. Hansen et al., *Target*, *supra* note 86, at 229 (“We suggest an initial objective of reducing atmospheric CO₂ to 350 ppm, with the target to be adjusted as scientific understanding and empirical evidence of climate effects accumulate.”).

97. See, e.g., Eric A. Posner & Cass R. Sunstein, *Climate Change Justice*, 96 *Geo. L.J.* 1565, 1611–12 (2008) (discussing carbon stocks and flows).

98. See, e.g., Lewis & Nocera, *supra* note 91, at 15,730 (discussing carbon residence times in atmosphere).

FIGURE 3: SHARE OF TOTAL CARBON STOCK, BY COUNTRY⁹⁹

Using the stocks approach, only eleven countries, accounting for roughly 75% of emissions, cannot argue they have contributed less than 2% of the existing carbon stock. The 174 countries that can argue they have contributed less than 2% of existing stocks account for roughly 25% of all global CO₂-e emissions.¹⁰⁰

Third, if we change focus from nations to economic sectors at the global level, entire economic sectors can be framed as one percent sources. For example, global air transport accounts for only around 3% of anthropogenic global warming.¹⁰¹ Global shipping accounts for comparable levels of emissions.¹⁰²

99. Figure based on data presented in Kevin A. Baumert, Timothy Herzog & Jonathan Pershing, Word Res. Inst., *Navigating the Numbers: Greenhouse Gas Data and International Climate Policy* 32 fig.6.1 (2005), available at http://pdf.wri.org/navigating_numbers.pdf (on file with the *Columbia Law Review*).

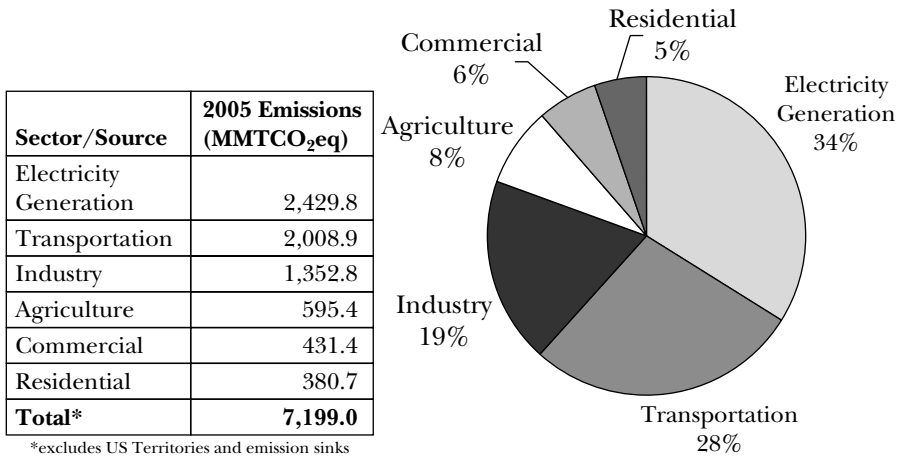
100. Only twelve countries, accounting for roughly 76% of the world's carbon stocks, cannot claim that they have contributed less than 1.5% of CO₂-e emissions to the world's stocks.

101. Aviation Industry Pushes for Global Deal to Address Sector's Greenhouse Emissions, *Int'l Env't Rep.* (BNA), Sept. 29, 2010, at 954 (discussing views of industry executives that aviation accounts for 2% of global carbon dioxide emissions); see also *Aviation and the Environment: Emissions [sic]: Hearing Before the Subcomm. on Aviation of the H. Comm. on Transp. & Infrastructure, 110th Cong. 92* (2008) (statement of Gerald Dillingham, Director, Physical Infrastructure Issues, U.S. Government Accountability Office) [hereinafter Dillingham statement] ("A 1999 study by the United Nations' Intergovernmental Panel on Climate Change (IPCC) estimated that global aircraft emissions generally accounted for approximately 3.5 percent of the warming generated by human activity.").

102. See Org. for Econ. Co-operation & Dev., *Int'l Transp. Forum, Reducing Transport Greenhouse Gas Emissions: Trends and Data 10* (2010), available at <http://www.internationaltransportforum.org/Pub/pdf/10GHGTrends.pdf> (on file with the *Columbia Law Review*) (noting that shipping accounts for 3% of global fossil-fuel-based emissions).

Economic sectors at the U.S. domestic level also can be framed either as one percent contributors to anthropogenic emissions¹⁰³ or in ways that do not reveal the one percent problem. For example, Figure 4 demonstrates how the annual EPA GHG inventory, the leading U.S. document that identifies sources of carbon emissions, frames emissions from economic sectors: Electricity Generation (34% of U.S. emissions); Transportation (28%); Industry (19%); Agriculture (8%); Commercial (6%); Residential (5%).¹⁰⁴ None are below 1%, so long as the sectors are treated as a whole and the denominator is U.S. emissions. If the denominator is global emissions, however, several of these sectors can make a one percent argument based on their relatively small contributions.

FIGURE 4: DIRECT U.S. GREENHOUSE GAS EMISSIONS BY ECONOMIC SECTOR¹⁰⁵



MMTCO₂eq = Million Metric Tons Carbon Dioxide Equivalents

In addition, policy debates typically do not focus at a general sectoral level, but focus instead at the level of more specific industrial or commercial sectors. For example, in the policy debate, aircraft emissions are often considered in isolation from the larger transportation sector.¹⁰⁶ Figure 5 demonstrates the percentage share of emissions attributable to each of the roughly 390 industrial sectors in the United States.

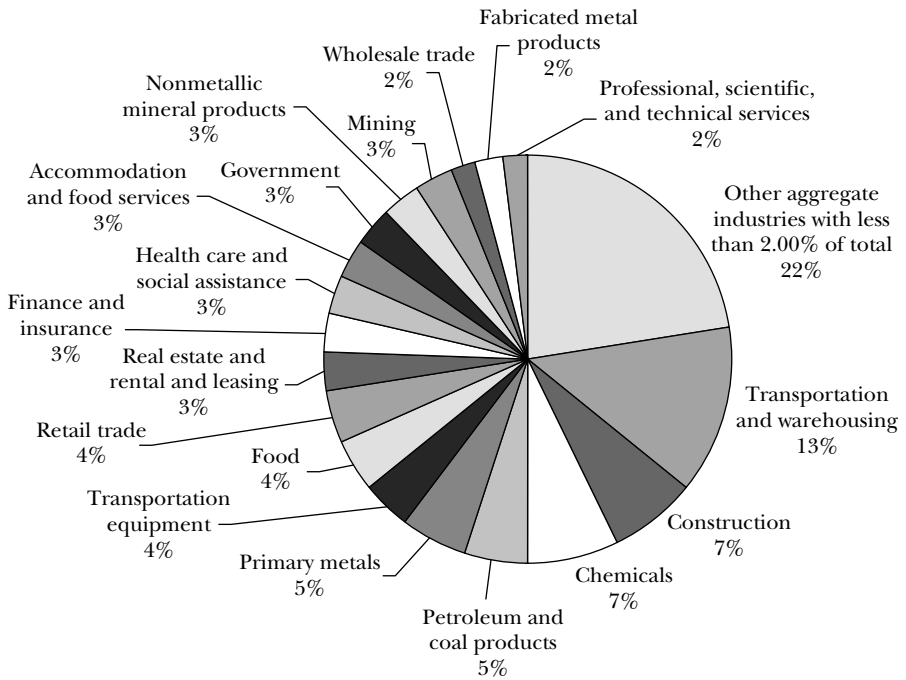
103. See Scope of a Cap-and-Trade Program, *supra* note 29, at 7 & fig.2 (analyzing sources of domestic carbon emissions).

104. Env'tl. Prot. Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2005, at 2-22 to -23 (2007), available at <http://epa.gov/climatechange/emissions/downloads06/07CR.pdf> (on file with the *Columbia Law Review*) (providing estimates of percentage of direct U.S. greenhouse gas emissions by economic sector for 2005).

105. Scope of a Cap-and-Trade Problem, *supra* note 29, at 7 & fig.2

106. See, e.g., Dillingham statement, *supra* note 101 (noting “aviation accounts for about 2.7% of the total U.S. contribution of greenhouse gas emissions”).

FIGURE 5: DIRECT AND INDIRECT INDUSTRY EMISSIONS, BY INDUSTRY¹⁰⁷



Although Figure 5 includes roughly 390 specific industrial sectors, only a small handful are above 1.99% of the overall industrial sector total, much less the U.S. or global total. The specific industry sectors that can make a one percent argument account for roughly 22% of the total from all of industry, and many of the specific industrial sectors that contribute the remaining 78% are composites of smaller subsectors. In addition, some sectors have shown a willingness to make one percent arguments based on a share in the 3 to 4% range.¹⁰⁸ If we exclude from the total those specific industrial sectors whose share of all industry emissions are 4% or below, these “one percent” candidates account for roughly 58% of the total from the overall industrial sector. If these sources are excluded, it will be impossible to achieve the overall industrial sector’s share of U.S. total reductions, whether the target is 50% or 80%. If the denominator is

107. Econ. & Statistics Admin., U.S. Dep’t of Commerce, U.S. Carbon Dioxide Emissions and Intensities Over Time: A Detailed Accounting of Industries, Government and Households 7, app. tbls.A-60, A-61, A-62 & A-63 (2010), available at <http://www.esa.doc.gov/sites/default/files/reports/documents/tablesa60-a63.xls> (on file with the *Columbia Law Review*) (providing industry sector-level data for total CO₂ emissions in 1998, 2002, and 2006). The full report is available at <http://www.esa.doc.gov/sites/default/files/reports/documents/co2reportfinal.pdf> and the appendix is available at http://www.esa.doc.gov/sites/default/files/reports/documents/appendix_0.pdf. Totals in the original are in million metric tons. Summing of sectors may generate double-counting.

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

total U.S. emissions or total global emissions, rather than just emissions from the U.S. industrial sector, nearly all of the specific industrial sectors can make the one percent argument.

B. *One Percent Arguments in the Political and Legal Arenas*

Opponents of climate change mitigation measures often make one percent arguments to defeat efforts to take any regulatory action or to shift potential regulatory burdens to other emissions sources. In international debates, advocates for nations ranging from the United States,¹⁰⁹ India,¹¹⁰ and Bangladesh¹¹¹ to groups of nations in the Middle East¹¹² have raised the one percent argument. On a global sectoral level, the trade association representing the international airline industry has argued that the air transport sector is being “unfairly targeted” in efforts to reduce air carbon emissions because the sector only contributes roughly 3% to anthropogenic global warming.¹¹³

109. See Martin Feldstein, Op-Ed., Cap and Trade: All Cost, No Benefit, Wash. Post, June 1, 2009, at A15 (arguing that because “a 15 percent fall in U.S. CO₂ output would lower global CO₂ output by less than 4 percent” and “would be virtually unnoticeable . . . [t]he U.S. should wait until there is a global agreement on CO₂ that includes China and India before committing to costly reductions in the United States”); This Week with George Stephanopoulos (ABC television broadcast June 28, 2009), transcript available at <http://abcnews.go.com/ThisWeek/Politics/story?id=7948866&page=8> (on file with the *Columbia Law Review*) (showing Sen. Charles Grassley arguing against cap and trade legislation “because if the United States moves ahead by itself, we’re not only going to lose those jobs, but the point is, after 30 or 40 years, we’re going to reduce CO₂ by less than 1 percent”).

110. The Indian press has noted that India only contributed 3% of the stock of greenhouse gases in the atmosphere, as compared to 28% for the United States. See, e.g., D. Balasubramanian, Climate Change and the Copenhagen Discord, *Hindu* (Feb. 10, 2010), <http://www.thehindu.com/sci-tech/science/article104597.ece> (on file with the *Columbia Law Review*).

111. See Stobo Sniderman, The Era of Carbon Conditionality, *Global Brief* (Nov. 22, 2010), <http://globalbrief.ca/blog/2010/11/22/the-era-of-carbon-conditionality> (on file with the *Columbia Law Review*) (noting that because Bangladesh “emits less than a fifth of one percent of the world’s total emissions” it “wants aid to help it *adapt* to climate change, not to reduce its emissions”); see also Cass R. Sunstein, The World vs. The United States and China? The Complex Climate Change Incentives of the Leading Greenhouse Gas Emitters, 55 *UCLA L. Rev.* 1675, 1688 (2008) (noting African nations are “trivial greenhouse gas emitters”).

112. See Oli Brown & Alec Crawford, Int’l Inst. for Sustainable Dev., Rising Temperatures, Rising Tensions: Climate Change and the Risk of Violent Conflict in the Middle East 29 (2009), available at http://www.iisd.org/pdf/2009/rising_temps_middle_east.pdf (on file with the *Columbia Law Review*) (arguing that developing nations in the Levant—Syria, Lebanon, Jordan, and the occupied Palestinian territory—which as a region produces less than one percent of global GHG emissions, may come to further resent Western nations and Israel if Copenhagen fails to produce meaningful concessions from developed countries).

