All the Tools in the Toolbox: A Plea for Flexibility and Open Minds in Assessing the Costs and Benefits of Climate Rules

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As the Biden Administration works on updating the social cost of carbon (SCC), some economists are urging a different approach, known as the "Marginal Abatement Cost" (MAC) method or the "target-consistent" approach. Rather than attempting to calculate all the damage caused worldwide by each ton of carbon dioxide released into the atmosphere, the MAC approach instead asks: what is the highest amount of money per ton that society will need to be willing to pay if we are going to successfully meet greenhouse gas reduction targets? This approach has the virtue of avoiding the most intractable complexities and uncertainties involved in estimating the SCC, including embedded ethical judgments about the degree to which the interests of future generations should be discounted in comparison to our own and the scope of the relevant "society" across which climate damages should be measured. Nonetheless, the MAC approach has come under fire from cost-benefit purists who argue, first, that it is inappropriate as a matter of good policymaking and, second, that it is prohibited by law. Both claims are at a minimum overstated and arguably outright wrong. As a matter of both legal mandate and good policy, the Biden Administration would do well to avoid the CBA orthodoxy that some commentators advocate. Instead, the Administration should *as a matter of good policy—and* can *as a matter of law—make use of the rich variety of tools in the regulatory decision-making toolbox, including the MAC approach, in developing climate policy.*

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Introduction: A Code Red for Humanity

When the Intergovernmental Panel on Climate Change (IPCC) released its latest climate report in the summer of 2021, the U.N. Secretary-General António Guterres called it a "code red for humanity."[1] The report characterized the evidence that global warming is driven by human influence as "unequivocal,"[2] called the recent rate and scale of changes to the global climate "unprecedented,"[3] and concluded that limiting warming to 1.5° or 2° C and thereby creating a reasonable chance of avoiding catastrophic impacts will require not simply limiting greenhouse gas emissions but eliminating them.[4] The bottom line is that global greenhouse gas emissions must reach net zero by mid-century—a task that will require a monumental and rapid transformation of the global economy unlike anything that has come before.[5] There is no question that this is a goal that markets cannot and will not achieve on their own. Rather, it will require a massive mobilization of public resources, power, and expertise across all levels and departments of government.

While this is certainly not the first alarming climate report to come out of the IPCC, this is the first time in history there is a president in the White House who seems to appreciate the gravity of our predicament and the scale of the changes needed to address it. Indeed, President Biden is the first U.S. president in a generation to talk in positive terms about the role of government and government regulation in tackling society's biggest challenges.[6] In a memo signed on his first day in office, President Biden named "the accelerating threat of climate change" as a top priority and promised "to mobilize the power of the Federal Government to rebuild our Nation and address these . . . challenges."[7] He talked about regulation as something that "promote[s] the public interest,"

1. Press Release, Secretary-General, Secretary-General Calls Latest IPCC Climate Report 'Code Red for Humanity,' Stressing 'Irrefutable' Evidence of Human Influence, U.N. Press Release SG/SM/20847 (Aug. 9, 2021).

2. IPCC, CLIMATE CHANGE 2021: THE PHYSICAL SCIENCE BASIS – SUMMARY FOR POLICY MAKERS 4 (2021) [hereinafter IPCC CLIMATE CHANGE 2021] ("It is unequivocal that human influence has warmed the atmosphere, ocean and land. Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred.").

3. *Id.* at 7 ("Human influence has warmed the climate at a rate that is unprecedented in at least the last 2000 years."); *id.* at 9 ("The scale of recent changes across the climate system as a whole and the present state of many aspects of the climate system are unprecedented over many centuries to many thousands of years.").

4. *See* IPCC CLIMATE CHANGE 2021, *supra* note 2, at 12-14.

5. *Special Report: Global Warming of 1.5°C—Summary for Policymakers*, IPCC 15 (2018), https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf [https://perma.cc/SE5F-S5VB] (concluding that limiting global warming to 1.5°C will require "unprecedented," "rapid and far-reaching transitions in energy, land, . . . infrastructure . . . and industrial systems").

6. *Compare infra* notes 7 and accompanying text, *with, e.g.*, Exec. Order No. 13,563, 76 Fed. Reg. 3821, 3821 (Jan. 21, 2011) (providing that the U.S. regulatory system must use the "least burdensome tools for achieving regulatory ends" and that each agency must "tailor its regulations to impose the least burden on society"), *and infra* note 11 and accompanying text.

7. Memorandum on Modernizing Regulatory Review, 2021 DAILY COMP. PRES. DOC. 63 (Jan. 20, 2021).

calling it "vital for tackling national priorities."[8] And he promised to overhaul the system of White House regulatory review to "ensure that [it] serves as a tool to affirmatively promote regulations that advance" a litany of progressive values, including "public health and safety, . . . racial justice, environmental stewardship, human dignity, equity, and the interests of future generations" and that it "does not have harmful anti-regulatory or deregulatory effects."[9] This way of talking about regulations and their role in society marks a dramatic departure, not just from previous Republican administrations, but from previous Democratic ones as well. Even Democratic administrations have described regulations as imposing "unreasonable costs on society"[10] and have focused primarily on making them less "burdensome" on the private sector.[11]

But, despite the promise to "improv[e] and moderniz[e]" the process of regulatory review, some early indications suggest that, in some respects at least, the new administration remains stuck in the past.[12] In particular, it appears intent on continuing to adhere to the neo-liberal economic orthodoxy that emphasizes a narrow and formalistic version of cost-benefit analysis (CBA) as the one-size-fits-all tool for regulatory review—an approach first brought to us by the Reagan Administration four decades ago.[13]

On the legislative front, in contrast, the architects of Biden's climate strategy seem to have learned from the past. They seem keenly aware that the policy landscape has changed significantly since then-Vice President Biden and President Obama tried and failed to get a massive cap-and-trade bill through Congress a decade ago.[14] It has become clear that we can no longer rely on a single conceptually elegant but politically cumbersome silver bullet to solve the climate crisis. Code red means all hands on deck. And for the administrative state, that must mean that federal agencies have the nimbleness and flexibility to draw on all tools in their toolbox. The Biden Administration's decision to steer clear of a big silver bullet policy, like a carbon tax or cap-and-trade, and to instead build an ambitious and pragmatic climate policy out of a large grab bag of grant programs, subsidies, tax incentives, and demonstration projects—all folded into the large infrastructure and "build back better" bills—reflects that lesson.

Meanwhile, on the regulatory side, the Biden Administration appears to be continuing with business as usual. A working group is busily working on toting up all the harms that are caused throughout the globe from each additional ton of CO_2 emitted into the atmosphere in order to calculate a dollar figure referred to

8. *Id.* § 1.
9. *Id.* § 2.
10. *See*, *e.g.*, Exec. Order No. 12,866, 58 Fed. Reg. 51,735, 51,735 (Oct. 4, 1993).
11. *See*, *e.g.*, Exec. Order No. 13,563, § 1, 76 Fed. Reg. 3821, 3821 (Jan. 18, 2011).
12. Memorandum on Modernizing Regulatory Review, *supra* note 7, § 2.
13. *See* Exec. Order No, 12,291, 46 Fed. Reg. 13,193 (Feb. 19, 1981).
14. American Clean Energy and Security Act, H.R. 2454, 111th Cong. (2009).

as the "social cost of carbon" (SCC).[15] The idea is to ultimately be able to plug that dollar figure into the CBAs of government regulations projected to result in reductions (or increases) in carbon emissions.[16]

But this enterprise of trying to calculate—down to the last dollar—the damages caused by each ton of CO_2 released into the sky is challenging, to say the least. Scientific uncertainties, controversial value choices, and intractable methodological debates abound. Estimates range from less than $0 to over $2,000/ton.[17] President Obama set the SCC at $32/ton; President Trump reduced it to between $1/ton and $7/ton. And over a dozen red-state attorneys general have already filed suit to try to stop the Biden Administration from imposing an interim value of $52 a ton.[18]

Most serious observers viewed the Obama SCC value as much too low, both in terms of its accuracy in accounting for the myriad damages of climate disruption and in its ability to push climate action at the pace needed to hit the 1.5° or 2° target agreed to by nearly every nation on earth in the 2015 Paris Agreement.[19] But early signs suggest that the Biden working group may peg the level significantly higher—perhaps at $125/ton.[20] If the working group sets the SCC at that level or higher, and lawsuits and political controversy don't derail it, the SCC could do some good. By plugging it into CBAs, agencies could use the SCC to build public support for badly needed rulemakings to reduce greenhouse gas emissions. President Biden has also suggested he may direct agencies to use the SCC in procurement and budgeting decisions, which could help to reduce the

15. *See* Notice of Availability and Request for Comment on Technical Support Document: Social Cost of Carbon, Methane and Nitrous Oxide Interim Estimates Under Executive Order 13990, 86 Fed. Reg. 24,669 (May 7, 2021).

16. The working group is also working on setting similar values for other greenhouse gases as well. *See* INTERAGENCY WORKING GRP. ON SOC. COST OF GREENHOUSE GASES, U.S. GOV'T, TECHNICAL SUPPORT DOCUMENT: SOCIAL COST OF CARBON, METHANE, AND NITROUS OXIDE – INTERIM ESTIMATES UNDER EXECUTIVE ORDER 13990 (2021).

17. *See* Pei Wang, Xiangzheng Deng, Huimin Zhou & Shangkun Yue, *Estimates of the Social Cost of Carbon: A Review Based on Meta-Analysis*, 209 J. CLEANER PROD. 1494 (2018); Noah Kaufman, Alexander R. Barron, Wojciech Krawczyk, Peter Marsters & Haewon McJeon, *A Near-Term to Net Zero Alternative to the Social Cost of Carbon for Setting Carbon Prices*, 10 NATURE CLIMATE CHANGE 1010 (2020).

18. *See* Missouri v. Biden, No. 4:21-cv-00287-AGF, 2021 WL 3885590 (E.D. Mo. Aug. 31, 2021) (dismissing complaint on standing and ripeness grounds), *appeal docketed*, No. 21-3013 (8th Cir. Sep. 8, 2021); Louisiana v. Biden, No. 2:21-cv-01074, 2022 WL 438313 (W.D. La. Feb. 11, 2022) (granting preliminary injunction), *modified*, No. 22-30087 (5th Cir. Mar. 16, 2022) (granting stay of preliminary injunction pending appeal).

19. *See, e.g.*, R. Daniel Bressler, *The Mortality Cost of Carbon*, 12 NATURE COMMC'NS, 202, at 1 ("[M]any commentaries have argued that current estimates of the SCC remain inadequate." (collecting sources)); *A Lower Bound: Why the Social Cost of Carbon Does Not Capture Critical Climate Damages and What that Means for Policy Makers*, INST. FOR POL'Y INTEGRITY (Feb. 2019), https://policyintegrity.org/files/publications/Lower_Bound_Issue_Brief.pdf [https://perma.cc/FH37-224N].

20. *See* Tamma Carleton & Michael Greenstone, *Updating the United States Government's Social Cost of Carbon* 7 (Univ. of Chi., Working Paper No. 2021-04, 2021) (urging the Biden working group to use a 2% discount rate, which would, keeping all other parameters of the Obama estimate constant, result in a SCC of $125/ton); Doug Obey, *As OMB Eyes Carbon 'Cost' Updates, Groups Clash Over Metric's Role*, INSIDE EPA (June 23, 2021), https://insideepa.com/daily-news/omb-eyes-carbon-cost-updates-groups-clash-over-metric-s-role [https://perma.cc/9BNX-6PE6] (quoting Richard Revesz, "I would expect that come January, the [SCC] number will be at least $125 a ton").

federal government's considerable carbon footprint and spur markets for green products.[21]

But amidst the giddy predictions of climate advocates hoping to see the SCC increase by a factor of 18 over the Trump Administration's number, a dollop of caution is perhaps also warranted. It is possible that the enormous complexity of the calculation will gin up political controversy that will diminish its authority. Perennial debates over the appropriate social discount rate alone render the SCC peculiarly vulnerable. In the context of the vast time horizons implicated by climate disruption, even very small adjustments in the discount rate produce big changes in the SCC.[22] Adequately accounting for the vast and "fat-tailed" uncertainties surrounding tipping points and catastrophic outcomes also poses intractable challenges.[23]

Worries like these are part of the reason that some economists are urging a different approach, increasingly referred to as the "Marginal Abatement Cost" (MAC) method or the "target-consistent" approach.[24] Rather than attempting to calculate all the damage caused worldwide by each ton of carbon released into the atmosphere, the MAC approach instead asks: what is the highest amount of money per ton that we will need to be willing to pay if we are going to successfully meet greenhouse gas reduction targets? This approach has the virtue of avoiding the complexities and scientific uncertainties involved in estimating the climate damages caused by each increment of CO_2, expressing all those harms in monetary terms, and wrestling over the appropriate discount rate for damages that will occur centuries hence. While estimating the costs of emissions-reducing technologies presents its own set of challenges, they are considerably more manageable.