113. See *supra* note 101 and accompanying text; note 106 and accompanying text.

At the domestic level, which is our focus, many parties make one percent arguments in legal and policy debates.¹¹⁴ One percent arguments have particular force in legislative and regulatory debates, where parties argue for exclusion from regulation due to the regulatory burden on large numbers of small sources.¹¹⁵

The opportunities to frame large carbon sources as one percent or less are almost limitless, and entities from across the political spectrum have availed themselves of these arguments. For example, coal industry advocates have used the one percent argument to cast doubt on the anthropogenic contribution to climate change and to argue against imposing carbon emissions limits on coal-fired electric generating facilities.¹¹⁶ At the same time, supporters of regulating carbon emissions from coal-fired electric generating facilities have asserted that regulation is necessary in part because alternatives—such as reducing emissions through efficiency or conservation measures—generate small reductions.¹¹⁷ One

114. Some parties do not use the one percent framing to undercut perceived obligations to reduce emissions, but rather to acknowledge their contribution and to support mitigation efforts. See City of New York, PlaNYC, A Greener, Greater New York 150 (2011), available at http://nytelecom.vo.llnwd.net/o15/agencies/planyc2030/pdf/planyc_201_planyc_full_report.pdf (on file with the *Columbia Law Review*) (outlining city's carbon mitigation actions); see also Alliance of Small Island States (AOSIS), Declaration on Climate Change 2009 ¶ 11 (2009), available at <http://aosis.info/documents/AOSIS%20Summit%20Declaration%20Sept%2021%20FINAL.pdf> (on file with the *Columbia Law Review*) (“[W]hile SIDS contribute the least to global emissions . . . our nations continue to take significant actions towards the reduction of our own emissions including through regional and inter-regional energy initiatives.”). The California Environmental Protection Agency Air Resources Board provides another useful example. The Board specifically stated it is “clear” emissions from light duty vehicles in California contribute “less than 1 percent” of global greenhouse gas emissions. Nonetheless, the Board found “it does not necessarily follow” that such light-duty vehicles should not be regulated in California. Cal. Evtl. Prot. Agency Air Res. Bd., Initial Statement of Reasons for Proposed Rulemaking, Public Hearing to Consider Adoption of Regulations to Control Greenhouse Gas Emissions from Motor Vehicles 145 (Aug. 6, 2004), available at <http://www.arb.ca.gov/regact/grnhsgas/isor.pdf> (on file with the *Columbia Law Review*).

115. See, e.g., Scope of a Cap-and-Trade Problem, *supra* note 29, at 9 & fig.2 (pointing to small residential share of total domestic carbon emissions as basis for focusing on other emissions source categories).

116. See National Energy Policy: Coal: Hearing Before the Subcomm. on Energy & Air Quality of the H. Comm. on Energy & Commerce, 107th Cong. 48–49 (2001) (statement of J. Brett Harvey, President, CONSOL Energy) (opposing inclusion of carbon dioxide in multi-pollutant clean air bill, stating, “[w]hile the human involvement in this growth represents less than one percent of greenhouse gas emissions, being emissions from motor vehicles, power plants, factories, homes, disposal sites, and, yes, even mines,” U.S. national energy policy should examine other means to mitigate greenhouse gas emissions).

117. See David Henderson, Op-Ed., Let There Be (Incandescent) Light, *Wash. Post*, Oct. 2, 2009, at A21 (“Banning traditional light bulbs as used in private homes seems an [environmental protection] effort [with] very little payoff . . . Congress should regulate matters that require the force of law, such as banning mountaintop removal in coal mining and new coal-burning power plants. Leave people to change their own light bulbs.”); see also Mike Tidwell, Op-Ed., To Really Save the Planet, Stop Going Green, *Wash. Post*, Dec.

percent arguments also have been made in opposition to efforts to reduce carbon emissions from personal motor vehicle idling,¹¹⁸ even though a recent study suggests that idling interventions could reasonably be expected to reduce almost 16 million metric tons of carbon dioxide, or 0.3% of U.S. emissions, a total equal to all of the emissions from the ammonia industry.¹¹⁹

The one percent argument also has been used to downplay the contribution of the U.S. Department of Defense to energy use and carbon emissions. The Department of Defense consumed 890 trillion BTUs of energy in 2008.¹²⁰ Representatives of the Department framed this as “more than half of the federal government’s energy consumption” but at the same time as “less than one percent of total U.S. energy consumption.”¹²¹ If we examine just the use of petroleum, the Department of Defense “consumes more than 300,000 barrels of oil a day” but representatives of the Department cast this as only “about 1.7 percent of the total for the United States and about 0.35 percent of the world’s total oil consumption.”¹²²

Agencies have used the one percent argument on numerous occasions to avoid preparing National Environmental Policy Act (NEPA) Environmental Impact Statements for major federal actions or to downplay the impacts of an action. Perhaps the most striking example is the specific lease sale that enabled the drilling of the BP Macondo Well, where the U.S. Department of the Interior concluded that the carbon emissions from the oil to be pumped from the leased property would not be significant and that “[t]he effect of proposed-[Lease Sale 206]-related

6, 2009, at B1 (“Instead of continuing our faddish and counterproductive emphasis on small, voluntary actions, we should follow the example of Americans during past moral crises and work toward large-scale change.”). One percent arguments against reducing household demand come from the right as well as the left. See, e.g., Joseph Kahn, *Cheney Promotes Increasing Supply as Energy Policy*, N.Y. Times, May 1, 2001, at A1 (noting Vice President Dick Cheney’s assertion that “[c]onservation may be a sign of personal virtue, but it is not a sufficient basis for a sound, comprehensive energy policy”).

118. See Brendan I. Koerner, *Is an Idle Car the Devil’s Workshop?*, Slate (May 27, 2008), <http://www.slate.com/id/2192187/> (on file with the *Columbia Law Review*) (“[C]utting out idling, though certainly advisable, isn’t going to . . . make a huge dent in our national carbon footprint. . . . [It] would represent about 0.2 percent of the carbon dioxide that was emitted in the United States in 2006.”).

119. Amanda R. Carrico et al., *Costly Myths: An Analysis of Idling Beliefs and Behavior in Personal Motor Vehicles*, 37 *Energy Pol’y* 2881, 2884 (2009).

120. Sustainable Energy and the Federal Government: Hearing Before the S. Subcomm. on Fed. Fin. Mgmt., Gov’t Info., Fed. Servs., & Int’l Sec. of the S. Comm. on Homeland Sec. & Gov’t Affairs, 111th Cong. 2 (Jan. 27, 2010) (statement of Dr. Dorothy Robyn, Deputy Under Secretary for Installations and Environment, U.S. Department of Defense), available at http://hsgac.senate.gov/public/index.cfm?FuseAction=Hearings.Hearing&Hearing_id=c7cb1779-8aa1-4250-8dfe-18e06b579af1 (on file with the *Columbia Law Review*) (testifying about risks to Defense Department arising from heavy petroleum use).

121. *Id.*

122. *Id.*

oil spills on fish resources and commercial fishing is expected to cause less than a 1 percent decrease in standing stocks of any population, commercial fishing efforts, landings, or value of those landings” and as a result the “expected level of impact” would be “negligible.”¹²³ Agencies have made similar arguments frequently in evaluating the climate change implications of their decisions, such as when they have considered leases for lands with fossil fuel resources whose extraction would result in the release of millions of tons of carbon, but less than one percent of global emissions.¹²⁴ Most recently, advocates for extracting and transporting the Canadian oil sands, which are one of the largest untapped sources of petroleum—and carbon emissions—in North America, have argued that “[i]t is important to recognize that the overall contribution of oil sands production to global GHG emissions is less than 0.1 percent.”¹²⁵ The State Department used similar reasoning in a recent draft NEPA Environmental Impact Statement on the pipeline and concluded that it will have minimal impact.¹²⁶

One percent arguments are also common in the legislative and regulatory advocacy of the agricultural sector. Advocates have acknowledged that agriculture accounts for roughly 7% of U.S. carbon emissions, yet they have argued that the large number of farms and other small sources justifies exclusion from federal cap and trade legislation for the entire sector.¹²⁷ An example of an argument made for a subsection of the agri-

123. 1 Minerals Mgmt. Serv., *supra* note 4, at 2–17.

124. See generally Madeline June Kass, *A NEPA Climate Paradox: Taking Greenhouse Gases into Account in Threshold Significance Determinations*, 42 *Ind. L. Rev.* 47, 48–55 (2009) (noting importance of considering climate change in NEPA analyses); Amy L. Stein, *Climate Change Under NEPA: Avoiding Cursory Consideration of Greenhouse Gases*, 81 *U. Colo. L. Rev.* 473, 483–99 (2010) (describing agency consideration of climate change impacts under NEPA).

125. *America’s Energy Future: Hearing Before the Subcomm. on Energy & Env’t of the H. Comm. on Energy & Commerce*, 111th Cong. 4 (2010) (statement of James J. Mulva, CEO, ConocoPhillips), available at http://republicans.energycommerce.house.gov/Media/file/Hearings/Energy/2010-06-15_oil_ceos/Mulva%20Statement.pdf (on file with the *Columbia Law Review*).

126. See Lynn Garner, *Senators Ask Clinton for Thorough Review of Proposal for Canadian Oil Sands Pipeline*, 209 *Daily Env’t Rep. (BNA)*, Nov. 1, 2010, at A-11 (reporting on status of NEPA analysis of oil sands pipeline). Similar arguments have been made about the relative size of the carbon emissions that should be subject to state versions of NEPA. See, e.g., Jeffrey D. Dintzer & Margaret A. Farrand, *Accounting for Climate Impacts Under the California Environmental Quality Act*, 1 *Daily Env’t Rep. (BNA)*, Jan. 5, 2009, at B-1 (“In the context of greenhouse gas emissions, it is far from clear how to determine what is ‘significant,’ so as to require preparation of an Environmental Impact Report, given that any given project contributes only a very small amount to the global problem.”).

127. See Megan Stubbs, *Cong. Res. Serv.*, R41622, *Environmental Regulation and Agriculture 1* (2011) (noting that because “[a]ttempt[] to regulate numerous individual crop and livestock operations can be cost prohibitive for government regulators[,] . . . much of the current federal farm policy . . . is . . . voluntary,” not compulsory); Steven D. Cook, *Farm, Forestry Groups Say Climate Bill Should Not Regulate Those Sectors*, 106 *Daily Env’t Rep. (BNA)*, June 5, 2009, at A-8 (quoting Dennis Nuxoll of American Farmland Trust for proposition that “so many small sources ‘does not warrant inclusion of

cultural sector is the dairy industry's promotion of the notion that the dairy industry generates only 2% of all U.S. emissions.¹²⁸ Similarly, in 2008 farmers in New York used a comparable argument to lobby against a proposed GHG emissions regulation.¹²⁹ Asserting that cows have a minimal effect on climate change, a New York Farm Bureau spokesman stated, "You could take all of our cows together and they probably wouldn't have the same effect on the atmosphere [as] the average traffic jam on the Tappan Zee Bridge."¹³⁰ The Department of Agriculture raised similar arguments in a public comment opposing the regulation.¹³¹

Advocates for other sectors have made similar arguments. The solid waste sector has used a one percent argument as a basis for arguing that it should not be subject to carbon regulations.¹³² The domestic general aviation industry has used this approach in opposing GHG emissions requirements. For instance, the Aircraft Owners and Pilots Association (AOPA) challenged EPA aviation regulations by arguing "[g]eneral aviation is estimated to contribute less than one percent of all [U.S. greenhouse gas] emissions."¹³³ In comments to the EPA, AOPA argued that "imposing new regulations, equipment requirements, or operational changes on general aviation would be difficult to justify since general aviation is not a significant source of greenhouse gas emissions."¹³⁴ The Regional Aviation News echoed this position by highlighting the adminis-

the whole agricultural sector within the category of covered sectors'" in the House cap and trade legislation).

128. See Press Release, Innovation Ctr. for U.S. Dairy, Dairy Industry Completes Fluid Milk Carbon Footprint Study as Part of Industrywide Sustainability Commitment (Sept. 22, 2010), available at <http://www.usdairy.com/Newsroom/2010PressReleases/Pages/DairyIndustryCompletesFluidMilkCarbonFootprintStudy.aspx> (on file with the *Columbia Law Review*) (discussing carbon emissions of dairy industry).

129. See Kate Galbraith, Farmers Panic About a 'Cow Tax,' N.Y. Times Green Blog (Dec. 1, 2008, 12:46 PM), <http://greeninc.blogs.nytimes.com/2008/12/01/farmers-panic-about-a-cow-tax> (on file with the *Columbia Law Review*) (reporting on response of agricultural sector to proposed carbon emissions regulations).

130. *Id.*

131. See Regulating Greenhouse Gas Emissions Under the Clean Air Act, 73 Fed. Reg. 44,354, 44,376 (proposed July 30, 2008) (providing Department of Agriculture comments on EPA carbon regulatory options). Ironically, the DOA advocated an exemption based on how many agricultural operations exceeded the statutory threshold: "Even very small agricultural operations would meet a 100-tons-per-year emissions threshold. For example, dairy facilities with over 25 cows, beef cattle operations of over 50 cattle, swine operations with over 200 hogs, and farms with over 500 acres of corn" would be covered. *Id.* at 44,377.

132. See Greenhouse Gas Emissions: Hearing before the Subcomm. on Energy & Env't of the H. Comm. on Sci. & Tech., 111th Cong. 38 (Feb. 24, 2009) (statement of Leslie Wong, Director, Greenhouse Gas Programs, Waste Management), available at http://science.house.gov/sites/republicans.science.house.gov/files/documents/hearing/022409_Wong.pdf (on file with the *Columbia Law Review*) ("Overall, the waste sector is a very small contributor to total U.S. GHG emissions—less than three percent.").