It is worrisome, then, that some commentators have taken aim at the MAC approach (or indeed any approach that does not hew to the formal CBA framework), arguing that it is bad as a matter of policy and prohibited as a matter of law.[25] Both claims are vastly overstated at a minimum and arguably outright wrong.

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21. *See* Exec. Order No. 13,990, § 5(b)(ii)(C), 86 Fed. Reg. 7037, 7040 (Jan. 20, 2021).

22. *See infra* notes 194 to 198 and accompanying text.

23. *See infra* notes 199 to 202 and accompanying text.

24. *See* Frank Ackerman & Elizabeth A. Stanton, *The Social Cost of Carbon*, 53 REAL-WORLD ECON. REV. 129, 142 (2010); Lina Isaacs, Göran Finnveden, Lisbeth Dahllöf, Cecilia Håkansson, Linnea Petersson, Bengt Steen, Lennart Swanström & Anna Wikström, *Choosing a Monetary Value of Greenhouse Gases in Assessment: A Comprehensive Review*, 127 J. CLEANER PROD. 37, 40-41 (2016); Kaufman et al., *supra* note 17; Nicholas Stern & Joseph Stiglitz, *The Social Cost of Carbon, Risk, Distribution, Market Failures: An Alternative Approach* (Nat'l Bureau of Econ. Rsch., Working Paper No. 28472, 2021); Gernot Wagner, David Anthoff, Maureen Cropper, Simon Dietz, Kenneth T. Gillingham, Ben Groom, J. Paul Kelleher, Frances C. Moore & James H. Stock, *Eight Priorities for Calculating Social Cost of Carbon*, NATURE (Feb. 19, 2021), https://www.nature.com/articles/d41586-021-00441-0?__ac_lkid=b232-9856-3f12-b0cd177b7960cc3 [https://perma.cc/L4VA-2K5Q].

25. *See* Joseph Aldy, Matthew J. Kotchenrobert, N. Stavins & James H. Stock, *Keep Climate Policy Focused on the Social Cost of Carbon*, 373 SCIENCE 850 (2021); Justin Gundlach & Peter Howard, *Improve the Social Cost of Carbon, Do Not Replace It*, REGUL. REV. (Apr. 12, 2021), https://www.theregreview.org/2021/04/12/gundlach-howard-improve-social-cost-carbon-not-replace-it/ [https://per

As a matter of policy, it is not at all clear that CBA is the best way to set standards for greenhouse gas emissions reductions or to evaluate climate-related rulemakings.[26] In its most formal iteration, after all, CBA purports to tell policymakers how much pollution is optimal. But when it comes to the climate crisis, the IPCC has already answered that question in no uncertain terms: the answer is zero—and we have to get there as soon as possible.[27] So, one might say, the marginal damages approach to the SCC and the CBA framework it represents are simply asking the wrong question. The MAC approach, on the other hand, asks what is perhaps a more useful question: what is the highest per-ton cost for emissions reductions we will need to spend in order to hit the net zero target (and the 1.5° to 2° of warming it represents)? That calculation gives us a figure we can use to judge the reasonableness of the per-ton expenditures required by emissions-reducing rules.

In fact, one might view the MAC approach as precisely the kind of "fast and frugal" decision-making tool that economist Herbert Simon proposed for situations in which the decision environment presents so much complexity and scientific uncertainty that attempts at optimization will run up against the limits of bounded rationality.[28] Like other fast and frugal tools, the MAC approach leverages the information we have (here, the net-zero by mid-century target) in order to produce a good decision rather than embarking on a "misguided quest" for optimality in a decision environment hobbled by cognitive limits and flawed and incomplete information.[29]

Alternatively, to the extent CBA in its less formal varieties is simply used as a tool to screen out rulemakings that impose unreasonable or disproportionate costs,[30] there are a number of decision tools used regularly by agencies in the design of environmental regulation that can serve the same purpose. These include cost-effectiveness analysis, feasibility analysis, and open-ended balancing. Rather than viewing CBA as the silver bullet of regulatory review, a

ma.cc/R49N-C5ZF]; COMMENTS TO THE OFFICE OF MANAGEMENT AND BUDGET ON THE SOCIAL COST OF GREENHOUSE GASES, INST. FOR POL'Y INTEGRITY, DOCKET NO. OMB-2021-0006-0001, at 11-14 (June 21, 2021).

26. *See generally* Jonathan S. Masur & Eric A. Posner, *Climate Regulation and the Limits of Cost-Benefits Analysis*, 99 CALIF. L. REV. 1557 (2011); Robert S. Pindyck, *Climate Change Policy: What Do the Models Tell Us?* (Nat'l Bureau of Econ. Rsch., Working Paper No. 19244, 2013); Lexi Smith, *Is Cost-Benefit Analysis the Right Tool for Federal Climate Policy?*, YALE CLIMATE CONNECTIONS (Oct. 14, 2021), https://yaleclimateconnections.org/2021/10/is-cost-benefit-analysis-the-right-tool-for-federal-climate-policy [https://perma.cc/4TU8-Q4KJ].

27. *See* IPCC CLIMATE CHANGE 2021, *supra* note 2, at 28 ("[The] near-linear relationship between cumulative anthropogenic CO2 emissions and the global warming they cause . . . implies that reaching net zero anthropogenic CO2 emissions is a requirement to stabilize human-induced global temperature increase at any level."); IPCC, GLOBAL WARMING OF 1.5 °C, SUMMARY FOR POLICYMAKERS 5 (2018) (stating that future climate-related risks, including longer-lasting and irreversible impacts, grow larger depending on the rate, peak, and duration of warming exceeding 1.5°C).

28. *See infra* notes 111-122 and accompanying text.

29. *See* CHARLES F. MANSKI, PUBLIC POLICY IN AN UNCERTAIN WORLD 138 (2013).

30. Indeed, this is the way CBA is most frequently employed by agencies in practice. *See infra* notes 164-169 and accompanying text.

wiser view sees formal CBA of the sort associated with the SCC as just one tool in a large toolbox, with the choice of tool depending entirely on context.

Finally, CBA is also asking the wrong question when it comes to distributional concerns. CBA is not a tool that is particularly adept at ferreting out and measuring distributional impacts or addressing equity concerns. Indeed, ignoring distributional impacts is in some sense built into CBA's very DNA: Measuring costs and benefits in the aggregate by definition obscures and erases information about how those impacts are distributed across society. If the Biden Administration is serious about prioritizing and making progress on issues of racial and economic justice (which loom especially large in the context of climate disruption), it needs a different tool, or set of tools, to accomplish that.

As a matter of law, there is little support for the view that CBA—and the damages approach to the SCC that goes with it—is required in agency decision making. Nonetheless, assertions like this have become fashionable[31] since the Supreme Court's 2015 ruling in *Michigan v. EPA*.[32] The reality is, however, that Congress has generally eschewed formal CBA in our lexicon of environmental statutes,[33] and a careful reading of the *Michigan* case suggests that the Court actually left agencies with wide discretion to choose from the broad array of cost-conscious tools available the one that best fits a particular context. Nor do other federal court cases suggest an emerging cost-benefit mandate or "cost-benefit state."[34]

This Article is, then, primarily a plea to the Biden Administration to remember the virtues of nimbleness, flexibility, and pragmatism as it constructs a new "improved and modernized" system of regulatory review[35] that is up to the task of confronting the climate crisis and the other monumental challenges we face.[36] The law does not require strict fealty to a cost-benefit credo. And the enormity of the task ahead will require agencies that can take advantage of the full toolbox in front of them, that can remain focused on tangible, real-world results, and that can nimbly switch tools when one is not delivering adequate results.

This Article proceeds in four parts. Part I catalogues and describes the array of tools agencies have at their disposal and the specific functions those tools serve in crafting and evaluating regulatory safeguards aimed at protecting the environment, public health, and a stable global climate. Part II then describes the evolving role of CBA as a tool in government decision making over the last century, from its rudimentary beginnings in project evaluation, to its formalization and elaboration in the field of economics as a practical instantiation

31. *See infra* note 279.

32. 576 U.S. 743 (2015).

33. *See infra* notes 129-132 and accompanying text.

34. *See generally* Amy Sinden, *A "Cost-Benefit State?" Reports of Its Birth Have Been Greatly Exaggerated*, 46 ENV'T L. REP. 10,933 (2016).

35. Memorandum on Modernizing Regulatory Review, *supra* note 7, § 2.

36. *See generally* Sidney A. Shapiro & Christopher H. Schroeder, *Beyond Cost-Benefit Analysis: A Pragmatic Reorientation*, 32 HARV. ENV'T L. REV. 433 (2008).

of Kaldor-Hicks efficiency, to its rejection by Congress in favor of fast and frugal feasibility tools in the environmental legislation of the 1970s, to President Reagan's adoption via executive order in 1981 of CBA as an explicitly anti-regulatory tool, and finally, to CBA's gradual embrace by a larger swath of the political spectrum and its ultimate survival through both Democratic and Republican administrations over the following four decades. Part III traces the adoption and development of the SCC in federal government decision-making beginning in the Obama Administration and up through recent calls to use the MAC approach for setting a price on carbon instead. Finally, Part IV argues that the MAC approach is defensible as good public policy and permissible as a matter of law. Accordingly, the Biden Administration should not heed calls to dismiss this alternative approach out of hand, but should instead keep in mind that the climate crisis is a multifarious and many-headed beast that will require all of government to combat. In conducting the myriad and varied rulemakings that this effort will entail, the Administration will be best served by keeping at the ready all the tools in the regulatory toolbox.

I. Conceptual Foundations: The Tools of Environmental Decision Making

Cost-benefit analysis is just one of an array of decision tools agencies have at their disposal in crafting regulatory safeguards aimed at protecting the environment, public health and safety, and a stable global climate. The broad variety of these tools and the similarities and distinctions among them are matters about which there has been considerable confusion in court opinions and the public policy literature.[37] This Article begins, then, with a catalogue of decision tools. CBA itself, as explained below, refers to a whole family of different tools. But the multiple varieties of CBA are in turn only a subset of the full array of tools available, and are hardly the most important or the most commonly used in U.S. law. Indeed, in most of our federal environmental statutes, Congress has rejected CBA, directing agencies to use other decision tools instead.[38]

Before cataloguing these tools, it is helpful to briefly think through the process of environmental regulatory design and its distinct decision nodes. Conceptually, the design of regulatory standards limiting pollution or other forms of environmental degradation involves two fundamental questions: the standard-setting question (how much should pollution levels be reduced?[39]) and

37. *See* Sinden, *supra* note 34, at 10,935, 10,950, 10,951, 10,954 (describing some of the confusion about distinct regulatory tools in Supreme Court opinions addressing CBA over the past five decades).

38. *See infra* notes 129-132 and accompanying text.

39. This question is sometimes broken down into two steps, where the first step sets an aggregate standard for the combined pollution (environmental degradation) caused by all sources, and the second step sets a standard for the pollution (or environmental degradation) caused by each individual source. Ambient standards, like the Clean Air Act's National Ambient Air Quality Standards, 42 U.S.C. §§ 7408-7409 (2018), or the Clean Water Act's Water Quality Standards, 33 U.S.C. § 1313 (2018), for example, are step 1 standards, while the Clean Air Act's new source review program, 42 U.S.C. §§ 7411, 7470-7492, 7501-7515 (2018), and the Clean Water Act's NPDES program, 33 U.S.C. § 1342 (2018), impose step 2 standards on individual sources.

the regulatory mechanism question (through what regulatory mechanism should that pollution reduction be accomplished?[40]). In some contexts, a preliminary threshold question is added; sometimes referred to as the regulatory "trigger," this question asks whether the pollutant or other form of environmental degradation at issue causes a harm that is worth regulating to begin with.[41] Finally, a fourth question is sometimes added on at the end—after the regulatory standard and mechanism have been established—in order to ensure that regulatory costs are not unreasonable or disproportionate. I refer to this fourth question as the cost-screening question.

In sum, we can think of regulatory decision-making as involving the four questions listed below. The second and third are the primary questions that must be addressed in every environmental rulemaking; the first and fourth may be added in some instances:

(1) **The trigger question**: is there a harm worth regulating to begin with?
(2) **The standard-setting question:** how much should pollution/environmental degradation levels be reduced?
(3) **The mechanism question:** through what regulatory mechanism should that reduction in pollution/environmental degradation be accomplished?
(4) **The cost-screening question**: are the costs of the proposed regulation unreasonable or disproportionate?

To a large degree, the third question has seemed to dominate the policy discussion on the climate crisis, with perhaps inordinate attention having been focused on the debate between cap-and-trade programs and carbon taxes. More recently, as the Democratic Party has moved away from those two market-based mechanisms in the wake of an emerging consensus that both are largely politically unviable (and perhaps insufficiently ambitious),[42] that discussion has turned to the patchwork of traditional regulatory approaches and targeted government subsidies that would be implemented under President Biden's

40. Some regulatory methods do not actually require the regulator to define a goal. Information regulation, for example, relies on the market and/or the political system to define the goal. *See* Amy Sinden, *The Tragedy of the Commons and the Myth of a Private Property Solution*, 78 U. COLO. L. REV. 533, 553 (2007).

41. For example, before setting a NAAQS for a particular pollutant, EPA must first make a trigger finding that, inter alia, "emissions of [that pollutant] cause or contribute to air pollution which may reasonably be anticipated to endanger the public health or welfare." 42 U.S.C. § 7408(a)(1)(A) (2018). Sometimes, no trigger finding by the agency is necessary because Congress has already "pulled the trigger" itself in the statute. The Clean Water Act (CWA), for example, simply prohibits the addition of pollution of any kind (broadly defined) to the waters of the U.S. from a point source. 33 U.S.C. § 1311(a) (2018). Accordingly, EPA does not need to make a trigger finding as to whether any particular pollutant warrants regulation. Instead, for point-source pollution in the waters of the U.S., the agency moves directly to the standard-setting question.

42. *See generally* Anthony Adragna, Marie J. French, Debra Kahn & Lorraine Woellert, *The Lucrative Climate Proposal That's Going Nowhere in Washington*, POLITICO (May 21, 2021, 4:30 AM), https://www.politico.com/news/2021/05/21/states-carbon-pricing-490021 [https://perma.cc/UA54-8LED] (stating that Republican opposition and Democrats' reluctance have stymied the possibility of enacting any carbon pricing mechanism for over ten years, with some progressives now also opposing carbon pricing on the grounds that it would not be effective enough).

legislative and regulatory climate strategy.[43] Unlike so much of the discussion of regulatory issues in the climate context, however, this Article and the decision tools discussed below relate primarily to the standard-setting question, with some attention to the trigger and cost-screening questions as well.

A. Cost-Benefit Analysis

The term "cost-benefit analysis" is frequently used but rarely defined. I define it here, as I have elsewhere, as a decision-making technique that weighs and compares the costs and the benefits of a course of action.[44] While CBA is often treated as a monolith, this definition encompasses a broad array of decision-making techniques falling on a spectrum from formal to informal.[45] At the informal end of the spectrum is a simple weighing of qualitatively described pros and cons along the lines of the technique Ben Franklin famously described using when confronting major life decisions: "[M]y way is to divide . . . a sheet of paper . . . into two columns; writing over the one Pro, and over the other Con."[46] This informal style of CBA involves (1) a qualitative description of the costs and benefits, (2) of a single alternative, and (3) a rough, intuitive, apples-to-oranges balancing of the two.

On the other end is a highly technical and formal analytic method that attempts to fully quantify and monetize all of the social costs and benefits of a whole range of alternative options and then pinpoint the optimum—that is, the level of net welfare maximization. Typically, formal CBA is normatively anchored in welfare economics. That is, it is defended on the ground that it identifies the optimal or economically efficient level of regulation in the Kaldor-Hicks sense.[47] A government regulation meets the criterion of Kaldor-Hicks efficiency if those who stand to benefit from the regulation could fully compensate those who stand to lose from it and still be better off.[48]

43. *See, e.g.*, German Lopez, *A Climate Opportunity*, N.Y. TIMES (Feb. 7, 2022), https://www.nytimes.com/2022/02/06/briefing/biden-democrats-climate-bill.html [https://perma.cc/WQ2F-PZWP] (detailing the climate provisions in Build Back Better, including tax credits for building clean energy sources, subsidies for buying electric vehicles, funding for clean energy infrastructure (e.g., electric vehicle charging stations and electric grid improvements), financing for clean energy research and development, and programs supporting decarbonization measures).

44. *See* Amy Sinden, *Formality and Informality in Cost-Benefit Analysis*, 2015 UTAH L. REV. 93, 98 (2015).

45. *See id.*

46. *See* Benjamin Franklin, *Letter from Benjamin Franklin to Joseph Priestly (Sept. 19, 1772)*, *in* BENJAMIN FRANKLIN, REPRESENTATIVE SELECTIONS, WITH INTRODUCTION, BIBLIOGRAPHY, AND NOTES 348-49 (Frank Luther Mott & Chester E. Jorgenson eds., 1936).

47. *See* ANTHONY E. BOARDMAN, AIDAN R. VINING & DAVID L. WEIMER, COST-BENEFIT ANALYSIS: CONCEPTS AND PRACTICE 32 (4th ed. 2017); E. J. MISHAN & EUSTON QUAH, COST-BENEFIT ANALYSIS (5th ed. 2007); RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW 17-20 (8th ed. 2011).

48. *See* E.J. MISHAN & EUSTON QUAH, COST-BENEFIT ANALYSIS 390 (1976); BOARDMAN ET AL., *supra* note 47, at 32.

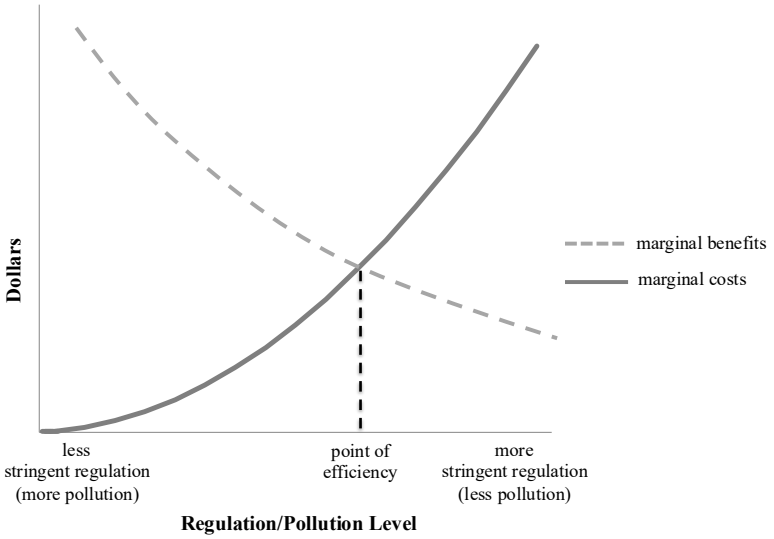
Thus, formal CBA aims to identify the alternative that maximizes overall net social benefit to all members of society in the aggregate.[49] Like the mid-twentieth-century neoliberal economics to which it traces its lineage, formal CBA thus excludes information about how costs and benefits might be distributed across society—for example, whether costs or benefits are disproportionately distributed along lines of race or class. Moreover, what precisely constitutes the appropriate scope of the "society" within which costs and benefits should be tallied is an open question that the discipline of economics cannot answer.

In the context of pollution regulation, formal CBA requires calculating the total social costs and the total social benefits of a whole range of regulatory alternatives that vary incrementally in stringency and in resulting pollution levels. In order for the result to correspond to the theoretical concept of Kaldor-Hicks efficiency, the cost and benefit estimates must approximate as closely as possible the full costs and benefits to every member of the relevant society. The analyst must then use those calculations to pinpoint the level of regulatory stringency (and the corresponding level of pollution) that maximizes net benefits. This is also the point at which the marginal benefits curve crosses the marginal costs curve, as in Figure 1 below.[50]

49. *See* BOARDMAN ET AL., *supra* note 47, at 13, 33; EDITH STOKEY & RICHARD ZECKHAUSER, A PRIMER FOR POLICY ANALYSIS 137 (1978); OFF. OF MGMT. & BUDGET, EXEC. OFF. OF THE PRESIDENT, CIRCULAR A-4, at 9-10 (2003) [hereinafter CIRCULAR A-4].

50. *See* EDWARD M. GRAMLICH, A GUIDE TO BENEFIT-COST ANALYSIS 1 (2d ed. 1990); TOM TIETENBERG, ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS 25, 66 (5th ed. 2000); Richard D. Morgenstern, *Conducting an Economic Analysis: Rationale, Issues, and Requirements*, *in* ECONOMIC ANALYSES AT EPA: ASSESSING REGULATORY IMPACT 25, 40 (Richard D. Morgenstern ed., 1997).

Figure 1: Formal CBA



Locating the efficient level of pollution/regulation by plotting the marginal costs and benefits curves

Since the goal is to find the point at which marginal costs and marginal benefits are just equal, it is not sufficient to measure costs and benefits in qualitative terms or to do a rough apples-to-oranges comparison. Rather, costs and benefits must be fully, or close to fully, quantified and then converted to a common metric (usually dollars) so that they can be precisely compared. Accordingly, formal CBA involves (1) quantification and monetization of all, or nearly all, costs and benefits to society as a whole in the aggregate, (2) for a full range of incrementally varying alternatives, in order to (3) identify the point of net benefits maximization, where marginal costs are just equal to marginal benefits.

These two contrasting visions of CBA—formal and informal—form two ends of a spectrum with more varieties in between.[51] One might, for example, be able to quantify and monetize only a portion of all costs and benefits. Or one might monetize all significant costs and benefits but only for a single alternative, and thus be able to say whether benefits outweigh costs for that alternative, but not whether it is the efficient level of regulation (with costs equaling benefits at the margin). There are also a number of different balancing tests that fall somewhere on the spectrum between the most informal, intuitive apples-to-oranges comparison and the most formal pinpointing of the regulatory level at which marginal costs just equal marginal benefits. A CBA that involves only a

51. For a more in-depth analysis of this idea, see Sinden, *supra* note 44.

single alternative might, for example, apply a balancing test that asks whether benefits "outweigh" costs. Alternatively, a slightly less formal version might ask whether benefits "justify" costs.[52] An even less formal balancing test asks simply whether costs are "grossly" or "wholly" disproportionate to benefits.[53]

The two ends of the CBA spectrum have very little in common other than the general approach of juxtaposing positive and negative impacts. Informal CBA relies on qualitative comparisons of pros and cons and gives no more than general guidance to a decision maker. Formal CBA, on the other hand, uses numbers and mathematics to produce purportedly precise answers. Notice also that informal and formal CBA play entirely different roles in the decision-making process.[54] Formal CBA purports to identify the optimal level of pollution, and thereby aims to answer the second question of regulatory design—the standard-setting question. Informal CBA, on the other hand, only evaluates a single option in comparison to the status quo and therefore has no capacity to identify the optimal choice from among a range of alternatives. Indeed, in most instances, informal CBA does not fully monetize costs and benefits and therefore does not allow for calculation of net benefits even for the single alternative considered, let alone identification of the point of net benefits maximization.[55] Accordingly, informal CBA cannot answer the standard-setting question but can at most provide information relevant to the fourth question—cost screening.

In sum, the term cost-benefit analysis can refer to a wide variety of decision-making techniques that range from formal to informal. But CBA is just one of the tools in the regulatory toolbox. Indeed, as discussed in more detail in Part II below, Congress has primarily relied on those other tools in crafting our federal environmental statutes. Accordingly, while federal agencies have been required to prepare CBAs of major rulemakings under a series of executive orders tracing back to the Reagan Administration,[56] those analyses are often at odds with the tools the agencies are statutorily required to use. The next three Sections take up the most prominent of these other decision tools.

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52. This is the formulation in the Clinton Executive Order, which still applies today and in 1993 replaced the earlier Reagan Executive Order, which had applied the more formal "outweigh" test. *See* Exec. Order No. 12, 866, § 1(b)(6), 3 C.F.R. 638, 639 (1994), *reprinted as amended in* 5 U.S.C. §601 app. at 88-92 (2012) (Clinton Order); Exec. Order No, 12,291, § 2(b), 46 Fed. Reg. 13,193 (Feb. 19, 1981) (Reagan Order).

53. A wholly disproportionate standard has been used in a variety of contexts. EPA has used it, for example, in implementing various provisions of the CWA. *See, e.g.*, Entergy v. Riverkeeper, 556 U.S. 208, 225 (2009); Ass'n Pac. Fisheries v. EPA, 615 F.2d 794, 805 (9th Cir. 1980); Seacoast Anti-Pollution League v. Costle, 597 F.2d 306, 311 (1st Cir. 1979); Weyerhaeuser Co. v. Costle, 590 F.2d 1011, 1045 n. 52 (D.C. Cir. 1978).