133. Aircraft Owners & Pilots Ass'n, General Aviation and Greenhouse Gas Emission, <http://www.aopa.org/whatsnew/regulatory/regghg.html> (on file with the *Columbia Law Review*) (last visited Aug. 14, 2011).

134. *Id.*

trative and cost burdens of such a regulatory scheme, “particularly if the scheme is applied to small operators, such as business aviation and helicopters, which contribute less than one percent of aviation emissions.”¹³⁵

The U.S. Chamber of Commerce has made one percent arguments by advocating for *de minimis* exemptions for small emissions sources (often small businesses). For example, in the GHG context, the Chamber wrote a letter to EPA Administrator Lisa Jackson urging her to not regulate GHGs under the Clean Air Act.¹³⁶ In the letter, the Chamber stated that it was “particularly concerned with the prospect that EPA regulation of GHGs under the CAA will lead to regulation of hundreds of thousands, if not more than a million, small sources.”¹³⁷

Use of one percent arguments is also common in legislative and regulatory debates outside the GHG area. For instance, in 2003 the California State Senate considered repealing a measure that exempted all pre-1974 cars from vehicle emissions testing.¹³⁸ A leading automobile website published a column opposing the bill, arguing that pre-1974 cars make up less than 1% of total miles driven in California.¹³⁹ Governor Gray Davis eventually signed S.B. 708 into law,¹⁴⁰ but the final version of

135. Special Report: Aviation and Climate Change—Part I, Regional Aviation News (July 23, 2007), <http://www.aviationtoday.com/ran/categories/commercial/14182.html> (on file with the *Columbia Law Review*) (stating “legislators and regulators should look at the record of what aviation has already accomplished over the last 40 years before using the industry as a scapegoat for their failure” to make tough regulatory decisions). As we noted at the outset, the effect of administrative costs on the marginal costs of regulating one percent sources is a genuine concern.

136. Letter from Am. Forest & Paper Ass’n et al., to Liza Perez Jackson, Adm’r, U.S. Evtl Prot. Agency (Apr. 1, 2009) [hereinafter Multi-Industry Letter], available at http://www.uschamber.com/issues/letters/2009/090401_caa.htm (on file with the *Columbia Law Review*); see also Steven D. Cook, Senate Republicans Want More Information from McCarthy on Small Source Emissions, 40 Daily Env’t Rep. (BNA), May 11, 2009, at A-9 (on file with the *Columbia Law Review*) (describing senators’ efforts to raise concerns about EPA regulation of small carbon emissions sources as “an incredibly cynical ploy . . . to block solutions to the climate crisis and create a distraction from the real issues” (quoting Kassie Siegel, Dir. of the Ctr. for Biological Diversity’s Climate Law Inst.)).

137. Multi-Industry Letter, *supra* note 136, at 1.

138. See Lesli A. Maxwell, High-Stakes Assault on Dirty Air: Dairies, Farms, Fireplaces and Old Cars Would See Tougher Anti-Pollution Regulations, *The Sacramento Bee*, Mar. 1, 2003, at A3 (noting that S.B. 708 would only exempt cars at least forty-five years old).

139. According to Karl Brauer, the majority of those cars are restored classic cars that are not driven for daily use, thus the one percent conclusion. Karl Brauer, Big Economies, Small Minds, *Edmunds.com* (Mar. 20, 2003), <http://www.edmunds.com/news/column/carmudgeon/94938/article.html> (on file with the *Columbia Law Review*). Thus, according to Brauer, “emissions testing old cars is a wasted effort if California really wants to improve its air quality.” *Id.*

140. Press Release, Cal. Evtl. Prot. Agency, Governor Davis Signs Landmark Air Quality Legislation into Law (Sept. 22, 2003), reprinted in Cal. Evtl. Prot. Agency, Environmental Accomplishments 1999–2003, at 535 (2003), available at <http://www.calepa.ca.gov/Legislation/Archives/Complete99-03.pdf> (on file with the *Columbia Law Review*).

the bill no longer affected the pre-1974 exemption and instead simply set up a checkpoint system for “smoking vehicles.”¹⁴¹

One percent arguments also have been raised on numerous occasions to defeat additional mercury controls on U.S. coal-fired electric generating plants.¹⁴² In 2004, the Chamber of Commerce commented in opposition to regulating mercury emissions from U.S. power plants: “U.S. power plant emissions contribute just one percent of the total global mercury emissions into the atmosphere, [and] much of the mercury that is deposited into lakes and rivers does not come from U.S. power plants.”¹⁴³ The Chamber went on to argue that “reducing emissions of mercury from U.S. power plants will have a minimal effect on lowering levels of methyl mercury in freshwater fish. Thus there is no present justification for a finding that it is necessary to regulate emissions of mercury from U.S. power plants.”¹⁴⁴

Presumably the assumption behind excluding one percent sources is that the costs of regulating them exceed the benefits and that the problem can be addressed adequately without them. As the discussion above suggests, however, advocates often do not feel compelled to make these arguments explicit. The size of a source’s contribution seems to suffice in many cases, and in the climate policy arena advocates are free to select a denominator that will frame their contribution in one percent terms. So long as advocates can easily frame the contributions of emissions sources and source categories to make one percent arguments, these arguments can be expected to proliferate and to contribute to the one percent problem for climate change policy.

III. A CARBON DISCLOSURE REGIME FOR LEGISLATION

One percent arguments rely on framing the issue in individual terms—focusing on the contribution of an individual source or sector relative to the whole—as opposed to framing it in terms of the aggregate

141. *Id.*; see also John Ellis, *City Officials Address Budget, Valley Air Issues Council Lends Its Support to a Package of Bills Aimed at Cleaning Up San Joaquin Valley Air*, *The Fresno Bee*, May 21, 2003, at B1 (reporting on responses to air emissions requirements).

142. See, e.g., *Clear Skies Act of 2003: Hearing on S. 485 Before the Subcomm. on Clean Air, Climate Change, & Nuclear Safety of the S. Comm. on Env’t & Pub. Works, 108th Cong. 372–73 (2003)* (statement of Wes Taylor, President of Production, TXU Energy North America) (arguing against new mercury emissions controls on coal-fired electric generating plants by asserting, “the mercury emission controls would not significantly reduce global loading of mercury—the Environmental Protection Agency has stated that U.S. electric generators comprise less than one percent of the global mercury emissions”).

143. William L. Kovacs, U.S. Chamber of Commerce, *Comments on EPA’s Proposed Rule: Proposed National Emission Standards for Hazardous Air Pollutants*; and, in the Alternative, *Proposed Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units 16–17 (2004)*, available at <http://www.uschamber.com/sites/default/files/comments/commentsepaproposedruleonmercury.pdf> (on file with the *Columbia Law Review*).

144. *Id.* at 17.

effects of individual contributions. As the previous Part demonstrates, these one percent arguments have been made with regard to carbon emissions reductions, even though emissions targets cannot reasonably be expected to be achieved without reductions from many one percent sources. To confront one percent arguments, it is critical to change the frame of reference from a focus on exemptions justified individually to a focus on aggregate effects. In the next two Parts we defend a policy tailored to shift the domestic frame of reference from one percent arguments to an aggregate accounting and, at the same time, to address an enormous gap in climate change policy.

In this Part, we defend requiring disclosure of the carbon emissions consequences of proposed and enacted federal legislation. Similar disclosure rules currently require Congress to calculate the financial cost to the federal government (and state and local governments) from bills and enacted legislation. Estimating the emissions costs of legislation would help Congress—perhaps the most important forum for long-term changes in the U.S. carbon emissions growth curve—assess aggregate carbon emissions, debate, set priorities, and make year-over-year comparisons. Publicly available estimates of the carbon emissions of any one piece of legislation and of aggregate emissions from legislative activity will enable a more robust climate mitigation debate and will make it more difficult for advocates to frame issues in ways that lead to the one percent problem. If an advocate for any one source or source category advances a one percent argument, others can assess the merits of the argument against the backdrop of the emissions associated with the particular legislative action and of all legislative activity. Disclosure has much to recommend it as a stand-alone change; it is also a necessary step toward legislative carbon budgeting, which we propose in the next Part. Whereas disclosure facilitates priority setting, budgeting would require individual decisions to be evaluated in relation to the whole.

A. *The Current Carbon Disclosure Regime*

To appreciate the need for a federal legislative carbon disclosure regime, it makes sense to begin with a brief snapshot of the current federal approach to carbon disclosure. Though information disclosure has been an important element of environmental regulation for many years,¹⁴⁵

145. See, e.g., National Environmental Policy Act of 1969, Pub. L. No. 91-190, § 102(2)(c), 83 Stat. 852, 853 (codified as amended at 42 U.S.C. § 4332(2)(C) (2006)) (requiring that federal agencies produce environmental impact statements prior to undertaking major federal actions); Emergency Planning and Community Right-to-Know Act of 1986, 42 U.S.C. § 11023 (requiring covered industrial sectors to file annual reports of disclosures of more than 650 listed toxic substances to create the Toxics Release Inventory). See generally Bradley C. Karkkainen, *Toward a Smarter NEPA: Monitoring and Managing Government's Environmental Performance*, 102 Colum. L. Rev. 903, 955–67 (2002) (providing assessment of role of information disclosure in environmental law and according reform of NEPA).

prior to 2009 most disclosure of carbon emissions was voluntary and occurred at the state, regional, or corporate level.¹⁴⁶ Three developments since 2009 have shifted the emissions disclosure landscape dramatically. These changes highlight the significant momentum toward a more comprehensive disclosure regime and make all the more stark the absence of an emissions accounting scheme as applied to Congress's lawmaking.

First, in 2009, the EPA adopted its first mandatory carbon disclosure regulation, requiring disclosure of the annual carbon emissions from a broad range of industrial and other entities.¹⁴⁷ The EPA estimates that the disclosure rule will require disclosure of approximately 85% of U.S. emissions.¹⁴⁸

Second, also in 2009, President Obama issued an executive order that requires federal agencies to create agency-wide targets for reductions in emissions by 2020 relative to a 2008 baseline.¹⁴⁹ Based on targeting reports by federal agencies, President Obama announced that the federal government would reduce its direct emissions by 28% by 2020.¹⁵⁰ The executive order requires each agency to report annually to the Director of the Office of Management and Budget (OMB) summarizing its progress in achieving the emissions reduction targets it has established,¹⁵¹ and to report annually a "comprehensive inventory" of its direct and indirect emissions.¹⁵² This executive order does not, however, require agen-

146. See Mandatory Reporting of Greenhouse Gases, 74 Fed. Reg. 16,448, 16,457–61 (proposed Oct. 30, 2009) (codified as amended in scattered sections of 40 C.F.R.) (providing concise summary of existing federal, state, and regional emissions reporting programs); Stein, *supra* note 124, at 483–99 (describing agency disclosure of climate change impacts under NEPA); Carbon Disclosure Project, <https://www.cdproject.net/en-US/Pages/HomePage.aspx> (on file with the *Columbia Law Review*) (last visited Aug. 14, 2011) (providing usable inventory of corporate emissions disclosures in absence of mandatory reporting requirements).

147. See Mandatory Reporting of Greenhouse Gases, 74 Fed. Reg. at 52,260 (requiring disclosure of carbon dioxide equivalents).

148. *Id.* at 56,272.

149. See Federal Leadership in Environmental, Energy, and Economic Performance, Exec. Order No. 13,514, § 2(a)–(b), 3 C.F.R. 248, 249–50 (2010).

150. See Press Release, White House Press Office, President Obama Sets Greenhouse Gas Emissions Reductions Targets for Federal Operations (Jan. 29, 2010), available at <http://www.whitehouse.gov/the-press-office/president-obama-sets-greenhouse-gas-emissions-reduction-target-federal-operations> (on file with the *Columbia Law Review*). The President also has directed agencies to reduce indirect emissions by 13% by 2020. Press Release, White House Press Office, President Obama Expands Greenhouse Gas Reduction Target for Federal Operations (July 20, 2010), available at <http://www.whitehouse.gov/the-press-office/president-obama-expands-greenhouse-gas-reduction-target-federal-operations> (on file with the *Columbia Law Review*).