54. *See* Sinden, *supra* note 44, at 118.

55. In its less formal varieties, CBA is at best a blunt instrument for welfare maximization. *See id.* at 118-20.

56. *See* Exec. Order No. 12,291, § 2(b), 3 C.F.R. 127, 128 (1982) (signed by President Reagan in 1981); Exec. Order No. 12,866, § 1(b)(6), 3 C.F.R. 638, 639 (1994), *reprinted as amended in* 5 U.S.C. § 601 app. at 88-92 (2012) (replacing the Reagan executive order, and signed by President Clinton in 1993); Executive Order 13,563, 76 Fed. Reg. 3821, 3821 (2011) (signed by President Obama in 2011 to "supplement[] and reaffirm[]" Executive Order 12,866).

B. Health-Based Standards

Health-based standards answer the standard-setting question.[57] They do that by instructing agencies to set regulatory limits at a level that will provide some particular degree of protection to human or ecological health.[58] The Clean Air Act, for example, requires the Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) at the level "requisite to protect the public health" without any consideration of costs.[59]

Like CBA, health-based standards can require a lot of information. In the case of a standard aimed at protecting public health from the impacts of pollution, for example, the analyst must have sufficient scientific studies to identify and characterize the causal link between each pollutant and its harmful effects on human physiology and, ideally, to quantify the relationship between exposure and response for each harm.[60] They must also have adequate data or modeling to estimate levels of each pollutant in the environment, taking into account weather patterns and other mechanisms of pollutant transport and dispersal, as well as sufficient information to identify exposed populations along with routes of exposure and metabolism in their bodies and so on.[61] CBA, of course, requires still more. In addition to all of the above, the cost-benefit analyst must take the additional step of *monetizing* health impacts in order to make direct comparisons with regulatory costs. Moreover, while health-based standards may focus on a particular slice of regulatory benefits—assessing human health outcomes, for example, while ignoring ecological impacts[62]—CBA demands a comprehensive accounting of all benefits to society as a whole.

The strength of health-based standards lies in their direct connection to what we care about: they have the potential, at least, to ground environmental standards in the actual environmental improvement Congress is trying to

57. *See* Michael A. Livermore & Richard L. Revesz, *Rethinking Health-Based Environmental Standards*, 89 N.Y.U. L. REV. 1184, 1190 (2014).

58. Two prominent examples are the Endangered Species Act, 16 U.S.C. §§1531-1544 (2018), and the provision for the establishment of National Ambient Air Quality Standards under the Clean Air Act, 42 U.S.C. § 7409 (2018).

59. 42 U.S.C. § 7409(b)(1); *see also* Whitman v. American Trucking Ass'ns, 531 U.S. 457 (2001) (holding that EPA must set the NAAQS solely on the basis of health, with no consideration of costs). Health-based standards come in two distinct varieties. They can be ambient standards, like the NAAQS, that set a limit on the concentration of a pollutant in the ambient air, or they can be discharge standards that set a limit on the absolute amount of pollutant allowed to come out of a smokestack, tailpipe, or discharge pipe in a particular time period. Since ambient standards on their own do not impose any particular requirements on any particular individual, rulemakings involving ambient standards typically require two stages of standard setting: first setting the ambient standards (e.g., the NAAQS) and then setting the discharge standards necessary to implement the ambient standards (e.g., the State Implementation Plans that implement the NAAQS under the Clean Air Act).

60. In the context of greenhouse gases and their relationship to the adverse effects of climate change on human health, these causal links are even more complex.

61. *See* Alon Rosenthal, George M. Gray & John D. Graham, *Legislating Acceptable Cancer Risk from Exposure to Toxic Chemicals*, 19 ECOLOGY L. Q. 269 (1992); NAT'L RSCH. COUNCIL, RISK ASSESSMENT IN THE FEDERAL GOVERNMENT: MANAGING THE PROCESS 3 (1983).

62. This is what the primary NAAQs under the Clean Air Act do, for example. 42 U.S.C. § 7409(b)(1) (providing that primary NAAQS shall be standards "requisite to protect the public health").

achieve. In some contexts, health-based standards have been quite successful at meeting that potential and actually driving environmental improvement. The NAAQS, for example, are—in the words of Justice Scalia—the "engine that drives the whole Clean Air Act,"[63] a statute that has been widely hailed for its success in cleaning up air quality in the United States over the past half century.[64] And the strict health-based standards under the Endangered Species Act (ESA)[65] have resulted in dramatic court injunctions against logging, mining, and other development activities,[66] giving environmentalists an influential seat at the table in natural resources decision-making.[67]

In other contexts, health-based standards have been less successful. The weakness of health-based standard setting lies in this tool's voracious demand for information. Sometimes those ambitious informational requirements have paralyzed agencies. Indeed, there have been several high-profile failures of health-based standard setting in federal environmental law, including the toxics program under the Clean Water Act and the Hazardous Air Pollutant (HAP) program under the Clean Air Act.[68] In these instances, Congress began with a health-based approach and then abandoned that approach when it produced only agency paralysis.[69]

The NAAQS program has arguably been more successful because the relevant provisions of the Clean Air Act pair health-based standard setting with feasibility standards (discussed below). The NAAQS set clear numeric goals for air quality improvement nationwide. But because they are ambient standards, they do not impose any specific restrictions on any particular individual. This perhaps takes the edge off politically and allows the agency to be a little less gun

63. *See Whitman*, 531 U.S. at 468.

64. *See The Benefits and Costs of the Clean Air Act from 1990 to 2020*, EPA (Apr. 2011), https://www.epa.gov/clean-air-act-overview/benefits-and-costs-clean-air-act-1990-2020-report-documents-and-graphics [https://perma.cc/2HKU-9GLT].

65. *See, e.g.*, 16 U.S.C. § 1536(a)(2) (2018) (requiring federal agencies to "insure" their activities are "not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of a [critical] habitat of such species . . . ."); *id.* at § 1538(a)(1)(B) (prohibiting "take" of any endangered species by "any person"); Tenn. Valley Auth. v. Hill, 437 U.S. 153, 173, 184 (1978) (holding that the ESA commands that species be protected "whatever the cost" and "admits of no exception").

66. *See, e.g.*, Lane Cnty. Audubon Soc'y v. Jamison, 958 F.2d 290, 295 (9th Cir. 1992) (enjoining timber sales on federal lands pending BLM's consultation with FWS regarding the spotted owl); Rio Grande Silvery Minnow v. Keys, 333 F.3d 1109, 1119-20, 1138 (10th Cir. 2003) (upholding the district court's preliminary injunction compelling the Bureau of Reclamation to maintain sufficient river flow to avoid jeopardizing endangered fish), *vacated by* 355 F.3d 1215 (10th Cir. 2004) (dismissing the appeal as moot and vacating the prior opinion but leaving the preliminary injunction intact); Ctr. for Biological Diversity v. Marina Point Dev. Assocs., 434 F. Supp. 2d 789, 795-96, 800 (C.D. Cal. 2006) (enjoining development of a residential condominium project due to "take" of bald eagles under Section 9 of the ESA); Village of False Pass v. Watt, 565 F. Supp. 1123, 1165-66 (D. Alaska 1983) (enjoining execution of the oil and gas leases until the Secretary of Interior complied with the reasonable and prudent alternatives specified in the biological opinion for the protection of endangered grey and white whales).

67. *See* Amy Sinden, *In Defense of Absolutes: Combating the Politics of Power in Environmental Law*, 90 IOWA L. REV. 1405, 1507-10 (2005).

68. *See* Oliver A. Houck, *The Regulation of Toxic Pollutants Under the Clean Water Act*, 21 ENV'T L. REP. 10,528, 10,534-35 (1991); 33 U.S.C. § 1317 (2018); 42 U.S.C. § 7412 (2018).

69. *See* Houck, *supra* note 68, at 10,534-35.

shy. Implementation of the NAAQS, on the other hand—which involves translating a national ambient standard into specific discharge limits imposed on individual polluters—is done almost entirely through feasibility standards, some set federally and some set at the state level.[70] And, as the next Section explains, feasibility standards impose considerably lower information demands on agencies. In addition, the fact that the NAAQS are set on a nationally uniform basis by the EPA helps overcome the information challenges posed by health-based standard setting by taking advantage of the EPA's considerable expertise and resources.

Another context in which health-based standard setting has produced success in protecting the environment is under the ESA. The ESA's standards are quite specific and keyed to harm to species and individual members of species.[71] So, while a standard to "protect the public health" (Congress's initial, unsuccessful attempt to control HAPs through health-based standard setting)[72] leaves a lot of room for industry to push back against any particular agency interpretation, the ESA's prohibitions on "taking" an endangered species,[73] "adversely modifying" its habitat,[74] or "jeopardizing [its] continued existence"[75] arguably draw clearer, brighter lines.[76] A dead fish is a dead fish, after all. And building a dam that blocks salmon passage to their spawning grounds or cutting down the tree a spotted owl nests in indisputably constitutes an adverse modification of the species' habitat. These kinds of determinations are perhaps more amenable to clear proof and bright lines than the innumerable inferences and assumptions necessary to trace a causal line from tumors in lab rats or epidemiological evidence of pollution-induced disease at high exposure levels to conclusions about the impacts of pollutants on public health.[77] So, context matters. And the devil is very much in the details.

70. Indeed, it was in part the fact that that CAA allows for consideration of costs in NAAQS implementation that sold Justice Scalia on the cost-blind, health-based approach to the NAAQS themselves in *Whitman v. American Trucking Associations*. *See* 531 U.S. 457, 470-71 (2001) (noting that while EPA must set the NAAQS at the level "requisite to protect public health," without consideration of costs, the States, pursuant to §§ 7407(a) and 7410, have the responsibility to implement those standards based on considerations that include economic costs and feasibility).

71. *See, e.g.*, Endangered Species Act, 16 U.S.C. § 1536 (2018) (codifying Section 7 of the ESA and prohibiting federal agencies from undertaking actions that may "jeopardize the continued existence of a threatened or endangered species"); *id.* § 1358 (codifying Section 9 of the ESA and prohibiting any person from "taking" an individual member of an endangered species).

72. 42 U.S.C. § 7412(b)(1)(B) (1988).

73. 16 U.S.C. § 1538(a)(1)(B) (1988).

74. 16 U.S.C. § 1536(a)(2) (1988).

75. *Id.*

76. Sinden, *supra* note 67, at 1491-92; Oliver A. Houck, *On the Law of Biodiversity and Ecosystem Management*, 81 MINN. L. REV. 869, 959 (1997).

77. *See* Wendy E. Wagner, *The Science Charade in Toxic Risk Regulation*, 95 COLUM. L. REV. 1613, 1618-27 (1995).

C. Feasibility Analysis

Feasibility analysis provides a third tool for answering the standard-setting question, one that takes yet another fundamentally different approach to the question. Of the three methods, feasibility analysis is the most prevalent in U.S. environmental law.[78] This approach sets environmental standards at the most stringent level that is economically and technologically feasible.[79] Unlike CBA, which considers the overall social costs of a regulation and compares them to its overall social benefits, feasibility analysis assesses the available pollution control technologies and their costs and makes a judgment about which technologies are feasible from both an engineering and a cost perspective.[80]

The latter judgement about cost might involve comparing the costs borne by the regulated industry to the financial capacities of that industry,[81] or it might involve identifying the "knee of the curve"—the point at which the cost curve slopes steeply upward signaling precipitously rising costs for incremental pollution reduction gains.[82] This renders the information and analysis requirements of feasibility analysis significantly less burdensome than those of CBA on two counts. First, when it does conduct a direct comparison, feasibility analysis compares two values easily expressed in monetary terms—the costs of pollution control versus an industries revenues or profits. Second, the costs measured by feasibility standards are considerably narrower than those assessed by CBA. While feasibility analysis focuses just on the costs to firms of pollution control,[83] CBA demands a full accounting of all the costs of a regulation to society as a whole, including costs to industry of pollution control technologies, but also including costs to consumers, administrative costs to government, and myriad ripple effects across the economy.[84] Additionally, feasibility analysis

78. *See* SIDNEY A. SHAPIRO & ROBERT L. GLICKSMAN, RISK REGULATION AT RISK: RESTORING A PRAGMATIC APPROACH 32 (1st ed. 2004); Thomas O. McGarity, *Media-Quality, Technology, and Cost-Benefit Balancing Strategies for Health and Environmental Regulation*, 46 L. & CONTEMP. PROBS. 159, 160-61 (1983).

79. *See generally* Jason R. Bent, *Health Theft*, 48 CONN. L. REV. 637 (2016); David M. Driesen, *Distributing the Costs of Environmental, Health, and Safety Protection: The Feasibility Principle*, *Cost-Benefit Analysis, and Regulatory Reform*, 32 B.C. ENV'T AFF. L. REV. 1 (2005); David M. Driesen, *Two Cheers for Feasible Regulation: A Modest Response to Masur and Posner*, 35 HARV. ENV'T L. REV. 313 (2011); Jonathan S. Masur & Eric A. Posner, *Against Feasibility Analysis*, 77 U. CHI. L. REV. 657, 669 (2010); Sidney A. Shapiro & Thomas O. McGarity, *Not So Paradoxical: The Rationale for Technology-Based Regulation*, 1991 DUKE L.J. 729; Wendy E. Wagner, *The Triumph of Technology-based Standards*, 2000 ILL. L. REV. 83; Dov Waisman, *Equity and Feasibility Regulation*, 50 U. RICH. L. REV. 1263 (2016).

80. *See* Am. Textile Mfr. Inst. v. Donovan, 452 U.S. 490, 514 (1981) (holding that the word "feasibility" in the Occupational Safety and Health Act was intended by Congress to connote both "economic and technological" feasibility).

81. *See, e.g.*, Occupational Exposure to Hexavalent Chromium, 71 Fed. Reg. 10,100, 10,299 (Feb. 28, 2006) (noting that "[w]hen the costs of compliance are less than one percent of revenues" or less than ten percent of profits, then the agency considers a standard economically feasible).

82. *See, e.g.*, EPA, Combined Sewer Overflow (CSO) Control Policy, 59 Fed. Reg. 18,688 (Apr. 19, 1994) (directing national pollutant discharge elimination system permittees to use knee of the curve analysis in selecting controls for reduction of CSOs).

83. *See* Jamison E. Colburn, *Tech-Based? Cost Factoring in U.S. Environmental Standards*, 7 MICH. J. ENV'T & ADMIN. L. 83, 92-106 (2017).

84. *See* BOARDMAN ET AL., *supra* note 47, at 1-2, 99-110.

avoids the most problematic and controversial aspect of formal CBA—its requirement that regulatory benefits be valued in monetary terms.

At first blush, feasibility analysis appears to ignore regulatory benefits entirely and focus solely on costs. But it is more accurately viewed as reflecting a congressional judgment that the benefits of regulation in a particular context are substantial enough to warrant feasible levels of regulation. Indeed, in many statutes, Congress has made that benefits determination explicit, pairing feasibility standards with a requirement that the agency make a health-based determination of some kind. Often, these provisions require the agency to make a threshold finding or pull a "regulatory trigger" by first considering potential regulatory benefits in order to determine whether the harm is one worth regulating to begin with.[85] This preliminary finding of potential regulatory benefit does not typically require a comprehensive accounting of benefits, nor does it require monetization in order to make a direct comparison with costs. The point is simply to show that some potential benefit is present in order to obviate the possibility that a regulation might be issued that "impose[s] enormous costs [for] little, if any, discernible benefit."[86] In other instances, the agency first sets a health-based ambient standard that is then implemented through feasibility-based discharge limits. The Clean Air Act's provisions governing implementation of the NAAQS, discussed above, are the most prominent example of the latter approach.[87]

Feasibility standards, which Part III discusses in more detail, are the most prevalent standard-setting tool in the federal pollution statutes. They are arguably largely responsible for much of the success this country has seen over the past half century in cleaning up air and water pollution. Virtually all of the actual discharge limits in both the Clean Air Act and the Clean Water Act use a feasibility approach.[88] And Congress has on a number of occasions turned to feasibility standards to produce on-the-ground results in contexts where health-based standards produced regulatory paralysis.[89]

D. Cost-Effectiveness Analysis

Cost-effectiveness analysis (CEA)—depending on how it is used—can provide a tool for answering the standard-setting question or the cost screening

85. *See* SHAPIRO & GLICKSMAN, *supra* note 78, at 33-35; Amy Sinden, *A 'Cost-Benefit State?' Reports of Its Birth Have Been Greatly Exaggerated*, 46 ENV'T L. REP. 10,933, 10,938-39 (2016); DAVID M. DRIESEN, CTR. FOR PROGRESSIVE REG., THE FEASIBILITY PRINCIPLE 26 (2004); ROBERT V. PERCIVAL, CHRISTOPHER H. SCHROEDER, ALAN S. MILLER & JAMES P. LEAPE, ENVIRONMENTAL REGULATION: LAW, SCIENCE, AND POLICY 247 (9th ed. 2022). Examples include the New Source Performance Standards under the Clean Air Act. *See* 42 U.S.C. §7411(a)(1) (2018) (feasibility standard); *id.* §7411(b)(1)(A) (trigger).

86. Indus. Union Dep't v. Am. Petroleum Inst., 448 U.S. 607, 645 (1980).

87. *See supra* note 70 and accompanying text.

88. *See* Houck, *supra* note 68, at 10,528 (calling feasibility standards (a.k.a. "technology-based standards") the "major thrust" of the Clean Water Act); Colburn, *supra* note 83, at 93-94 (listing feasibility standards in Clean Air Act); *id*. at 100 (listing feasibility standards in Clean Water Act).

89. *See supra* note 69 and accompanying text.

question. It takes a single regulatory goal or outcome and compares the costs of reaching that goal under various regulatory alternatives.[90] Typically, the outcome is quantified but not monetized so that alternatives that produce the chosen outcome to varying degrees can be directly compared in terms of their "cost-effectiveness ratio."[91] Thus, for example, regulatory alternatives of varying ambition and effectiveness might be compared in terms of their dollar cost "per life saved" or "per acre of wetlands preserved." Such an approach can theoretically be used to answer the standard-setting question, but it is rarely made the sole criterion for decision making, since a cost-effectiveness ratio gives the decision maker no information on the absolute quantity of the relevant outcome to be obtained.[92] Alternatively, where the regulatory standard has been set using some other decision tool, CEA might perform a cost-screening function by comparing the costs of various regulatory or technological mechanisms for reaching the pre-determined standard.[93]

CEA is sometimes used in conjunction with a cost-effectiveness threshold.[94] Under this method, the analyst sets a threshold representing the maximum cost per unit outcome deemed reasonable. This can then provide the basis for a cost screening tool, in which alternatives yielding cost-effectiveness ratios above the threshold are screened out as too expensive, while those at or below the threshold are approved. This approach has been used in the context of health care policy in decisions about which health care interventions to fund.[95]

EPA has also employed cost-effectiveness thresholds to answer the standard-setting question for environmental regulations. EPA took this approach in crafting its 2011 "Cross-State Air Pollution Rule" aimed at curbing the interstate transport of ozone forming pollutants.[96] EPA began by setting a cost-effectiveness threshold for reductions of a particular pollutant ($500/ ton of NO_X reductions, for example).[97] It then set state-by-state emissions limits equal to the

90. *See* MISHAN & QUAH, *supra* note 48, at 8; CIRCULAR A-4, *supra* note 49, at 10-14.

91. *See* BOARDMAN ET AL., *supra* note 47, at 464.

92. *See* CIRCULAR A-4, *supra* note 49, at 11.

93. *See* TIETENBERG, *supra* note 50, at 54-55.

94. *See, e.g.*, Praveen Thokala, Jessica Ochalek, Ashely A. Leech & Thaison Tong, *Cost-Effectiveness Thresholds: The Past, the Present and the Future*, 36 PHARMACOECONOMICS 509 (2018).

95. *See* David Cameron, Jasper Ubels & Fredrik Norström, *On What Basis are Medical Cost-Effectiveness Thresholds Set? Clashing Opinions and Absence of Data: A Systematic Review*, 11 GLOBAL HEALTH ACTION 1,447,828 (2018); André Soares Santos, Augusto Afonso Guerra-Junior, Brian Godman, Alec Morton & Cristina Mariano Ruas, *Cost-Effectiveness Thresholds: Methods for Setting and Examples from Around the World*, 18 EXPERT REV. PHARMACOECONOMICS & OUTCOMES RSCH. 277 (2018).

96. *See* Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed. Reg. 48,208 (Aug. 8, 2011) (to be codified at 40 C.F.R. pt. 51, 52, 72, 78 & 97).

97. EPA's method for setting those thresholds was somewhat akin to what is often referred to as a "knee of the curve" analysis, where a standard is set just below the point at which marginal costs begin to rise steeply. The Supreme Court described EPA's analysis in the Cross-State Air Pollution Rule this way:

> EPA first calculated, for each upwind State, the quantity of emissions the State could eliminate at each of several cost thresholds. Cost for these purposes is measured as cost per ton of emissions prevented, for instance, by installing scrubbers on powerplant smokestacks. EPA

total amount of that pollutant that would be generated in a given state if all pollution sources in the state used every control measure available for reducing emissions of the pollutant without exceeding this per-ton cost threshold.[98] The Supreme Court approved EPA's use of cost-effectiveness thresholds in this rulemaking in *E.M.E. Homer v. EPA*.[99] This application of cost-effectiveness thresholds in the pollution context can also be thought of as a form of feasibility analysis, where the cost-effectiveness threshold essentially defines the limit of what is deemed "economically feasible."

CEA is also called for by Executive Order 12,866, though it is often overshadowed by the CBA mandate.[100] CEA is distinct from CBA in that it does not involve a direct comparison of social costs to social benefits. Therefore, CEA does not purport to provide a measure of overall social welfare.[101] Nor does it purport to comprehensively cover all aspects of regulatory benefit. Rather, it focuses on a single dimension of benefit, like lives saved or tons of some pollutant reduced. In this way, it avoids one of the most problematic and controversial aspects of formal CBA—the conversion of regulatory benefits into a monetary metric. But the trade-off is that it also tends to leave out relevant aspects of regulatory benefit.[102]

E. Open-Ended Balancing

In what has been called "open-ended balancing," Congress sometimes provides a laundry list of factors for an agency to consider in setting standards.[103] These lists often include elements that might fall within the general category of costs or benefits, but they differ from CBA in that they do not call for a direct binary comparison of costs against benefits. Nor do they typically specify what

> estimated, for example, the amount each upwind State's NOX emissions would fall if all pollution sources within each State employed every control measure available at a cost of $500 per ton or less. The Agency then repeated that analysis at ascending cost thresholds.
>
> Armed with this information, EPA conducted complex modeling to establish the combined effect the upwind reductions projected at each cost threshold would have on air quality in downwind States. The Agency then identified "significant cost threshold[s]," points in its model where a "noticeable change occurred in downwind air quality, such as . . . where large upwind emission reductions become available because a certain type of emissions control strategy becomes cost-effective." For example, reductions of NOX sufficient to resolve or significantly curb downwind air quality problems could be achieved, EPA determined, at a cost threshold of $500 per ton (applied uniformly to all regulated upwind States). "Moving beyond the $500 cost threshold," EPA concluded, "would result in only minimal additional . . . reductions [in emissions]."

EPA v. E.M.E. Homer City Generation, 572 U.S. 489, 501-02 (2014) (quoting Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed. Reg. at 48,248-51, 48,256).

98. *E.M.E. Homer City Generation*, 572 U.S. at 502 (citing 76 Fed. Reg. at 48,249).

99. *See id.* at 495-96, 502-03.

100. Exec. Order No. 12,866, § 1(b)(5), 58 Fed. Reg. 51,735, 51,736 (Oct. 4, 1993).

101. BOARDMAN ET AL., *supra* note 47, at 464, 474-75.

102. *Id.*

103. *See* SHAPIRO & GLICKSMAN, *supra* note 78, at 32.

relative weight the agency should place on each factor.[104] They also differ from CBA in that they do not necessarily aspire to a comprehensive accounting of all social costs and all social benefits. The list may represent only a partial catalogue of all the social benefits and costs that could be associated with a given regulation and may be intentionally written so as to give more weight to the listed factors than other social impacts.

For example, the Clean Water Act requires discharge limits for various pollutants to be set on the basis of feasibility standards combined with open-ended balancing. One set of these limits is for toxic pollutants, which are to be set at the level "which . . . shall require application of the best available technology economically achievable."[105] But the statute also goes on to specify a list of factors for the agency to consider in setting that standard:

> [T]he age of equipment and facilities involved, the process employed, the engineering aspects of the application of various types of control techniques, process changes, the cost of achieving [the] effluent reduction, non-water quality environmental impact (including energy requirements), and such other factors as the Administrator deems appropriate.[106]

Like CBA, open-ended balancing calls for weighing different factors or values against each other, but it does not countenance the kind of precise, direct numerical comparison that formal CBA involves. Additionally, it differs from both formal and informal CBA in not purporting to comprehensively consider costs and benefits to society as a whole.