151. Exec. Order No. 13,514, § 8, 3 C.F.R. at 255.

152. To assist this effort, the Executive Order requires the Council on Environmental Quality (CEQ), an executive office agency, in consultation with other agencies to issue guidelines on greenhouse gas accounting and reporting. The CEQ issued Federal Greenhouse Gas Accounting and Reporting Guidance (Oct. 6, 2010) [hereinafter CEQ Accounting Guidance], available at http://www.whitehouse.gov/sites/default/files/microsites/ceq/ghg_guidance_document_0.pdf (on file with the *Columbia Law Review*), as

cies to calculate the carbon implications of their own regulations.¹⁵³ (We address the extension of carbon disclosure and budgeting rules to agency regulations below.)¹⁵⁴

Third, at the same time that federal agencies were establishing the emissions reduction targets required by President Obama's executive order, the Council on Environmental Quality issued draft guidance on how federal agencies can improve their evaluation of GHGs under the National Environmental Policy Act,¹⁵⁵ the centerpiece of federal disclosure requirements for federal government projects and the grandfather of environmental disclosure regimes.¹⁵⁶ This draft guidance proposes that when a federal agency anticipates that its actions will cause direct emissions of 25,000 metric tons or more of GHG annually, the same threshold that applies under the EPA's mandatory disclosure rule, the agency "should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public."¹⁵⁷

These recent developments represent an important shift in the scope and architecture of the federal disclosure regime applicable to carbon. The new measures avoid the most extreme aspects of the one percent problem by focusing disclosure on emissions, rather than on the impact of emissions. As CEQ makes clear in its guidance for applying NEPA, estimated levels of GHG emissions "can serve as a reasonable proxy for assessing potential climate change impacts."¹⁵⁸ This has several advantages. Emissions are more easily estimated than the marginal environmental impact of those emissions. Estimating emissions is also less dependent upon the current state of climate science than is analyzing their impact. Further, these new disclosure requirements facilitate year-over-year compari-

well as an accompanying Technical Support Document Federal Greenhouse Gas Accounting and Reporting Guidance (Oct. 6, 2010) [hereinafter Technical Support], available at http://www.whitehouse.gov/sites/default/files/microsites/ceq/technical_support_document_1.pdf (on file with the *Columbia Law Review*). That Guidance specifically declines to establish de minimis reporting thresholds below which reporting is not required. See CEQ Accounting Guidance, *supra*, at 16. Rather the agency is to use the methodologies in the Technical Support Document to address small or trace emissions. Technical Support, *supra*, at 1.

153. See Exec. Order No. 13,514, § 8, 3 C.F.R. at 255 (requiring agencies to prepare annual Strategic Sustainability Performance Plans for review by CEQ and OMB, but not requiring assessment of carbon impacts of regulations themselves).

154. See *infra* notes 228–233, 264 and accompanying text.

155. Memorandum from Nancy H. Sutley, Council on Env'tl. Quality, to Heads of Federal Departments and Agencies, Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions (Feb. 18, 2010), http://ceq.hss.doe.gov/nepa/regs/Consideration_of_Effects_of_GHG_Draft_NEPA_Guidance_FINAL_0218_2010.pdf (on file with the *Columbia Law Review*) [hereinafter, Sutley Memorandum].

156. Karkkainen, *supra* note 145, at 904–05.

157. Sutley Memorandum, *supra* note 155, at 1.

158. *Id.* at 3; see also Stein, *supra* note 124, at 483–99 (discussing how agencies disclose climate change impacts under NEPA).

son of emissions.¹⁵⁹ These relative comparisons frame emissions information in ways that that can help to address the one percent problem. For example, year-over-year emissions disclosures provide the information necessary to focus the policy debate on how each source can improve as opposed to the contribution of any one source as compared to all others. Studies show that individuals treat relative comparisons of small values as more meaningful than absolute values, for which they typically have little basis for judgment.¹⁶⁰ These new disclosure rules also mandate disclosures from more sources than previously required.

Though important advances, these developments also make all the more plain an enormous gap in our carbon disclosure regime. While carbon disclosure now applies to federal agencies, significant federal actions, and nearly 85% of private sources of emissions, no carbon disclosure requirements currently apply to the institution whose structural decisions most significantly affect the long-term emissions of the country: Congress. Without any disclosure regime that attaches to federal legislation and appropriations, the emissions impact of legislation is not part of most legislative debates.

The result is not only the omission from legislative debate of, but also the creation of a misleading impression concerning, the carbon consequences of federal legislation. Consider, for instance, the 2009 American Reinvestment and Recovery Act (ARRA), the stimulus bill, which included \$787 billion in stimulus spending. The ARRA included important new provisions promoting weatherization, energy efficiency, rail transport, and other requirements that will likely reduce carbon emissions by millions of tons over the short and long term.¹⁶¹ The ARRA allocated the lion's share of the \$787 billion (approximately 90%, or \$700 billion), however, to economic stimulus spending that was not designed to reduce carbon emissions, and only a small share (approximately 10%, or \$70 billion) was reserved for clean energy and other projects likely to reduce carbon emissions.¹⁶² From the perspective of carbon emissions, two im-

159. Sutley Memorandum, *supra* note 155, at 3; see also Karkkainen, *supra* note 145, at 956–57 (praising Toxics Release Inventory (TRI) for providing reports on pollutants released, facilitating benchmarking).

160. See Stone et al., *supra* note 48, at 403 (showing subjects treat relative risks comparisons, such as “twice as safe,” as more meaningful than risk stated in absolute terms); see also Colin Camerer & Howard Kunreuther, *Decision Processes for Low Probability Events: Policy Implications*, 8 *J. Pol’y Analysis & Mgmt.* 565, 570 (1989) (showing same effect); Diane F. Halpern, Sonia Blackman & Billis Salzman, *Using Statistical Risk Information to Assess Oral Contraceptive Safety*, 3 *Applied Cognitive Psychol.* 251, 256 (1989) (showing same effect).

161. American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115 (to be codified in scattered titles of U.S.C.) .

162. See Farhana Hossain, Amanda Cox, John McGrath & Stephan Weitberg, *The Stimulus Plan: How to Spend \$787 Billion*, *N.Y. Times*, http://projects.nytimes.com/44th_president/stimulus (on file with the *Columbia Law Review*) (last visited Nov. 7, 2011) (identifying ARRA projects); see also *Where the US Stimulus Money is Going*, 461 *Nature* 856, 856–57 (2009) (noting allocation of stimulus funds for research).

portant features of the bill are its effects on increasing overall economic activity and its promotion of new infrastructure with long-term carbon implications. The funded infrastructure included not only railroads and local mass transit, which are likely to reduce emissions as compared to many alternatives, but also roads and other projects likely to increase long-term carbon emissions. Although only very general analysis is possible with the limited information available, the general stimulus, road-building, and other provisions may yield carbon emissions that swamp the reductions from the Act's efficiency-related provisions.¹⁶³

Calculating the effects of government economic stimulus on GDP is difficult, but even a very rough estimate provides a sense of the importance of legislative carbon disclosure and budgeting. If we assume that the ARRA was responsible for a 1.5 to 4.2% increase in GDP for the first year (or roughly \$213 billion to \$596 billion in GDP growth),¹⁶⁴ and if we assume that the economy-wide ratio in 2008 of .48 kilograms of CO₂ per dollar of U.S. GDP growth remained constant,¹⁶⁵ this effect of the bill

163. In an implicit recognition of the important nexus between economic activity and carbon emissions, Congress has asked the National Academy of Sciences to conduct a carbon audit of the tax code. See Energy Improvement and Extension Act of 2008, Pub. L. No. 110-343, § 117(a), 122 Stat. 3807, 3831 (“[T]he National Academy of Sciences [shall] undertake a comprehensive review of . . . specific tax provisions that have the largest effects on carbon and other greenhouse gas emissions”); see also Consolidated Appropriations Act of 2010, Pub. L. No. 111-117, 123 Stat. 3034 (to be codified in scattered titles of U.S.C.) (appropriating \$1.5 million to conduct audit).

164. The Congressional Budget Office's report in third quarter of 2010 estimated that the ARRA increased GDP by 1.5–4.2%. Cong. Budget Office, *Estimated Impact of the American Recovery and Reinvestment Act on Employment and Economic Output from April 2010 Through June 2010*, at 3 tbl.1 (2010) [hereinafter Cong. Budget Office, *Estimated Impact*], available at <http://www.cbo.gov/ftpdocs/117xx/doc11706/08-24-ARRA.pdf> (on file with the *Columbia Law Review*). We note that there is substantial uncertainty about the multiplier by which GDP increases when the government spends a dollar. Some models suggest that it is zero (all government spending is wasteful because monetary policy stabilizes the economy), others that it is one (suggesting that stimulus spending simply shifts GDP from the future to now), and yet others that it is infinity (fiscal stimulus saves us from a financial meltdown). See Russell Hall, *How Much Does GDP Rise if the Government Buys More Output?* 3–6 (Nat'l Bureau of Econ. Research, Working Paper No. 15496, 2009), available at <http://www.nber.org/papers/w15496> (on file with the *Columbia Law Review*) (describing different models for multiplier by which GDP increases). We also note the problem that the numbers available through the International Energy Agency are average numbers, whereas the stimulus results in a marginal change. The marginal change is likely to be different from the average, and there also is a broader question regarding whether the ARRA-induced GDP growth is long-term. We are only trying to provide a very rough sense of the impact of the bill, however, and our estimates are valuable even if they are off by an order of magnitude.

165. See Int'l Energy Agency, *IEA Statistics: CO₂ Emissions from Fuel Combustion 89* (2010), available at <http://www.iea.org/co2highlights/CO2highlights.pdf> (on file with the *Columbia Law Review*). These assumptions are necessary in part because there was substantial opposition to calculating the environmental impacts of projects funded by the ARRA, at least ostensibly because the assessment process would delay spending. See Conn Carroll, *NEPA: Yet Another Reason the Stimulus Is Guaranteed to Fail*, *The Foundry* (Feb. 5, 2009, 4:03 PM), <http://blog.heritage.org/2009/02/05/nepa-yet-another-reason-the>

alone would have added 101 million to 284 million metric tons of CO₂ to the atmosphere in the first year. The CO₂ emissions avoided by the weatherization and other energy-related provisions would have to be remarkably large to offset these estimated increases.¹⁶⁶ In sum, although the stimulus bill was promoted as having, and had, many carbon-friendly provisions,¹⁶⁷ largely absent from the debate was the massive net increase in carbon emissions that may have been caused by the bill. Only an analysis of the net carbon emissions of the entire statute would have provided policymakers with an understanding of whether the legislation was consistent not only with economic goals but also with the environmental goal articulated by President Obama of reducing national carbon emissions by 17% by 2020.¹⁶⁸ Such a carbon analysis would prompt the unavoidable

stimulus-is-guaranteed-to-fail (on file with the *Columbia Law Review*) (discussing impact of NEPA delays on stimulus implementation). ARRA activities must clear NEPA review, § 1609, but provisions are in place to ensure the expeditious completion of NEPA reviews, § 1609(b).

166. For example, even if the ARRA target number of 600,000 homes were weatherized, see Press Release, U.S. Dep't of Energy, Secretary Chu Announces Major New Recovery Act Milestone: 300,000 Homes Weatherized (Jan. 19, 2011), available at <http://energy.gov/articles/secretary-chu-announces-major-new-recovery-act-milestone-300000-homes-weatherized> (on file with the *Columbia Law Review*) (noting that by January 2011 half of 600,000 home target had been achieved), and if weatherization reduced home energy consumption by 10%, a figure suggested for weatherization by leading experts, see Gerald T. Gardner & Paul C. Stern, *Environmental Problems and Human Behavior* 259 tbl.10-3 (2d ed. 2002), and household CO₂ emissions are no more than 50 metric tons per year, see Vandenberg & Steinemann, *Carbon-Neutral*, supra note 17, at 1691–94 (estimating total emissions per individual to be over 7 tons per year and 2.59 individuals per household, for total of over 18 tons of CO₂ emissions per household per year), then full implementation of the stimulus weatherization funds could be expected to generate annual emissions reductions of no more than 3 million metric tons (10% x 50 tons per year x 600,000 homes = 3 million tons per year), a figure that is a fraction of our estimate of 102–284 million tons of GDP-related increases in emissions. The GDP calculations draw on the Bureau of Economic Analysis's 2008 fourth quarter dollar amount for GDP, which is \$14,081.7 billion. See Bureau of Econ. Analysis, U.S. Dep't of Commerce, *Current-Dollar and "Real" GDP*, <http://www.bea.gov/national/xls/gdplev.xls> (on file with the *Columbia Law Review*) (last updated Aug. 26, 2011). We used the fourth quarter of 2008 because Table 1 of the CBO report estimates the macroeconomic effect of ARRA in the first quarter of 2009, suggesting that the last quarter of 2008 is a better pre-stimulus baseline. See Cong. Budget Office, *Estimated Impact*, supra note 164, at 3 tbl.1. The totals were calculated as follows: .015 x 14,081.7 billion x .00048 tons of carbon dioxide (= 101 million tons of CO₂) and .042 x 14,081.7 billion x .00048 tons of carbon dioxide (= 284 million tons of CO₂).

167. See Sins of Emission, *Economist*, Mar. 14, 2009, at 26, ("The administration has dedicated roughly a tenth of the \$787 billion to be spent under the stimulus bill to energy and the environment . . . includ[ing] \$33 billion to green the country's electricity supply, \$27 billion for energy efficiency and \$19 billion for cleaner forms of transport.")

168. See Press Release, White House Press Office, President to Attend Copenhagen Climate Talks (Nov. 25, 2009), available at <http://www.whitehouse.gov/the-press-office/president-attend-copenhagen-climate-talks> (on file with the *Columbia Law Review*) ("[T]he President is prepared to put on the table a U.S. emissions reduction target in the range of 17% below 2005 levels in 2020."). See generally Office of Mgmt. & Budget, *Creating the Clean Energy of Tomorrow and Protecting the Environment and Natural Resources*, The

but as yet largely postponed national debate over the tension between economic growth goals and carbon emissions reduction targets.

B. *Legislation and Disclosure*

Because federal legislation is so important to our long-term emissions strategy, Congress's legislative choices should not be made without consideration of their carbon emissions consequences. The character of the collective action problem created by the climate problem also recommends that all proposed and enacted legislation be subject to carbon disclosure.