* * *

In sum, CBA encompasses a range of decision tools on a spectrum from formal to informal. Depending on the variety, CBA can be used to answer either the standard-setting or the cost screening question. But CBA is hardly the only tool in the regulatory toolbox. There are also a number of other tools agencies use in different contexts to answer one of those two questions.[107]

II. The Evolving Role of CBA in U.S. Regulatory Decision Making

A. The Early Years: CBA Emerges Amidst Developing Skepticism

Some form of CBA has been used as a tool in government decision making for several centuries at least. There are reports, for example of engineers in the

104. *See id*.

105. 33 U.S.C. §1311(b)(2)(A) (2018).

106. 33 U.S.C. §1314(b)(2)(B).

107. It is also worth noting that the definition of "costs" varies across this range of different tools. Thus, under informal CBA, the "costs" considered are technically costs to society as a whole, including all ripple effects (like the decreased profits at the gas station down the street from the factory that laid off workers due to increased pollution control costs), although shortcuts and proxies are used in practice. By contrast, in feasibility analysis, costs are typically defined more narrowly as costs to the regulated industry only. Similarly, "the cost of achieving [the] effluent reduction" in the open-ended balancing test above is typically taken to mean just costs to the regulated industry. 33 U.S.C. §1314(b)(2)(B). In CEA, the scope of costs measured "varies enormously" depending on the analysis. BOARDMAN ET AL., *supra* note 47, at 474.

nineteenth-century French government using CBA in their evaluations of canals, railroads, and other public works projects. Government use of CBA first emerged in the United States in the early twentieth century in the evaluation of publicly funded dams and navigation projects by the Army Corps of Engineers. The practice initially developed from efforts to justify projects politically and was eventually codified in the Flood Control Act of 1936, which required the benefits of projects to exceed their costs.[108] Over time, as political pressure mounted to monetize more "intangibles," the practice became more formalized and quantified.[109] By the early 1950s, the Corps had begun hiring a staff of economists, who soon set about using the new welfare economics and the theory of Kaldor-Hicks efficiency described above to build a theoretical foundation for CBA as a tool for identifying economically efficient social policies.[110]

The rise of a formal, Kaldor-Hicks-based version of CBA within the economics profession in the mid-twentieth century was emblematic of a larger trend spanning multiple academic disciplines, including computer science, biology, and artificial intelligence. In all of these fields, researchers equated rational decision making with optimization, building models that required the rational decision maker to first make a thorough and comprehensive evaluation of the consequences and pros and cons of all conceivable alternatives and then pick the optimum or the one best serving the decision maker's goals.[111]

By the 1950s, those models of rational decision making had begun to receive some pushback from within the fields of economics and political science. Herbert Simon, for example, began to question whether such optimizing strategies can successfully or meaningfully be carried out in the real world given the limitations of "bounded rationality," a term he coined to refer to real-world constraints on human knowledge and cognitive abilities.[112] Thinking along very similar lines, political scientist Charles Lindblom criticized these optimizing models as requiring "superhuman comprehensiveness" that "soar[s] beyond any sense of practical moderation."[113] In Lindblom's view, optimization is in many

108. The Flood Control Act of 1936, Pub. L. No. 74-738, 49 Stat. 1570 (codified as amended at 33 U.S.C. § 701a).

109. *See* Robert Dorfman, *Forty Years of Cost-Benefit Analysis*, *in* ECONOMETRIC CONTRIBUTIONS TO PUBLIC POLICY 268 (Richard Stone and William Peterson eds., 1978); THEODORE PORTER, TRUST IN NUMBERS: THE PURSUIT OF OBJECTIVITY IN SCIENCE AND PUBLIC LIFE 178 (1995).

110. *See* PORTER, *supra* 109, at 186.

111. *See* DAVID BRAYEBROOKE & CHARLES E. LINDBLOM, A STRATEGY OF DECISION: POLICY EVALUATION AS A SOCIAL PROCESS 38 (1963); JAMES G. MARCH & HERBERT A. SIMON, ORGANIZATIONS 137 (1958).

112. *See* HERBERT A. SIMON, MODELS OF BOUNDED RATIONALITY, VOL. 3: EMPIRICALLY GROUNDED ECONOMIC REASON 291-294 (1982); Herbert A. Simon, *Theories of Bounded Rationality, in* DECISION AND ORGANIZATION 161, 172-176 (B. McGuire & Roy Radner eds., 1972). *See also* Reinhard Selten, *What is Bounded Rationality*, *in* BOUNDED RATIONALITY: THE ADAPTIVE TOOLBOX13 (Gerd Gigerenzer & Reinhard Selten, eds., 2001) ("Humans and animals make inferences about unknown features of their world under constraints of limited time, limited knowledge and limited computational capacities."). Some have used term "bounded rationality" to mean something quite different from Simon's point. *See, e.g.,* Christine Jolls, Cass R. Sunstein, & Richard Thaler, *A Behavioral Approach to Law and Economics*, 50 Stan. L. Rev. 1471, 1477-78, 1548 (1998) (framing "bounded rationality" as a source of human irrationality).

113. *See* BRAYEBROOK & LINDBLOM, *supra* note 111, at 38-39.

contexts "not merely incapable of being fully realized (which everyone admits) but [is] in most circumstances and most connections, a fruitless and unhelpful . . . ideal."[114]

Simon, Lindblom, and others set out instead to understand what decision makers actually do in practice.[115] Lindblom argued that "[p]roblem solvers actually exploit in quite systematic ways, adaptive strategies for decisionmaking"[116]—that is, strategies specifically adapted to the constraints of what Simon called "bounded rationality"[117] and Lindblom called "man's limited problem-solving capacities," as well as the widespread inadequacy of information.[118] These strategies "accomplish[] an enormous simplification of the analytic task compared to the [optimization models],"[119] but can, in appropriate circumstances, yield superior results. These "fast and frugal" decision tools take advantage of characteristics specific to particular decision-making contexts to work around limits on knowledge and cognitive ability.[120] Under a tool Simon dubbed "satisficing," for example, the analyst avoids having to examine the entire universe of possible alternatives by setting an aspiration level for some particular value that is important to her, and then searching until she finds an alternative that meets or exceeds that level.[121] Because they exploit particular characteristics of a given decision environment, these fast and frugal tools offer "domain-specific rather than universal strategies . . . not a single hammer for all purposes."[122] But they can, in particular contexts, outperform optimizing models.[123]

In the 1970s, at the height of the twentieth century environmental movement, a wave of environmental health and safety legislation swept through Congress. While they didn't reference Simon's and Lindblom's work explicitly,

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114. *Id.* at 16.

115. *See id.* at 5-6, 45; Simon, *A Behavioral Model of Rational Choice*, *supra* note 28, at 99 ("Broadly stated, the task is to replace the global rationality of economic man with a kind of rational behavior that is compatible with the access to information and the computational capacities that are actually possessed by organisms, including man, in the kinds of environments in which such organisms exist."); MANSKI, *supra* note 29, at 137-38 (calling the search for optimal solutions in contexts of partial knowledge a "misguided quest," and arguing "[w]e must face up to the nonexistence of optimal decision criteria and suffice with reasonable ones"); *id* at 136 (arguing that in place of welfare economics' expected utility maximization, the search for decision tools should focus on "actualist rationality" where "what matters is [a decision tool's] performance in practice").

116. BRAYEBROOK & LINDBLOM, *supra* note 111, at 61.

117. SIMON, *supra* note 112, at 291-94.

118. *Id.* at 48, 49-50.

119. *Id.* at 111.

120. Gerd Gigerenzer & Reinhard Selten, *Rethinking Rationality*, *in* BOUNDED RATIONALITY: THE ADAPTIVE TOOLBOX 4 (2001) ("Note that dispensing with optimization . . . does not imply that the outcome of a nonoptimizing strategy is bad. For instance, optimization is often based on uncertain assumptions, which are themselves guesswork, and as a consequence, there may be about as many different outcomes of optimizing strategies as there are sets of assumptions. In these real-world cases, it is possible that simple and robust heuristics can match or even outperform a specific optimizing strategy. . . . Bounded rationality is neither optimization nor irrationality."); *id* at 5, 8-9 (calling these kinds of decision tools "fast and frugal").

121. *See* Simon, *A Behavioral Model of Rational Choice*, *supra* note 28, at 104.

122. Selten, *supra* note 112, at 7.

123. *Id.* at 4; Simon, *A Behavioral Model of Rational Choice*, *supra* note 28, at 99.

members of Congress seemed to be animated by some of the very same concerns. Congress had been taking tentative steps toward regulating the problems of air pollution and water pollution at the federal level for several decades and had already begun to see playing out in practice some of the bounded rationality problems Simon and Lindblom had warned against. As a result, they wanted decision tools that would deliver concrete, real-world results rather than some theoretical conception of rationality. In short, Congress chose to prioritize what political scientist Charles Manski would later call "actualist" over "axiomatic" rationality—that is, the idea that in designing decision-making tools, what should matter is not a tool's theoretical appeal or abstract consistency, but its actual "performance in practice."[124]

These concerns and priorities generated considerable skepticism on Capitol Hill about formal CBA.[125] Indeed, a House subcommittee report in 1976 concluded that "[t]he limitations on the usefulness of benefit/cost analysis in the context of health, safety, and environmental regulatory decision-making are so severe that they militate against its use altogether."[126] And a 1978 study on federal regulation by the Senate Committee on Government Affairs argued that due to "serious limitations to the use of economic impact analysis in the health and safety area . . . decisionmaking to protect the public from serious hazards should not be reduced to those terms."[127] This skepticism among lawmakers was also reflected in a burgeoning academic literature critiquing CBA on theoretical grounds.[128]

Thus, in crafting the many environmental statutes that became law in those years, Congress consistently rejected formal CBA as a framework for agency decision-making.[129] In some instances, Congress turned instead to health-based standards, but most frequently, Congress turned to feasibility analysis. Feasibility standards were purposely designed to streamline and speed up the regulatory process.[130] They were, in a sense, fast and frugal decision tools. They

124. MANSKI, *supra* note 29, at 136.

125. *See* PERCIVAL ET AL., *supra* note 85, at 363-64; SUBCOMM. ON OVERSIGHT & INVESTIGATIONS OF THE H. COMM. ON INTERSTATE & FOREIGN COMMERCE, 94TH CONG., FEDERAL REGULATION AND REGULATORY REFORM 510-15 (Subcomm. Print 1976).

126. SUBCOMM. ON OVERSIGHT & INVESTIGATIONS OF THE H. COMM. ON INTERSTATE & FOREIGN COMMERCE, *supra* note 125, at 510-11, 515.

127. 6S. COMM. ON GOVERNMENTAL AFFAIRS, STUDY ON FEDERAL REGULATION: FRAMEWORK FOR REGULATION, S. DOC. NO. 96-13, at xxiv (1st Sess. 1978).

128. *See, e.g.*, C. Edwin Baker, *The Ideology of the Economic Analysis of Law*, 5 PHIL. & PUB. AFF. 3, 6 (1975); Duncan Kennedy, *Cost-Benefit Analysis of Entitlement Problems: A Critique*, 33 STAN. L. REV. 387, 422-44 (1981); Arthur A. Leff, *Economic Analysis of Law: Some Realism About Nominalism*, 60 VA. L. REV. 451, 478-79 (1974); Mark Sagoff, *Economic Theory and Environmental Law*, 79 MICH. L. REV. 1393 (1981); Lawrence Tribe, *Policy Science: Analysis or Ideology?*, 2 PHIL. & PUB. AFF. 66 (1972); Dorfman, *supra* note 109, at 268; ARTHUR SMITHIES, THE BUDGETARY PROCESS IN THE UNITED STATES 344-46 (1955).

129. *See* SHAPIRO & GLICKSMAN, *supra* note 78, at 32; Lynn E. Blais, *Beyond Cost/Benefit: The Maturation of Economic Analysis of the Law and its Consequences for Environmental Policymaking*, 2000 U. ILL. L. REV. 237, 238-40; Thomas O. McGarity, *Media-Quality, Technology, and Cost-Benefit Balancing Strategies for Health and Environmental Regulation*, 46 L. & CONTEMP. PROBS. 159, 160-61 (1983).