The suggestion that proposed and enacted legislation should be accompanied by estimates of its carbon emissions impact might initially sound adventurous. Information disclosure and analysis rules, however, have a well-established and growing place in the legislative process. As we explain below, estimates of carbon emissions would not only respond to the same type of information deficits and collective action problems that motivated existing legislative disclosure requirements, but could also employ a similar design.

1. *Congress's Self-Imposed Fiscal Disclosure Requirements.* — Numerous disclosure and analysis requirements currently apply to congressional committee reports and legislation. In the House of Representatives, for instance, a committee report must contain estimates of the cost to the federal government of the legislation,¹⁶⁹ an estimate of the unfunded costs to nonfederal entities,¹⁷⁰ a statement of the constitutional authority for the bill,¹⁷¹ and a preemption statement.¹⁷² Senate rules require, in addition, that committee reports accompanying bills contain an evaluation of the regulatory impact of the bill, including its effects on individuals and businesses, its impact on privacy, and the additional paperwork it requires.¹⁷³

By far the oldest and most cross-cutting legislative disclosure requirements relate to the budget and financial consequences of legislation.¹⁷⁴ For our purposes, it is useful to focus on two of the most influential budget-related disclosure rules. First, as part of the near-total reform of

Federal Budget, Fiscal Year 2012, <http://www.whitehouse.gov/omb/factsheet/creating-the-clean-energy-of-tomorrow> (on file with the *Columbia Law Review*) (last visited Aug. 14, 2012) (describing Administration's energy and environmental policy).

169. Rules of the House of Representatives, Rule XIII, cl. 3(c)-(d), 112th Cong. (2011) [hereinafter House Rules], available at http://rules.house.gov/Media/file/PDF_112_1/legislativetext/112th%20Rules%20Pamphlet.pdf (on file with the *Columbia Law Review*).

170. 2 U.S.C. § 658b(c)-(d) (2006).

171. House Rules, *supra* note 169, Rule XII, cl. 7(c).

172. 2 U.S.C. § 658b(e).

173. Standing Rules of the Senate, S. Doc. No. 110-9, Rule XXVI, cl. 11(b)(1) (2007).

174. See Garrett & Vermeule, *supra* note 23, at 1307 ("The most influential and ubiquitous procedural framework designed to produce and structure information is the congressional budget process.").

the federal budgeting process in the Congressional Budget and Impoundment Control Act of 1974,¹⁷⁵ Congress created the Congressional Budget Office and required the CBO to calculate the costs incurred over a four-year period by each bill or joint resolution reported by any committee of the House or Senate.¹⁷⁶ Whenever feasible, these bill-by-bill estimates are to be included in the committee reports accompanying the proposed legislation.¹⁷⁷ The Act also requires the CBO to provide an annual report to Congress of its fiscal policy, including the budget consequences of newly enacted legislation.¹⁷⁸ The point of these disclosure requirements was to furnish Congress with detailed information concerning the budget consequences of proposed legislation so that its budget consequences form part of the legislative debate, and to provide an external measure of the budget consequences of enacted legislation.

In the 1990s, a second reform resulted from concerns raised by state and local officials that federal legislation was regularly imposing requirements on state and local governments without appropriating funds to pay for implementing these requirements—so-called unfunded federal mandates.¹⁷⁹ By enacting unfunded federal mandates, federal lawmakers could claim credit for popular new programs without having to pay for them from the federal fisc or through unpopular tax increases.¹⁸⁰ In response to these concerns, Congress enacted the Unfunded Mandates Reform Act of 1995 (UMRA).¹⁸¹ The mechanics of UMRA are similar to the budget disclosure requirement of the 1974 Budget Act: When proposed legislation includes any federal mandate, UMRA requires the authorizing congressional committee to submit the bill to the Congressional Budget Office and identify the mandate.¹⁸² A statement by the CBO estimating the direct cost of the mandate must be included in the commit-

175. Pub. L. No. 93-344, 88 Stat. 297 (codified as amended at 2 U.S.C. §§ 601–688).

176. See *id.* § 403, 88 Stat. at 320 (codified as amended at 2 U.S.C. § 653(1)). CBO prepares hundreds of these cost estimates a year. See Cong. Budget Office, Cost Estimates for the 111th Congress, <http://www.cbo.gov/CEBrowse.cfm> (on file with the *Columbia Law Review*) (last visited Aug. 14, 2011) (listing current estimates for various bills).

177. 2 U.S.C. § 653. These requirements also are now incorporated in congressional rules. See, e.g., House Rules, *supra* note 169, Rule X, cl. 4(f) (requiring submission of “estimates with respect to all matters to be set forth in the concurrent resolution”).

178. 2 U.S.C. § 602(e). For an example of such a report, see generally Cong. Budget Office, Pub. No. 4156, *The Budget and Economic Outlook: An Update* (2010) (providing annual report to Congress).

179. See John Dinan, *Strengthening the Political Safeguards of Federalism: The Fate of Recent Federalism Legislation in the U.S. Congress*, *Publius*, Summer 2004, at 55, 56–57 (describing concerted efforts by major state and local government organizations to end unfunded mandates).

180. See Elizabeth Garrett, *Framework Legislation and Federalism*, 83 *Notre Dame L. Rev.* 1495, 1514 (2008) [hereinafter Garrett, *Framework Legislation*] (describing incentives of legislators to support unfunded mandates); Anita S. Krishnakumar, *Representation Reinforcement: A Legislative Solution to a Legislative Process Problem*, 46 *Harv. J. on Legis.* 1, 17 (2009) (same).

181. Pub. L. No. 104-4, 109 Stat. 48 (codified at 2 U.S.C. §§ 658–658g, 1501–1571).

182. 2 U.S.C. § 658b(b).

tee's report on the bill.¹⁸³ Any bill that does not include a statement,¹⁸⁴ or that includes unfunded mandates over an inflation-adjusted threshold of expenses in any given year for the next four, is subject to a point of order.¹⁸⁵ The goals of UMRA are also similar to those of the 1974 Budget Act's simple disclosure rule: to create better information about the costs of unfunded mandates in the legislative process and to raise the political costs to Congress of imposing these mandates.¹⁸⁶

Although the UMRA has its limitations, including the fact that it does not apply to duties imposed on states as a condition of receiving federal assistance,¹⁸⁷ it is generally credited with influencing congressional deliberation and legislative choices.¹⁸⁸ Because proponents of legislation generally seek to avoid triggering unfunded mandate issues under UMRA, UMRA may exert its most important influence on legislation at the drafting stage, "forc[ing] lawmakers and their staffs to consider . . . the impact that proposed bills would have on state and local governments."¹⁸⁹ Congress infrequently enacts legislation that exceeds the statutory thresholds of UMRA. Between 1996 and 2005, of the 5,769 bills that the CBO reviewed, it identified sixty-four that contained unfunded mandates that exceeded the cost threshold; five of those were enacted.¹⁹⁰ Between 2005 and 2010, Congress enacted an average of fewer than three laws per year that exceeded the statutory threshold.¹⁹¹ Although these figures do not provide an assessment of the total financial

183. *Id.* § 658b(a), (c)–(d), (f) (requiring committee to include and publish CBO's report); *id.* § 658c(a)–(b) (requiring CBO to prepare report).

184. *Id.* § 658d(a)(1).

185. *Id.* § 658d(a)(2). The 2010 yearly threshold, adjusted for inflation, was \$70 million for intergovernment mandates. Cong. Budget Office, Pub. No. 4255, *A Review of CBO's Activities in 2010 Under the Unfunded Mandates Reform Act 1* (2011) [hereinafter Cong. Budget Office, *Activities in 2010*].

186. See 141 Cong. Rec. 7749, 7749 (1995) (statement of Sen. John Glenn ("[O]ne of the major objectives of [UMRA] is to develop better information and data on the cost of mandates and to force that to be considered up front."); see also Garrett, *Framework Legislation*, *supra* note 180, at 1500 (noting same goal).

187. 2 U.S.C. § 658(7)(A)(i). See generally U.S. Gov't Accountability Office, GAO-05-454, *Unfunded Mandates: Views Vary About Act's Strengths, Weaknesses, and Options for Improvement* (2005) (providing relatively comprehensive assessment of UMRA's strengths and weaknesses).

188. See Garrett, *Framework Legislation*, *supra* note 180, at 1505 (arguing UMRA has affected substance of legislation and dynamics of legislative process); Krishnakumar, *supra* note 180, at 19–20 (crediting UMRA based on CBO studies with influencing congressional behavior and decreasing number of bills with unfunded mandates above statutory threshold).

189. Krishnakumar, *supra* note 180, at 20–21 (recounting anecdotal evidence of success); see also Garrett, *Framework Legislation*, *supra* note 180, at 1505–06 ("[UMRA] has changed the way that prospective legislation is drafted Anytime there is a markup, this always comes up." (quoting then-H. Rules Comm. Chairman Gerald Solomon)).

190. Cong. Budget Office, *A Review of CBO's Activities Under the Unfunded Mandates Reform Act, 1996 to 2005*, at 4–5 (2006).

191. Cong. Budget Office, *Activities in 2010*, *supra* note 185, at 5. Two such laws were enacted in 2006, three in 2007, one in 2008, none in 2009, and seven in 2010. *Id.*

effects of mandates that fall below the statutory threshold,¹⁹² and although the 1974 Budget Act's mandate for cost estimates for bills has not single-handedly contained the federal deficit, these two Acts' disclosure requirements at least provide information so that Congress and the public can have an independent basis on which to debate the costs of legislation. In addition, the credibility of CBO cost estimates can alter the dynamics of the legislative process.¹⁹³ Lawmakers may more easily discount cost studies generated by interest groups as the product of self-interest or bias.¹⁹⁴ As a result, CBO cost estimates can arm interest groups with data from a credible, independent source.¹⁹⁵

2. *Carbon Disclosure Rule for Congress* — Legislation has not only budget implications, but also carbon emissions implications. The basic idea of a legislative disclosure requirement is that the carbon emissions consequences of proposed legislation should be considered, just as budget consequences are, during the legislative process.

A legislative carbon emissions disclosure requirement could adopt the same basic structure as the congressional budget disclosure rules. Specifically, a unit of the Congressional Budget Office could provide estimates of the carbon consequences of legislation to be included in committee reports on the proposed legislation.¹⁹⁶ It could also require the CBO to produce an annual report calculating the carbon emissions impact of newly enacted legislation. Like UMRA, the disclosure regime could require that any bill considered on the floor include estimates of the bill's carbon consequences, and enforce this requirement through a point of order, waivable by a majority vote. This enforcement structure has proved critical for UMRA.¹⁹⁷ These requirements could be implemented through legislation or first adopted in House or Senate Rules.¹⁹⁸

192. See Garrett, *Framework Legislation*, supra note 180, at 1511 (noting CBO does not assess cumulative impact of unfunded mandates below statutory threshold).

193. See Elizabeth Garrett, *Enhancing the Political Safeguards of Federalism? The Unfunded Mandates Reform Act of 1995*, 45 U. Kan. L. Rev. 1113, 1148–50 (1997) [hereinafter Garrett, *Enhancing*] (discussing national policymakers' perception of CBO cost estimates as credible and disinterested).

194. See *id.* at 1148 (“Studies produced by the intergovernmental lobby on the costs of unfunded mandates have been discounted as the product of self-interested parties who are seeking to promote their own agenda.”).

195. *Id.* at 1150 (“CBO’s estimates will be well regarded because of its reputation, and those representing states’ interests before national lawmakers may find their arguments given more weight when they can rely on this information.”).

196. Alternatively, the carbon calculation function could be vested in a freestanding agency. The critical point, as noted below, is that the agency with this responsibility should have, or have the capacity to develop, the credibility of CBO. Indeed, CBO’s credibility recommends reposing this responsibility in it.

197. See Garrett & Vermeule, supra note 23, at 1312 (noting that prior to UMRA, with its enforcement structure, Congress frequently ignored other requirement to produce fiscal notes on cost imposed on states and local governments).

198. Both the House and Senate currently have rules that require disclosure of the budget consequences of proposed legislation. See S. Con. Res. 21, 110th Cong. § 201 (enacted) (2007) (adopting Senate pay-as-you-go point of order); H.R. Res. 6, 110th Cong.

This disclosure regime has several motivations. First, carbon emissions are currently not even calculated by any authoritative source within the legislative process. Second, as illustrated by the stimulus bill,¹⁹⁹ without such disclosure the carbon emissions consequences of legislation are frequently misunderstood. Although disclosure would not guarantee that legislators would consider the carbon emission costs of legislation, it would at least facilitate them doing so, either on their own initiative or in response to lobbying from interest groups using this information.²⁰⁰

The parallels between a carbon disclosure rule and unfunded mandates are close. In both cases, classic problems of collective action and public choice give legislators incentives either to shift costs to the states, in the case of unfunded mandates, or not to account for them at all, in the case of carbon emissions. As with unfunded mandates, a disclosure rule for carbon emissions would function as a precommitment strategy of a minimally invasive kind: It would effectively force the individual members and the institution to consider and to at least implicitly endorse or reject the carbon emissions of legislation. Moreover, as with federal unfunded mandates, simply requiring that these estimates be produced by the CBO, an office with credibility across party lines, and upon which Congress relies for budget estimates, could have an important effect on the dynamics of the legislative process. A credible set of estimates would improve the quality of the debate within Congress and the lobbying of Congress by providing a single set of data for all to consider. More generally, this approach would more closely align Congress's own carbon disclosure obligations with those of the federal agencies and much of private industry.

With regard to technical feasibility, too, budget cost estimates and carbon estimates are comparable in many respects. Although we have had a longer national experience with budget estimates, carbon emissions calculations have become far more sophisticated in recent years. To be sure, carbon emissions estimates involve a level of judgment, including making projections about future economic cycles and growth, selecting appropriate benchmarks when specific data are unavailable, and having a willingness to stop the analysis if additional precision provides sharply diminishing returns.²⁰¹ But in response to the recent tide of disclosure requirements for private industry and the federal government, firms and governments are already making these types of calculations. Under the

§ 405 (enacted) (2007) (adopting House pay-as-you-go point of order). House and Senate Rules could also be the source of a carbon disclosure requirement. As an interim measure, these carbon cost-of-legislation estimates could be produced by a private organization such as those established to monitor government action.

199. See *supra* text accompanying notes 161–168 (discussing how stimulus bill relates to environmental regulation).

200. Garrett, *Enhancing*, *supra* note 193, at 1164.

201. See, e.g., Michael P. Vandenbergh & Mark A. Cohen, *Climate Change Governance: Boundaries and Leakage*, 18 *N.Y.U. Envtl. L.J.* 221, 282 (2010) (discussing use of benchmarks to calculate carbon emissions in corporate supply chains).

United Nations Framework Convention on Climate Change, the EPA already generates an annual report of the total carbon emissions from the United States as a whole.²⁰² In addition, as noted above, federal law now requires all federal agencies to estimate their carbon emissions through 2020,²⁰³ requires significant federal agency projects to include estimates of their carbon emissions,²⁰⁴ and requires large industrial facilities in the United States to disclose emissions.²⁰⁵ Several states have adopted carbon emissions disclosure requirements for government and private emissions.²⁰⁶ A large portion of the largest firms in the world also produce detailed annual reports of their emissions under the voluntary Carbon Disclosure Project guidelines.²⁰⁷

To facilitate these disclosure estimates several broadly used carbon registries have developed sophisticated estimation protocols.²⁰⁸ The EPA has also provided extensive technical guidance to the regulated community on how to make the calculations for annual facility emissions reporting.²⁰⁹ Similarly, the CEQ has provided draft guidance to agencies on how to fulfill their reporting obligations.²¹⁰

202. See generally EPA, Inventory, *supra* note 14.

203. Federal Leadership in Environmental, Energy, and Economic Performance, Exec. Order No. 13,514, § 2, 3 C.F.R. 248, 249 (2010).

204. Sutley Memorandum, *supra* note 155, at 2.

205. Mandatory Reporting of Greenhouse Gases, 74 Fed. Reg. 56,260, 56,272 (Oct. 30, 2009) (codified as amended in scattered sections of 40 C.F.R.); see also Carbon Disclosure Project, <https://www.cdproject.net/en-US/Pages/HomePage.aspx> (on file with the *Columbia Law Review*) (last visited Oct. 16, 2011) (reporting organizations' disclosures).

206. See, e.g., The Global Warming Solutions Act, 2006 Cal. Legis. Serv. ch. 488 (A.B. 32) (West) (requiring reporting of greenhouse gas emissions from California emissions sources); Cal. Code Regs. tit. 17, §§ 95100–95133 (2010) (requiring reporting and verification of state greenhouse gas emissions); 310 Mass. Code Regs. § 7.71 (2010) (same); N.H. Code R. Env-A 900 (Lexis Nexis 2010) (requiring same of owners and operators of emissions sources); Nw. States in Action, Climate Solutions, <http://climate.solutions.org/nw-states/?searchterm=Nw.%20States%20in%20Action> (on file with the *Columbia Law Review*) (last visited Sept. 5, 2011) (providing updates on state environmental action).

207. “The Carbon Disclosure Project is an independent not-for-profit organization holding the largest database of primary corporate climate change information in the world.” Carbon Disclosure Project, *supra* note 205; see also Greenhouse Gas Protocol, About the GHG Protocol (2011), <http://www.ghgprotocol.org/about-ghgp> (on file with the *Columbia Law Review*) (“The Greenhouse Gas Protocol is the most widely used international accounting tool for government and business leaders to understand, quantify, and manage greenhouse gas emissions.”).

208. See *supra* note 206 and accompanying text (describing state emissions disclosure requirements).

209. See Sutley Memorandum, *supra* note 155, at 1 (citing CEQ's technical guidance under NEPA); Technical Support, *supra* note 152, at 1 (citing EPA's technical guidance under its mandatory disclosure rule).

210. See Sutley Memorandum, *supra* note 155, at 1 (citing CEQ's technical guidance under NEPA).

The legislative emissions estimates could include direct and indirect emissions to reduce incentives for leakage,²¹¹ but a rule of reason could be followed to ensure that the time and transaction costs of calculating carbon emissions do not become prohibitive. Further, to avoid making the calculations overly burdensome, reasonable constraints could be placed on the extent of the indirect emissions (e.g., including only first- and second-tier suppliers) and time period (e.g., the ten-year time horizon used for budgeting purposes) subject to analysis.²¹² Fiscal budgeting involves similar uncertainty. The Congressional Budget Office routinely creates estimates of projected effects of legislation and budget proposals based on different models of macroeconomic changes likely in the next ten years, and routinely makes assumptions about how other legislation, including changes in tax policy, might affect their estimates.²¹³ Carbon emission estimates and budget estimates both involve similar types of judgments and assumptions based on uncertainty about future events.

At a fundamental level, the carbon disclosure proposal builds on the core insight that if a set of interests is not being sufficiently protected by federal legislation, it is worth adopting new legislative procedures to help those interests.²¹⁴ That approach has been taken with federalism interests,²¹⁵ and with deficit reduction goals.²¹⁶ A requirement that the carbon impact of legislation be disclosed would fall in the same class. At the same time, it also directly addresses the most important gap in our current carbon disclosure regime. As noted above, current law requires dis-

211. For a discussion of the importance of leakage (the shifting of emissions from a jurisdiction where emissions are regulated to one where they are not), indirect emissions, and methods of reducing the costs of calculating indirect emissions, see Michael P. Vandenbergh, *Climate Change: The China Problem*, 81 S. Cal. L. Rev. 905, 945–50 (2008); Vandenbergh & Cohen, *supra* note 201, at 282.

212. Alternatively, the disclosure could apply only to legislation that involves more than a threshold level (e.g., 10,000 or 25,000 metric tons) of carbon per year. The 25,000-ton threshold, as discussed above, was adopted in the EPA's mandatory disclosure rule and the executive order requiring GHG targeting by agencies. See *supra* text accompanying note 157.

213. For an example of the assumptions the CBO must make in creating protections, see, for example, Cong. Budget Office, *An Analysis of the President's Budgetary Proposals for Fiscal Year 2011* app. B (2010), http://www.cbo.gov/ftpdocs/112xx/doc11280/front_matter.shtml (on file with the *Columbia Law Review*) (using "textbook" growth model," "life-cycle growth model," and "infinite-horizon growth model" to analyze supply-side effects of budget); *id.* app. A (relying on assumptions about tax policy in ten-year period of budget estimate).

214. See Garrett, *Enhancing*, *supra* note 193, at 1115 ("[I]f one believes that federalism interests are insufficiently protected, one should consider directing some efforts toward the adoption of new legislative procedures.").

215. See *supra* text accompanying notes 179–195 (discussing Unfunded Mandates Reform Act of 1995).

216. See *supra* text accompanying notes 175–178 (discussing 1974 Budget Act).

closure for federal agencies and much of private industry, but not for federal legislation. Congress is the outlier.²¹⁷

IV. PAY-AS-YOU-GO EMISSIONS BUDGETING

The literature on emissions disclosure by governments and private firms suggests that disclosure alone often has a surprisingly strong influence on decisionmaking.²¹⁸ But given that carbon emissions are deeply intertwined with economic activity, it would be naive to assume that disclosure alone would prompt Congress to achieve substantial overall reductions in carbon emissions in the near term without an enforcement mechanism. Instead, after an initial disclosure-alone period to fine-tune the carbon emissions estimation process for legislation, Congress should subject all federal legislation to emissions budgeting, similar to the Pay-As-You-Go (PAYGO) budget regime adopted in the 1990s to reduce the deficit.²¹⁹ As with the disclosure regime we sketch, an emissions PAYGO approach could be adopted not just by Congress but also by states and municipalities.²²⁰ Under this regime, the net effects of legislation ap-

217. This regime could also be adopted by state and local legislative bodies, and transnational legislative powers, such as the European Union. It is also worth highlighting the active congressional interest in legislative disclosure requirements. In a 2001 article, Elizabeth Garrett and Adrian Vermeule proposed adoption of “constitutional impact statements,” which, similar to the proposal we make here for carbon disclosure, would require committees to include a statement of the bill’s constitutional implications before it could be debated on the floor. Garrett & Vermeule, *supra* note 23, at 1310. On January 5, 2011, the House revised its own rules to require such a statement of the Congress’s constitutional power to enact the proposed legislation. See House Rules, *supra* note 169, Rule XII, cl. 7(c)(1) (adopted Jan. 5, 2011). The House revision does not require as detailed a statement as Professors Garrett and Vermeule proposed, but it clearly seeks to prompt more deliberation about Congress’s constitutional powers. See *id.* In its justification for this Rule, the House Rules Committee writes, “Just as a cost estimate from the Congressional Budget Office informs the debate on a proposed bill, a statement outlining the power under the Constitution that Congress has to enact a proposed bill will inform and provide the basis for debate.” Comm. on Rules, U.S. House of Representatives, New Constitutional Authority Requirement for Introduced Legislation (Jan. 5, 2011), <http://rules.house.gov/about/PolicyDetail.aspx?NewsID=72> (on file with the *Columbia Law Review*). So too with regard to carbon emissions.

218. See Shameek Konar & Mark A. Cohen, Information as Regulation: The Effect of Community Right to Know Laws on Toxic Emission, 32 *J. Envtl. Econ. & Mgmt.* 109, 123 (1997) (finding relationship between toxic release reporting and later toxic emissions).

219. Budget Enforcement Act of 1990, Pub. L. No. 101-508, tit. XIII, §§ 13201–13204, 104 Stat. 1388, 1388-609 to 1388-616 (codified as amended in scattered sections of 2 U.S.C.). Federal agencies, as noted above, have already committed to reducing emissions by 28% in ten years. See *supra* text accompanying note 150.

220. In particular, the PAYGO approach may provide the carbon discipline necessary for many cities to achieve the commitments made in the Mayors Climate Protection Agreement, which has been signed by more than 1,000 mayors and which requires essentially that government operations achieve the carbon emissions targets included for the United States in the Kyoto Protocol. U.S. Conference of Mayors, U.S. Mayors Climate Protection Agreement (2005), available at <http://www.usmayors.org/climateprotection/documents/mcpageement.pdf> (on file with the *Columbia Law Review*).

proved in any congressional term must fall within an established emissions budget, just as under budgetary versions of PAYGO the net effect of federal spending has to fall within particular deficit reduction goals. The PAYGO approach can be used with a simple no-net-increase rule or can follow a particular carbon emissions reduction glide path.

The turn to PAYGO rules is admittedly a second-best solution. It concedes that fine-tuning the optimum annual national emissions budgets and specific target reductions has been stalled politically; to date, our ordinary political process has not led to significant emissions reductions, and it shows little signs of doing so. In light of this impasse, a first pragmatic step is to require that, to the extent a new statute, appropriation, or major agency action increases carbon emissions, equal or greater emissions reductions would need to be found elsewhere from within the wing-span of Congress or the relevant agency.

PAYGO emissions budgeting directly confronts the analytic slippage and cognitive effects that create the one percent problem. The one percent problem emerges from treating each case individually, irrespective of the cumulative effects on the whole, and of treating small contributions as if they did not exist. In contrast, this budgeting approach requires individual decisions to be made with reference to cumulative targets. Under PAYGO budgeting, it does not matter whether a source affected by legislation is one percent or less; what matters is that the net effect of the legislation produce equal or lesser carbon emissions.

A. *Our Two Deficits: Budget and Emissions*

The government's fiscal deficit and the emissions problem have striking parallels. To begin with, in both areas we are running a severe deficit. The government's fiscal deficit has ballooned in the last ten years.²²¹ The country is also emitting far more GHGs on an annual basis than climate models allow. As we addressed in Part II, climate scientists have established targets for emissions reductions needed to keep atmospheric carbon concentrations below 450 to 500 ppm of CO₂, and thus to decrease the risk of catastrophic climate change.²²² Although the exact level and slope of the descending glide path of net emissions is still subject to some debate, it is clear that the country's current net emissions far exceed those targets. With a small exception arising from the recession, the trend of U.S. emissions is ascending.²²³ In short, we are in the red: Our national emissions far exceed our target budgets, just as our current federal spending far exceeds federal revenues.

221. See Cong. Budget Office, *Federal Debt and Interest Costs 11* (Dec. 2010), available at <http://www.cbo.gov/ftpdocs/119xx/doc11999/12-14-FederalDebt.pdf> (on file with the *Columbia Law Review*) (showing change from federal budget surplus of \$236 billion in 2000 to federal budget deficit of \$1,294 billion in 2010).