130. *See* Wagner, *supra* note 79, at 94-97; Houck, *supra* note 68, at 10,531-39.

worked around the limits of human knowledge and bounded rationality by sidestepping the complex and contentious risk assessment issues that tended to bog down cost-benefit analysis and—to a lesser but still significant degree—health-based standard setting. And they exploited the specific characteristics of the informational environment by asking more tractable and incontrovertible questions about technology, engineering, and equipment costs. Over time, feasibility standards built up a track record that largely delivered on that promise, driving substantial and measurable reductions in pollution levels at a relatively quick pace.[131] Indeed, over the ensuing decades, Congress turned repeatedly to feasibility standards to get the regulatory process moving when programs based on other approaches produced agency paralysis.[132]

B. The Middle Years: The Right's Embrace Gives Way to Broadening Acceptance

But in politics as well as physics, every action has an equal and opposite reaction. And if feasibility standards were delivering real, on-the-ground results, not everyone was happy about that. As the 1970s wore on and the environmental statutes passed in the early part of the decade began to produce specific, enforceable rules, affected industries began to bridle at the new restrictions and look for ways to push back. The idea that CBA might be used in evaluating not just government projects but government regulations and that it might provide a means of reining in overzealous regulators had begun to percolate over the previous decade among a small group of right-wing economists wary of market intervention and suspicious of the new regulatory state.[133] And it was not long before industry lawyers and lobbyists picked up on that idea.[134]

131. *See* Houck, *supra* note 68, at 10,531-39; Wagner, *supra* note 79, at 94-97.

132. *See* Houck, *supra* note 68, at 10,531-39; Wagner, *supra* note 79, at 96-97.

133. RICHARD L. REVESZ & MICHAEL A. LIVERMORE, RETAKING RATIONALITY: HOW COST-BENEFIT ANALYSIS CAN BETTER PROTECT THE ENVIRONMENT AND OUR HEALTH 21-26 (2008). This idea was first explicated in Ronald Coase's now famous article, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960). While that article has in ensuing years become enormously influential—even credited with giving birth to the Law and Economics movement—at the time it was largely ignored by mainstream economics. *See* Steven G. Medema, *Neither Misunderstood Nor Ignored: The Early Reception of Coase's Wider Challenge to the Analysis of Externalities*, 22 HIST. ECON. IDEAS 111 (2014). It was, however, highly influential among a small group of right-wing economists at the University of Virginia, the University of Chicago, and the London School of Economics, who were generally skeptical of government intervention in markets, such as James Buchanan, Ralph Turvey, and others. *Id.*

134. These ideas began to get picked up on by conservative think tanks in the 1960s and 1970s, *see, e.g.*, Paul W. MacAvoy, *Overview of Regulatory Effects and Reform Prospects*, *in* REFORMING REGULATION 9, 17-20 (Timothy Clark, et al. eds., 1980), and from there were adopted by industry lawyers and lobbyists. *See, e.g.,* Lead Indus. Ass'n v. EPA, 647 F.2d 1130, 1161 (D.C. Cir. 1980) (addressing arguments by an industry trade association that EPA should set the NAAQS using CBA rather than health-based standard-setting); Indus. Union Dep't v. Am. Petroleum Inst., 448 U.S. 607, 667 (1980) (involving argument by industry trade association that the Occupational Safety and Health Administration should set standards for toxics exposure in workplaces on the basis of CBA rather than a hybrid feasibility-health-based approach).

While initial efforts to sell a CBA test for regulation in the courts and in the halls of Congress were largely unsuccessful,[135] the climate in Washington, D.C. began to shift markedly in the 1980s. President Reagan swept into office in 1981 on an avowedly anti-regulatory platform and turned a friendly ear to industry lobbyists and their allies.[136] At their urging, he signed Executive Order 12,291, which imposed a CBA requirement for all major federal regulations, to be overseen by a then little-known office within the White House Office of Management and Budget: the Office of Information and Regulatory Affairs (OIRA).[137]

CBA was in these early years widely viewed as an overtly partisan tool explicitly aimed at weakening and delaying regulation,[138] and it largely lived up to that reputation.[139] When President Clinton came into the White House in 1993 after 12 years of Republican control, there was speculation that he might do away with CBA altogether. But ultimately, while he replaced Reagan's executive order with one of his own, President Clinton kept in place Reagan's basic system of centralized White House regulatory review and its CBA mandate, softening it a bit around the edges with references to the importance of unquantifiable benefits and distributional impacts.[140] While on paper these were rather modest changes in wording and emphasis, Executive Order 12,866 nonetheless marked a sea-change in the politics of CBA. In the decades that followed, CBA was gradually embraced by a broader swath of the political spectrum, including a set of politically moderate academics drawn to CBA's promise of technocratic rationality.[141]

This new crop of CBA adherents argued that a formal standardized and professionalized CBA would lead to more rational government decision-making by promoting social welfare maximization, appropriately cabin the discretion of unelected agency bureaucrats, and improve transparency and accountability.[142] A number of these scholars sought to sidestep the by then well-developed and well-established theoretical critiques of CBA by deemphasizing its conventional grounding in Kaldor-Hicks efficiency, resting their defense of CBA instead on

135. Sinden, *supra* note 44, at 129-31.

136. REVESZ & LIVERMORE, *supra* note 133, at 21-29.

137. Exec. Order No. 12,291, § 2(b), 3 C.F.R. 127, 128 (1982).

138. REVESZ & LIVERMORE, *supra* note 133, at 21-30.

139. REVESZ & LIVERMORE, *supra* note 133, at 27-29; David M. Driesen, *Is Cost-Benefit Analysis Neutral?*, 77 U. COLO. L. REV. 335, 339 (2006).

140. Exec. Order No. 12,866, §§ 1(a) & 1(b)(6), 3 C.F.R. 638, 639 (1994), *reprinted as amended in* 5 U.S.C. § 601 app. at 88-92 (2012).

141. *See, e.g.*, MATTHEW D. ADLER & ERIC A. POSNER, NEW FOUNDATIONS OF COST-BENEFIT ANALYSIS (2006); REVESZ & LIVERMORE, *supra* note 138; CASS R. SUNSTEIN, RISK AND REASON: SAFETY, LAW, AND THE ENVIRONMENT 99, 120-23 (2002).

142. CASS R. SUNSTEIN, THE COST-BENEFIT STATE: THE FUTURE OF REGULATORY PROTECTION 19-20 (2002); ADLER & POSNER, *supra* note 141, at 19-21; REVESZ & LIVERMORE, *supra* note 133, at 13-16.

pragmatism and "common sense."[143] But even while distancing themselves from the problematic concept of Kaldor-Hicks efficiency, these scholars articulated a vision of CBA that remained squarely rooted in the ideal of social welfare maximization. By offering a standardized method aimed at what they viewed as the politically neutral normative polestar of net benefits maximization, they argued that formal CBA offered the best tool for restraining agency discretion.[144]

These scholars also put considerable emphasis on the capacity of formal CBA to promote transparency and accountability.[145] Critics have long argued that CBA inhibits transparency by obscuring key value judgments behind a veil of apparent scientific accuracy and legitimacy and that the use of sophisticated mathematics and abstruse concepts like discounting in formal CBA make it inaccessible to the general public.[146] But CBA's new proponents countered that formal CBA's reliance on standardized methods and its emphasis on numbers and data rather than gut feeling and instinct allow the public to more readily ascertain the rationale for an agency's decision and may even allow for replication of results by outside observers.[147]

C. Recent Years: The Tilt Toward Formality

Despite this broadening political support for CBA, a series of attempts over the years to codify the executive orders' CBA requirement into a statutory CBA super-mandate have all been unsuccessful.[148] As a result, agencies have for the past forty years navigated a narrow tight rope—on the one hand, preparing a CBA in order to comply with the executive orders' commands, but, on the other

143. *See, e.g.*, ADLER & POSNER, *supra* note 141, at 63-68 (defending CBA not as a direct implementation of the Kaldor-Hicks efficiency criterion, but rather as a pragmatic decision procedure that tracks economic efficiency or overall welfare reasonably well and better than any of its competitors); REVESZ & LIVERMORE, *supra* note 138, at 10 (defending CBA as "a requirement of basic rationality"); Cass R. Sunstein, *Is Cost-Benefit Analysis for Everyone?*, 53 ADMIN. L. REV. 299, 302 (2001) ("[T]he strongest argument for CBA rests not with neoclassical economics but with common sense.").

144. *See supra* note 142.

145. *See* Cass R. Sunstein, Nonquantifiable 6 (June 17, 2013) (unpublished manuscript), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2259279 [https://perma.cc/6BBV-ESPN] ("Quantification helps to promote accountability, transparency, and consistency . . . ."); *see* SUNSTEIN, *supra* note 142, at 9, 27.

146. *See* Lisa Heinzerling, *Regulatory Costs of Mythic Proportions*, 107 YALE L.J. 1981, 2064-65, 2068 (1998); Amy Sinden, *Cass Sunstein's Cost-Benefit Lite: Economics for Liberals*, 29 COLUM. J. ENV'T L. 191, 219-22 (2004); Christopher Carrigan & Stuart Shapiro, *What's Wrong with the Back of the Envelope? A Call for Simple (and Timely) Benefit-Cost Analysis*, 11 REGUL. & GOVERNANCE 203 (2017) ("RIAs have become denser, making it harder for the public to understand how their conclusions are reached.").

147. *See* Daniel H. Cole, *Law, Politics, and Cost-Benefit Analysis*, 64 ALA. L. REV. 55, 69-70 (2012).

148. The bill that came the closest to passage was the Risk Assessment and Cost-Benefit Analysis Act of 1995—part of the Republican Party's Contract with America that would have essentially codified the Reagan executive order, requiring agencies to perform formal CBA for all proposed "major health, safety, and environmental rules" (those with annual costs of $25 million or more) and prohibiting promulgation of any final rule unless the agency "certified" that the benefits justify the costs. H.R. 690, 104th Cong. (1995). After passing the House by 271 to 141, the Senate counterpart fell just two votes short of overcoming a filibuster.

hand, justifying their rulemakings on the basis of the entirely different decision-making framework specified in the statute.[149]

Still, as an executive command, the CBA requirement has endured through six presidencies—four Republican and two Democratic—and appears well on its way to surviving the Biden presidency as well. Congress continues to eschew CBA, particularly in its more formal iterations, and the courts have largely followed suit. But the executive branch has—perhaps surprisingly—taken the opposite tack, its practices gradually congealing over the decades into an increasingly formal brand of CBA, at least in aspiration.[150]

Several forces appear to be fueling the executive branch's embrace of formal CBA. One is the executive orders themselves. While acknowledging the difficulties of quantification and the importance of immeasurable values like dignity and equity, the CBA executive orders, as well as the guidance documents implementing them, contain lots of language holding up the formal optimizing version of CBA as the norm and the goal.[151] They describe CBA as a tool for finding "the most efficient alternative,"[152] or the alternative that "maximizes net benefits."[153] They talk in the language of economic theory, directing agencies to measure costs and benefits in terms of "opportunity costs" and "willingness-to-pay"[154] and citing "the Potential Pareto criterion" as "the foundation of CBA."[155] And they hold up full quantification of costs and benefits as the norm and the expectation, instructing "each agency . . . to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as

149. *See, e.g.*, Final Rule: Primary National Ambient Air Quality Standards for Sulfur Dioxide, 75 Fed. Reg. 35,520, 35,587 (June 22, 2010) ("EPA prepared a Regulatory Impact Analysis (RIA) of the potential costs and benefits associated with this action. However, the CAA and judicial decisions make clear that the economic and technical feasibility of attaining the national ambient standards cannot be considered in setting or revising NAAQS. . . . Accordingly, although an RIA has been prepared, the results of the RIA have not been considered by EPA in developing this final rule.").

150. *See* Sinden, *supra* note 44, at 147-68.

151. *See* CIRCULAR A-4, *supra* note 49, at 10 ("By measuring incremental benefits and costs of successively more stringent regulatory alternatives, you can identify the alternative that maximizes net benefits."); *id.* at 23 (noting that agency CBAs should be "consistent with economic theory"); EPA, GUIDELINES FOR PREPARING ECONOMIC ANALYSES 1-4 ("[The Potential Pareto] criterion is the foundation of [CBA], requiring that a policy's net benefits to society be positive. . . . The policy that maximizes net benefits is considered the most efficient."), https://www.epa.gov/environmental-economics/guidelines-preparing-economic-analyses [https://perma.cc/Z4WZ-QYC6]; *id*. at 11-13 (requiring a strict numerical comparison of costs against benefits in order "to determine a regulation's net benefits, even if important benefits or costs cannot be monetized").

152. CIRCULAR A-4, *supra* note 49, at 2.

153. Exec. Order No. 12,866, § 1(a), 3 C.F.R. 638-39 (1994); *see* CIRCULAR A-4, *supra* note 49, at 9.

154. CIRCULAR A-4, *supra* note 49, at 18. The Circular also repeatedly references the importance of ensuring that the methods used by agencies in preparing CBAs are "consistent with economic theory." *Id.* at 21, 23.