222. See *supra* text accompanying notes 84–85.

223. Matthew L. Wald, *Recession Special: Cleaner Air*, N.Y. Times, Jan. 16, 2011, at WK2.

With regard to political dynamics, the emissions problem is surprisingly analogous to the deficit problem. The political costs of deficit reduction are near-term, specific to identifiable interest groups, and easy to quantify, but the benefits (lower bond rates, etc.) are long-term, diffuse, and difficult to quantify. So too with emissions reductions: The costs of reductions are near-term, easy to quantify, and target identifiable groups; the benefits are long-term, hard to quantify, and have diffuse impacts.

Finally, like the climate change problem, the government's fiscal deficit is an instance of a one percent problem. Government spending follows from so many decisions by so many actors that it is frequently individually rational for those actors to continue to spend, or seek more funding, without attention to the cumulative effects of those decisions. The arguments for seeking more spending in those cases are one percent arguments: They rely on assessing individual contributions or expenditures one by one in relation to some whole or denominator ("my contributions are just one percent of the problem or budget"),²²⁴ and do so without considering the cumulative effects of those individual decisions. This allows individual spending decisions to creep upward, each decision rationalized on its own terms, without attention to their cumulative effects. Once those individual decisions lead to the undesired aggregate outcome, they create a budget one percent problem to stand alongside the emissions one percent problem.

B. *Fiscal Versus Carbon Deficit Accounting*

One very stark difference between the government's fiscal deficit and the carbon deficit concerns accounting and budgeting measures. With the fiscal deficit, the government monitors and records the magnitude of the deficit. A principal statutory duty of the Congressional Budget Office is to prepare budget projections and cost estimates of legislation.²²⁵ The CBO publishes multiple reports a year on the state of the federal deficit,²²⁶ and the federal deficit is a major issue for political consideration and evaluation in Congress.

224. See, e.g., 155 Cong. Rec. S10,257, S10,269 (daily ed. Oct. 8, 2009) (statement of Sen. Bill Nelson) (defending NASA spending as "less than 1 percent of the total Federal budget"); 150 Cong. Rec. H4175, H4217 (daily ed. June 16, 2004) (statement of Rep. Louise Slaughter) (advocating for increase in spending for federal arts agencies as "1/100 of 1 percent of the Federal budget"); 140 Cong. Rec. H3967, H4036 (daily ed. May 25, 1994) (statement of Rep. Nita Lowey) (advocating for foreign aid bill as "such a small percentage of Federal spending—less than 1 percent of the budget").

225. See 2 U.S.C. § 653(1) (2006).

226. See, e.g., Cong. Budget Office, Budget and Economic Information, <http://www.cbo.gov/budget/budget.cfm> (on file with the *Columbia Law Review*) (last visited Aug. 27, 2011) (stating that "Monthly Budget Reviews . . . help to inform the Congress and the public on the monthly status of outlays, receipts, and the deficit or surplus throughout the fiscal year").

As we have seen, the same is not true regarding carbon emissions.²²⁷ The closest the federal government comes to tracking and targeting carbon emissions is the process created by the 2009 executive order discussed above.²²⁸ The executive order provides a useful starting point for discussing carbon budgeting. As we noted above, the executive order requires agencies to create agency-wide targets to reduce emissions by 2020 relative to a 2008 baseline.²²⁹ Based on emissions targets generated by each agency, President Obama announced that the federal government would reduce its direct emissions by 28% from the 2008 baseline by 2020,²³⁰ reduce its indirect emissions by 13% by 2020,²³¹ and provide an annual monitoring mechanism.²³²

The executive order represents a significant advance in several respects. First, and most important, the agency-wide focus frames agency actions in terms of the agency's net emissions; if the agency increases emissions for some activities, it must assess whether emissions reductions can be achieved elsewhere. Second, the executive order requires agencies to set targets for agency-wide emissions reductions, and enforces these targets with compliance and monitoring obligations. This is an elementary form of budgeting. Third, the executive order requires comparisons relative to a baseline, facilitating year-over-year or relative comparisons.²³³

Of course, the executive order does not extend to Congress. Congress has no baseline of yearly emissions within which it must keep its legislative activity. Given both that carbon emissions can be readily estimated and that the course of the nation's emissions needs to be reversed, it makes sense to understand our national carbon emissions as an analog to deficit expenditures—that is, to see it as a consideration, like spending and revenue, relevant to virtually every government action.

C. *What Budgeting Rule for Carbon?*

Developing an emissions budgeting scheme for carbon emissions is an ambitious task; we aim here only to sketch some of the basic building blocks for a legislative budgeting scheme. Given that the federal govern-

227. See *supra* text accompanying notes 188–190 (discussing disclosure of financial costs of legislation).

228. Federal Leadership in Environmental, Energy, and Economic Performance, Exec. Order No. 13,514, 3 C.F.R. 248 (2010).

229. *Id.* § 2(a)–(b), 3 C.F.R. at 249–50 (2010).

230. Press Release, White House Press Office, President Obama Sets Greenhouse Gas Emissions Reduction Target for Federal Operations, *supra* note 150.

231. Press Release, White House Press Office, President Obama Expands Greenhouse Gas Reduction Target for Federal Operations, *supra* note 150.

232. See *supra* text accompanying notes 151–152 (discussing agencies' emissions reduction reporting requirements).

233. See J.B. Ruhl & James Salzman, *Gaming the Past: The Theory and Practice of Historic Baselines in the Administrative State*, 64 *Vand. L. Rev.* 1, 18–44 (2011) (showing benefits and possible manipulation of historical baselines as regulatory metric).

ment does not evaluate legislation's impact on emissions, subjecting legislation to some budgeting, regardless of the particular budgeting rule, would be a tremendous advance in addressing the one percent problem for carbon emissions. Budgeting changes the frame of reference from individual expenditures to the cumulative impact of many small (and large) decisions. That change of reference exposes what one percent arguments seek to obscure: the net impact of decisions expressed in a single metric. Carbon emissions budgeting would force decisions to be made in reference to net effects, as opposed to allowing the frame of reference to be defined so that cumulative effects fall outside the framework of decision.

In view of the benefits of budgeting, the question is what budgeting rule fits the emissions problem. In the next sections, we argue that the severity of the emissions deficit, and the political tradeoffs required to solve it, recommend a budgeting precommitment strategy of last resort, a PAYGO rule, and address how a PAYGO rule fits alongside other carbon emissions reduction policies.

1. *Fiscal PAYGO Budgeting.* — The basic idea of PAYGO budgeting is straightforward: It requires that additional spending (or reductions in revenue) that exceed a target budget be “paid for” either by offsetting decreases in spending or increases in revenue.²³⁴ In other words, a PAYGO rule requires the legislative actions to which it applies be cost-neutral, in the sense that they do not increase the budget deficit (or reduce a surplus) over a specified target.²³⁵

PAYGO budget rules rose to prominence in the late 1980s and early 1990s as a second-best approach to fiscal budgeting after successive Congresses and presidential administrations had proven unable to stick to a target budget. In 1985, Congress enacted the Balanced Budget and Emergency Deficit Control Act of 1985 (known as Gramm-Rudman-Hollings),²³⁶ which established target budget deficits and a process for sequestration of funds for overages.²³⁷ The Congress and the President, however, failed to meet the target deficit reductions set in the Gramm-Rudman-Hollings Act, and in 1990, established a PAYGO budgeting process applicable to discretionary spending.²³⁸ After

234. Cong. Budget Office, CBO Staff Memorandum: Pay-As-You-Go Budgeting 1 (1990), available at <http://www.cbo.gov/ftpdocs/77xx/doc7750/90-CBO-019.pdf> (on file with the *Columbia Law Review*).

235. Perspectives on Renewing Statutory PAYGO: Hearings Before H. Comm. on the Budget, 110th Cong. 13 (2007) [hereinafter PAYGO Hearing] (statement of Peter Orszag, Director, Congressional Budget Office).

236. Pub. L. No. 99-177, 99 Stat. 1038 (codified as amended in scattered sections of 2 U.S.C.).

237. See *id.* § 201, 99 Stat. at 1039 (providing five-year reductions of maximum deficits); *id.* §§ 251–253, 99 Stat. at 1063–78 (providing process for sequestration in view of overages).

238. Budget Enforcement Act of 1990, Pub. L. 101-508, §§ 13201–13204, 104 Stat. 1388, 1388 (codified as amended in scattered sections of 2 U.S.C.); Robert Keith, Cong.

reinstatement in 1993 and 1997, Congress allowed the statutory PAYGO requirements to lapse in 2002.²³⁹ From 2002 to 2010, PAYGO rules had a bumpy ride of lapse and reenactment,²⁴⁰ serving for a period only as internal rules of the House and Senate until the reinstatement of statutory PAYGO budgeting on a permanent basis in 2010 in the Statutory Pay-As-You-Go Act of 2010.²⁴¹ Like its predecessors, the 2010 Act aims “to enforce a rule of budget neutrality on new revenue and direct spending legislation.”²⁴²

The 2010 Act provides a good overview of how a statutory PAYGO requirement works. The first key feature of the 2010 Act is the requirement that the House or Senate include an estimate of the budgetary effects of each piece of proposed legislation prior to voting on it.²⁴³ These estimates are provided by the chairs of each House’s respective budget committee, based on estimates (in the form of five- and ten-year scorecards) created by the Congressional Budget Office.²⁴⁴ After each session of Congress ends, OMB determines whether either the House or Senate scorecard records a debit for the budget year.²⁴⁵ If so, the President “shall issue” a sequestration order that reduces spending by enough to offset the debit (or the larger of the two debits, if both the House and Senate PAYGO scorecards have debits),²⁴⁶ with certain exceptions.²⁴⁷

The Senate’s own PAYGO rule has a similar substantive aim, but it deploys a different enforcement mechanism. The Senate rule prohibits Senate consideration of any mandatory spending or revenue legislation that would increase the budget deficit.²⁴⁸ If legislation that violates the PAYGO principle is introduced, it is subject to a point of order, which requires a vote of sixty Senators to waive.²⁴⁹ In general, points of order have been successful when raised.²⁵⁰ Between 1993 and 2009, forty-three points of order were raised; in all cases except one, they prompted a mo-

Research Serv., R41157, *The Statutory Pay-As-You-Go Act of 2010: Summary and Legislative History 1* (2010).

239. For more detailed accounts of the statutory path of the PAYGO statutes, see Keith, *supra* note 238, at 2–3; George K. Yin, *Temporary-Effect Legislation, Political Accountability, and Fiscal Restraint*, 84 *N.Y.U. L. Rev.* 174, 226 n.208 (2009).

240. See Keith, *supra* note 238, at 2–3; Yin, *supra* note 239, at 226 n.208 (providing capsule summary of fate of PAYGO provisions during period).

241. Pub. L. No. 111-139, 124 Stat. 8 (to be codified in scattered sections of 2 U.S.C.).

242. *Id.* § 2, 124 Stat. at 8.

243. *Id.* § 4(a)(2)(A), 124 Stat. at 10–11.

244. *Id.* § 4(b), 124 Stat. at 11–12; Keith, *supra* note 238, at 8–9.

245. Statutory Pay-As-You-Go Act of 2010 § 5(a)–(b), 124 Stat. at 15–16.

246. *Id.* (providing that OMB shall prepare and President “shall issue”).

247. *Id.* §§ 5(b), 6(a)(1), 124 Stat. at 15–16 (subjecting only direct spending to sequestration).

248. S. Con. Res. 21, 110th Cong. § 201(a) (2007) (enacted).

249. *Id.* § 201(b).

250. Bill Heniff, Jr., Cong. Research Serv., RL 31943, *Budget Enforcement Procedures: Senate Pay-As-You-Go (PAYGO) Rule 11* (2010).

tion to waive the point of order.²⁵¹ During that time, the Senate voted to waive consideration of the PAYGO point of order only eight times; in all the other instances, the point of order was sustained, preventing consideration of the issue.²⁵²

PAYGO budgeting rules have not been a budgeting panacea, but they have fundamentally altered the budget debate. “Offset requirements force those seeking [new] federal benefits to undertake an additional role,” Elizabeth Garrett writes of PAYGO budgeting. “[N]ot only are they funding seekers, but they must also become funding predators.”²⁵³ Under PAYGO rules, to propose additional expenditures or programs, groups must first “advocate eliminating or reducing an existing one.”²⁵⁴ In this way, PAYGO rules increase the cost of proposing new spending or revenue reductions because the proposal must demonstrate how the additional cost or lost revenue would be offset. More generally, the rules require that each expenditure be justified in relation to all other expenditures. Most analysts conclude that PAYGO rules do affect legislative outcomes.²⁵⁵

This is not to say that PAYGO rules are without limitations or imperious to manipulation. To begin with, PAYGO rules address only the cost of new legislation, not the cost of legislation that is already on the books.²⁵⁶ PAYGO has typically applied only to subsets of federal spending and revenue decisions, leaving important carve-outs for spending and revenue policy outside of its scope.²⁵⁷ PAYGO rules are also silent as to the budget effects that occur outside the budget window (ten years in the 2010 Act).²⁵⁸ PAYGO rules are also susceptible to political winds, and have been suspended for legislation viewed as “must-pass,” such as the 2008 economic stimulus legislation or the legislation to maintain the al-

251. *Id.*

252. *Id.*

253. Garrett, *Harnessing*, *supra* note 25, at 515.

254. *Id.*

255. See, e.g., PAYGO Hearing, *supra* note 235, at 6 (statement of Peter Orszag, Director, Congressional Budget Office) (stating PAYGO rules “can definitely help to enforce fiscal discipline”); Allen Schick, *The Federal Budget: Politics, Policy, Process* 170–71 (3d ed. 2007) (noting that under PAYGO “all revenue losses had to be offset” and that PAYGO rules “forced both House and Senate to play the offsets game . . . to include revenue-raising provisions whose sole purpose is to make room for tax cuts”).

256. See Yin, *supra* note 239, at 227 (deeming PAYGO a “modest step toward budget restraint”).

257. See Statutory Pay-As-You-Go Act of 2010, Pub. L. No. 111-139, § 11, 124 Stat. 8, 24–29 (to be codified at 2 U.S.C. § 905) (exempting some programs and tax policy); see also Keith, *supra* note 238, at 9 (providing account of gaps in PAYGO coverage).

258. See Yin, *supra* note 239, at 228 (noting that because PAYGO is silent about budget effects outside of ten-year window it is subject to manipulation by Congress). If Congress only passed permanent spending increases and temporary spending cuts (or tax increases), it could do an end-run around PAYGO limitations. *Id.* For a helpful treatment of the accounting and timing tricks Congress has used to evade PAYGO rules, see generally Cheryl D. Block, *Pathologies at the Intersection of the Budget and Tax Legislative Processes*, 43 *B.C. L. Rev.* 863 (2002).

ternative minimum tax.²⁵⁹ Perhaps more fundamentally, an effective PAYGO requires accurate estimates of financial consequences of legislation. Without reasonably accurate estimates, the offsets that PAYGO requires do not do their work. But even with these limitations, PAYGO rules have altered the dynamics and outcomes of budgeting.

2. *Carbon PAYGO Budgeting.* — An emissions PAYGO rule could operate very similarly to the basic structure of budgeting PAYGO rules. Each proposed and enacted bill would be required to include a statement of its net impact on carbon emissions over a five- or ten-year period. The Congressional Budget Office carbon emissions estimates, the disclosure requirement defended above, would be the basis for these emissions statements, just as the CBO budget estimates form the basis of fiscal PAYGO disclosures.²⁶⁰ Likewise, at the end of the congressional session, OMB could be tasked with finalizing the emissions scorecard of the session's legislation; in the event of overages, the President could be authorized to withhold or sequester funds for the projects that create carbon emissions deficits (with emergency exceptions, just as those used for PAYGO rules).²⁶¹ Alternatively, the carbon PAYGO scheme could take the form of a House or Senate rule, enforced by a point of order for bills that are not carbon neutral.

In the form of either a statute or House or Senate Rule, an emissions PAYGO regime would put immediate pressure on proponents of any legislative activity to identify offsets—whether in the form of reduced emissions through greater efficiencies and conservation, or in the form of sequestration projects—to make the legislation's emissions effects net neutral. The political calculus attached to virtually all legislation would shift; it would induce those proposing emissions-increasing legislation to become carbon predators as well, looking for offsetting emissions reductions, just as budgetary PAYGO forces a search for offsets.

Consider, for instance, a congressional requirement for greater fuel efficiency in cars or trucks. To a member of Congress who seeks to fund a project, like the construction of a highway, which would create emissions both directly through construction-related activities and indirectly through increased motor vehicle use, the fuel efficiency standards now have a new value: They can help offset the emissions effect of a particular road-building project. An emissions PAYGO rule would attach a value to offsetting emissions reductions (or sequestration) in the political process that currently does not exist.

A PAYGO carbon budgeting rule directly addresses the one percent problem. Budget estimates for legislation put the costs of legislation on

259. See Yin, *supra* note 239, at 229.

260. Compare Statutory Pay-As-You-Go Act of 2010, § 4(b), 124 Stat. at 11–12 (to be codified at 2 U.S.C. § 933) (providing for CBO estimates), with *id.* § 4(c), 124 Stat. at 12–13 (to be codified at 2 U.S.C. § 933) (providing for OMB adjustments).

261. See *id.* § 4(g), 124 Stat. at 14–15 (to be codified at 2 U.S.C. § 933) (providing for emergency legislation subject to point of order in Senate).

the table for consideration along with the legislation; a PAYGO rule forces an accounting of the total effects of any new proposals. The fact that any individual's contribution is likely to be relatively small does not matter because those contributions are aggregated and made relevant by the demand for a net neutral emissions result.

3. *Limitations and Objections.* — It is important to understand how a carbon PAYGO scheme would fit alongside other climate change policies. We focus here on the relationship between carbon PAYGO and the leading measures in the policy debate to date: a carbon tax and a cap and trade system.

a. *How Does Carbon PAYGO Fit with Carbon Tax and Cap and Trade?* — Perhaps the most important question is how a carbon PAYGO scheme could complement other approaches to climate change, such as cap and trade and a carbon tax, that have received considerable attention. The answer has two parts.

Second-Best. — The first is that a carbon PAYGO regime is a second-best solution in ways that cap and trade and a carbon tax are not. In the near term, economic schemes like cap and trade or a carbon tax are more likely to efficiently locate sources for emissions reduction. In the robust climate change debate over the past two decades, however, neither of these more efficient solutions to emissions reductions has been adopted, and they may not be adopted in time to achieve the necessary near-term emissions reductions.²⁶² A carbon PAYGO regime is better tailored to address the friction points in the legislative process, and it can provide a step toward these other measures. Like taxes, industry- or sector-based carbon caps are difficult to establish and maintain because they impose costs on known parties. An across-the-board PAYGO regime, in contrast, allows Congress to clearly establish (and claim) a commitment to a simple and broadly appealing idea, without disclosing at the outset how it will affect particular constituencies. Because of its across-the-board focus, it also shifts the dynamics of negotiations; it makes clear that all aspects of the economy, not merely those targeted by a tax or cap and trade regime, are a possible source of reductions.

If a carbon PAYGO system is implemented as a first step, it could not only help to generate momentum for other policies, such as cap and trade and carbon taxation, but also play a useful role if those measures were implemented. Once a sense of urgency and priority about climate change becomes sufficient to support cap and trade or carbon taxes, those measures may be capable of producing a carbon surplus. But they would also inevitably be subject to intense lobbying from one percent sources (for example, asking for “carbon tax relief”). The carbon PAYGO system, however, is designed to prevent those arguments from prevailing,

262. See Ruhl & Salzman, *Climate Change*, supra note 25, at 59 (discussing mitigation options); William B. Bonvillian, *Time for Climate Plan B*, *Issues in Sci. & Tech.*, Winter 2011, at 51, 51 (noting that carbon mitigation measures should be implemented promptly because “the nation cannot afford to suspend climate efforts”).

in part by putting carbon and money on a similar footing. As in the fiscal context, PAYGO in the carbon emissions context provides transparency about the impacts of legislative activity, does so with a common metric, and creates hurdles to the kinds of near-term, interest-group-serving behavior that now dominates policymaking.

Government Decisions. — Even if a carbon tax and a cap and trade scheme are adopted, a carbon PAYGO rule addresses government decisions that these measures do not. A cap and trade scheme and a carbon tax can and should create strong economic incentives to reduce carbon emissions. In simple terms, by increasing the cost of generating emissions, these schemes would generate investment in more emissions-efficient technologies, thus creating incentives to conserve.

Neither a cap and trade scheme nor a carbon tax, however, creates direct incentives for government to take carbon emissions into account. Moreover, there is a limit to how far economic incentives, without infrastructure change, can reduce emissions. Consider automobiles. Cap and trade, carbon tax, and even high requirements for tailpipe emissions could radically reduce emissions by reshaping the nation's fleet of automobiles, but they will not build mass transportation alternatives. They may increase the public support for these alternatives, but many of the political economy problems that have barred investments in mass transport in the past will still exist. The carbon PAYGO requirement, on the other hand, would force legislators to confront these choices before public opinion shifts. By disclosing the carbon implications of a wide range of federal decisions, it may hasten the shift in public opinion. The carbon PAYGO disclosure, and the debates that the disclosure will generate about how carbon emissions should be accounted for in the legislative process, can be expected to generate news accounts in the mass media. In sum, carbon PAYGO provides an accounting mechanism for large-scale infrastructure choices that have tremendous long-term impacts on carbon emissions.

b. *Too Radical or Too Minimal?* — A carbon PAYGO regime might appear impossibly ambitious or too cautious. On the one hand, in the current political environment, the requirement that legislation be carbon neutral would itself require a significant change in legislative priorities. On the other hand, based on current climate science models, a carbon PAYGO scheme looks underambitious because it would address only new legislation, just as the budgetary PAYGO scheme applies only to new legislation and budgets, and would not require reassessment of the carbon or budget costs of already enacted legislation. In a sense both of these objections are right; it is both too ambitious and too cautious. But in view of the stagnation of other proposed large-scale measures, and the way in which a PAYGO scheme confronts carbon's one percent problem, a carbon PAYGO scheme deserves legislative and policymaking attention. It not only fills a gap in our current policy—Congress is an outlier in not

budgeting the carbon emissions of its action—but also directly confronts the slippage that one percent arguments exploit.

Of course, it would be preferable if the exact shape of the emissions glide path required in a PAYGO regime could be established through scientific and policy analysis. Perhaps when that becomes possible, and when the public shares the sense of urgency and priority that is felt by climate scientists, legislative carbon predators may be required to find more than one ton of carbon emissions avoided for every ton increased (much like the offset ratchet required of new sources in areas that are not in attainment with the Clean Air Act national ambient air quality standards). But one of the benefits of the PAYGO proposal is that a “no net increase” approach may impose a certain amount of political discipline and achieve some carbon reductions even if the glide path analysis becomes bogged down in partisan rancor. The wide appeal of the “no net loss” policy for wetlands is a good example of the traction that this simple concept can have in policy debates. There is no inherent reason why the current amount of wetlands is optimal—we could have more or less than desired—but this simple, static metric has been influential for almost twenty years.²⁶³

c. *Scalable Solutions Amenable to Private Initiative.* — The legislative carbon disclosure and carbon PAYGO approaches we propose for the U.S. Congress could be scaled up to international bodies, or adopted domestically with regard to smaller entities than Congress.

They can be scaled up for use by entities at the international level ranging from the European Union to the United Nations to the World Bank. They also can be scaled down to require disclosure and budgeting for federal regulations. Specifically, the carbon analysis could be included in the OIRA’s review of regulations,²⁶⁴ through a revision to the regulatory review executive order.²⁶⁵ These disclosure and PAYGO requirements could also be scaled down for adoption by state legislatures, local county commissions, and city councils.²⁶⁶ The general concept of reframing emissions sources from individual contributions to net effects also may be valuable to nongovernmental organizations when they develop carbon advocacy campaigns and firms when they develop corporate carbon strategies. In addition, even before the will exists in Congress or other governmental bodies to adopt a carbon disclosure and PAYGO ap-

263. See Michael P. Vandenbergh, *An Alternative to Ready, Fire, Aim: A New Framework to Link Environmental Targets in Environmental Law*, 85 Ky. L.J. 803, 893–94 (1997) (discussing “no net loss” policy and other metrics).

264. Exec. Order No. 12,866, §§ 1, 6(a)(2), 3 C.F.R. 638, 638, 645 (1994) (stating as principle of regulation that benefits must justify costs, and requiring specific calculation of costs and benefits for significant regulations), amended by Exec. Order No. 13,563, § 1, 76 Fed. Reg. 3821, 3821 (Jan. 18, 2011).

265. *Id.*

266. For a recent review of other state and local climate mitigation options, see generally Katherine A. Trisolini, *All Hands on Deck: Local Governments and the Potential for Bidirectional Climate Change Regulation*, 62 Stan. L. Rev. 669 (2010).

proach, nongovernmental organizations could begin calculating and disclosing a carbon scorecard of legislative activity. Those nongovernmental calculations could put this information into the public debate about legislation, increasing pressure on legislators to hold themselves accountable.

CONCLUSION

Climate change creates a perfect setting for one percent arguments; the global nature of the problem invites framing contributions to it in global terms. But if we carry our intuitive acceptance of one percent arguments for exemption from regulation to this global stage, the prospect for a solution moves further from reach. The reasons are clear: It is nearly impossible to reach established emissions reduction goals without addressing the vast number of sources, sectors, and countries that can frame their emissions as just one percent, or far below one percent, of the problem. But the frequency and force of one percent arguments in every domain of climate change policy—not to mention the near-complete impasse on progress on emissions reductions—suggests that one percent arguments retain a potent currency.

Our response aims to reframe the issue away from individual exceptions, accreting individually, toward an aggregate assessment of emissions goals. To do so, we suggest at a minimum plugging a neglected but gaping hole: the lack of a requirement that Congress even measure the emissions effects of legislation, unlike federal agencies and a vast swath of private industry. Disclosure is a powerful tool for politics; and carbon emissions disclosure, like disclosure of the financial costs of legislation, will at least inform the backdrop of legislative debates. But disclosure alone is not as effective as setting enforceable limits. We therefore also propose Pay-As-You-Go carbon budgeting as a pragmatic first step in the nation's emissions reduction strategy. Climate science makes clear that in the near term global and national emissions must begin to decline; requiring that future legislation be at least net carbon neutral is a modest first step in that direction. It is also a step that directly confronts one percent arguments because it forces all emissions to be evaluated in relation to their net effects. A focus on net effects will deter, if not defeat, one percent arguments.