155. EPA, *supra* note 151, at 1-4. The "potential Pareto criterion" is another name for Kaldor-Hicks efficiency. EPA's Guidelines contain a detailed appendix that provides a textbook introduction to the fundamentals of economic theory. *Id*. app. A.

possible."[156] Indeed, they even go so far as to require each agency to perform a strict numerical calculation of net benefits, even when such a calculation is nonsensical because important benefits (or costs) have been left out of the numeric estimate.[157]

There are also institutional pressures pushing the executive branch toward increased formality in CBA. Cass Sunstein's writings on his time serving as President Obama's OIRA Administrator are particularly instructive on this point. Sunstein characterizes the language of Obama's CBA executive order as "reflect[ing] an unprecedented emphasis on the importance of quantification"[158] and calls CBA's capacity to promote net benefits maximization "exceedingly important."[159] Because of the emphasis on quantification and net benefits maximization, OIRA requires agencies to be able to make their case that a rule is cost-benefit justified on the numbers alone: "If the quantifiable benefits are lower than the quantifiable costs, agencies must explain why they seek to proceed. . . . In the Obama Administration, it has been very rare for a rule to have monetized costs in excess of monetized benefits."[160] Lisa Heinzerling, who served as Associate Administrator of the EPA's Office of Policy during this same period, describes that tilt toward formality at OIRA as permeating the culture at the EPA and creating a kind of chilling effect among EPA personnel. In Heinzerling's words, "OIRA's fine cost-benefit sieve leads EPA personnel to be deeply wary of developing rules that have very high costs in relation to their quantified and monetized benefits." [161]

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156. Exec. Order No. 13,563, § 1(c), 3 C.F.R. 215, 216 (2012), *reprinted in* 5 U.S.C. § 601 app. at 102-03 (2012). Executive Order 13,563 follows this statement with an acknowledgment of the difficulties that arise in attempting to quantify some values, but makes the directive that agencies discuss unquantifiable values permissive rather than mandatory: "Where appropriate and permitted by law, each agency *may* consider (and discuss qualitatively) values that are difficult or impossible to quantify, including equity, human dignity, fairness, and distributive impacts." *Id.* (emphasis added).

157. *See* EPA, *supra* note 151, at 11-3 (requiring a strict numerical comparison of costs against benefits in order "to determine a regulation's net benefits, *even if important benefits or costs cannot be monetized*" (emphasis added)).

158. Cass R. Sunstein, *The Real World of Cost-Benefit Analysis: Thirty-Six Questions (and Almost as Many Answers)*, 114 COLUM. L. REV. 167, 171 (2014).

159. Cass R. Sunstein, *The Office of Information and Regulatory Affairs: Myths and Realities*, 126 HARV. L. REV. 1838, 1864 (2013). This increased emphasis on formality in the Obama Administration followed a similar trend during the George W. Bush Administration. *See* Curtis W. Copeland, *The Role of the Office of Information and Regulatory Affairs in Federal Rulemaking*, 33 FORDHAM URB. L.J. 1257, 1292 (2006) (describing "a perceptible 'stepping up the bar' in the amount of support required for [agencies'] rules [during the George W. Bush Administration], with OIRA reportedly more often looking for regulatory benefits to be quantified and a cost-benefit analysis for every regulatory option that the agency considered").

160. Sunstein, *supra* note 159, at 1865-66; *see also* Sunstein, *supra* note 158, at 180-81 (noting that where a regulation's monetized benefits are less than monetized costs, "the agency is unlikely to attempt to go forward with this regulation," and if it does, it "will not be easy to establish" that the benefits justify the costs); *id.* at 188 (observing that if an agency were to express monetized benefits in wide ranges, "[a] great deal of work would be done to try to achieve greater precision and confidence in the numbers").

161. Lisa Heinzerling, *Inside EPA: A Former Insider's Reflections on the Relationship Between the Obama EPA and the Obama White House*, 31 PACE ENV'T L. REV. 325, 352 (2014); *see also* CASS R. SUNSTEIN, VALUING LIFE: HUMANIZING THE REGULATORY STATE 37 (2014) ("Within the federal government, agencies are acutely aware of the cost-benefit requirement of Executive Order 13563 and

The professional culture at OIRA, where the staff is made up primarily of economists steeped in the particular and highly formal brand of CBA that comes out of welfare economics, may be one of the drivers behind this apparent push toward formality in the executive branch. Another driver may be the institutional dynamics at the agencies, where personnel are highly attuned to the need to craft rules in a way that insulates them against legal and political attack.[162] These dynamics may heighten what Doug Kysar has called the "cognitive lure" of formality that can hold sway in an agency environment where "the promise of an 'objective' quantitative analysis seem[s] difficult to resist in the face of a heavily politicized, deeply uncertain, and morally fraught decision."[163]

Nevertheless, in the face of this increasing shift toward formality in the executive branch, the worries that drove Congress half a century ago to rely primarily on fast and frugal feasibility standards rather than formal CBA still persist. Vast information gaps remain and quantified regulatory benefits are still the exception rather than the rule.[164] Even at EPA, which is often held up as the exemplar of advanced and sophisticated CBA, of the hundreds of pollutants the agency regulates, there is primarily just one—particulate matter—for which the agency is able to monetize benefits with any regularity and reliability.[165] In the

Executive Order 12866."); Rena Steinzor, *The Case for Abolishing Centralized White House Regulatory Review*, 1 MICH. J. ENV'T & ADMIN. L. 209, 243-44 (2012) (describing the dynamic set up by the centralized review of agency rules by OIRA as giving it significant power and sway over agency rule making); Sunstein, *supra* note 158, at 180-81 (noting that where a regulation's monetized benefits are less than monetized costs, "the agency is unlikely to attempt to go forward with this regulation").

162. Wendy E. Wagner, *The CAIR RIA: Advocacy Dressed up as Policy Analysis*, *in* REFORMING REGULATORY IMPACT ANALYSIS 56, 57 (Winston Harrington et al. eds., 2009).

163. DOUGLAS A. KYSAR, FISH TALES 190, 197 (1st ed. 2009); *see also* Cole, *supra* note 147, at 69 (observing that "government increasingly rel[ies] on [CBA] as a tool in policymaking" despite its "various subjective and manipulable elements" in part because it "*appear[s]* more scientific," and because it allows "decision makers . . . [to] boil down fundamental questions of regulatory policy to a single number (or a set of numbers . . .), which creates the impression (or misimpression) that the policy choice is . . . clear"); Amy Sinden, *The Economics of Endangered Species: Why Less is More in the Economic Analysis of Critical Habitat Designations*, 28 HARV. ENV'T L. REV. 129, 183 (2004) (describing "an ongoing tug-of-war between environmentalists and industry in which each side will progressively force [the agency] to spend more and more money seeking the holy grail of accuracy in the quantification of costs and benefits").

164. *See* Jason K. Burnett, Yee-Ho I. Chen, Robert W. Hahn & Elizabeth A. Mader, *Assessing Regulatory Impact Analyses: The Failure of Agencies to Comply with Executive Order 12,866*, 23 HARV. J.L. & PUB. POL'Y 859, 869-70 (2000); Jonathan Masur & Eric Posner, *Unquantified Benefits and the Problem of Regulation Under Uncertainty*, 102 CORNELL L. REV. 87, 104 (2016) (reporting the results of an empirical study of CBAs of federal regulations in which for over seventy-four percent of the regulations, the agency "could not quantify all of the relevant benefits or costs because of empirical uncertainty—missing data, modeling difficulties, or other related effects"); Al McGartland, Richard Revesz, Daniel A. Axelrad, Chris Dockins, Patrice Sutton & Tracey Woodruff, *Estimating the Health Benefits of Environmental Regulations: Changes Needed for Complete Benefits Assessment*, 357 SCI. 457 (2017); Driesen, *supra* note 139, at 371-77 (finding, in an empirical study of OIRA review of 25 rules, numerous instances in which significant benefits were left unquantified).

165. *See* Amy Sinden, *The Problem of Unquantified Benefits*, 49 ENV'T L. 73, 111 (2019) ("Of the thirty-three Clean Air Act CBAs in the sample [of forty-five], fifteen quantified only particulate matter benefits, even though, in each instance, the rule was also expected to reduce multiple other harmful pollution agents—typically ozone, sulfur dioxide, oxides of nitrogen, volatile organic compounds, and/or hazardous air pollutants. In four other instances, particulate matter benefits amounted to at least 99% of

vast majority of rulemakings, EPA leaves significant benefits unmonetized.[166] Moreover, the agency typically only estimates costs and benefits for one or two alternatives.[167] This, of course, renders meaningful calculation of net benefits and identification of the benefit-maximizing alternative an impossibility, such that a formal optimizing CBA capable of fulfilling the standard-setting function simply cannot be performed. CBA is in these instances relegated to the cost screening function instead.

As a result, OIRA and the agencies rarely achieve in practice the formality in CBA to which they aspire. This mismatch between aspiration and practice leads to a phenomenon I have called "false formality," where the agency inappropriately employs elements of formal analysis in a CBA that lacks the precision necessary for formal treatment.[168] In one rulemaking, for example, EPA used a precise, numeric balancing test—meant for formal CBAs in which all significant costs and benefits are quantified—to compare a fairly complete estimate of costs to a benefits estimate that was vastly incomplete and on that basis reached the illogical and unsupported conclusion that costs exceeded benefits.[169]

All of this leaves the agencies in an incongruous position, navigating the tension between the expectations of formality—that CBA will hew to a set of precise and objective standards—and its less than formal performance in practice. As the next Part explores, these tensions are also evident in the debates over the social cost of carbon.

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total monetized benefits."). Indeed, the data from that study demonstrates that ninety-three percent of the total monetized benefits produced in connection with EPA CBAs over that thirteen-year period were attributable to reductions in particulate matter. *See id.* at 79 n. 24.

166. *See* Sinden, *supra* note 165, at 107-09 (stating that in an empirical study of EPA's forty-five major rulemakings between 2002 and 2015, eighty percent of CBAs failed to monetize whole categories of benefits the agency itself described as "significant," "substantial," or "important"); *see also* Ronnie Levin, *Lead in Drinking Water*, *in* RICHARD D. MORGENSTERN, ECONOMIC ANALYSES AT EPA: ASSESSING REGULATORY IMPACT 230 (1997) ("Serious gaps in data and methodology constrain the utility of [CBA]. Typically, only a few potential health or other benefits can be quantified, and even fewer can be valued monetarily. Consequently, when the sum of the limited subset of benefits that can be quantified and monetized is shown to be less than the estimated costs, it is often impossible to conclude anything about the relative magnitude of the full benefits.").

167. *See* Sinden, *supra* note 165, at 110-11 (stating that in an empirical study of EPA's forty-five major rulemakings between 2002 and 2015, 40% analyzed only one alternative, 51% analyzed one or two, and 71% analyzed one, two, or three alternatives).

168. *See* Sinden, *supra* note 44.

169. This occurred in EPA's proposed Cooling Water Intake Structure Rule for existing power plants in 2002. National Pollutant Discharge Elimination System—Proposed Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities, 67 Fed. Reg. 17,122, 17,158 (proposed April 9, 2002) (rejecting a more environmentally protective alternative on the ground that "the incremental cost of this option relative to the proposed option ($413 million) significantly outweigh the incremental benefits ($146 million)"). EPA appears to have used the overly precise balancing test at OIRA's urging. *See* Amy Sinden, *Cost-Benefit Analysis, Ben Franklin, and the Supreme Court*, 4 U.C. IRVINE L. REV. 1174, 1199 n. 127 (2014). And while the record is somewhat murky on this point, this nonsensical complete-costs-incomplete-benefits balance appears to have been the basis for the agency's decision to reject the more stringent alternative in favor of a weaker rule. *Id.* at 1199-1200.

III. The Social Cost of Carbon

Having described the evolution of environmental decision making in the federal government over the past half century, including the increasing emphasis on formal varieties of CBA in the executive branch despite a marked absence of CBA in the statutes that actually govern agency decision making, this Part describes White House efforts over the past decade to facilitate the application of formal CBA to climate policy by developing a standardized social cost of carbon (SCC) for use across the federal government.

A. Evolution of the SCC in the United States

With the increasing emphasis on formality and quantification in CBA during the first decade of the twenty-first century, it is perhaps not surprising that early in his White House tenure, President Obama directed his administration to take up the task of developing an official U.S. government estimate of what had come to be known in the academic literature as "the social cost of carbon" or "SCC."[170] The SCC is a dollar figure intended to represent the total damages caused by each additional ton of CO_2 released into the atmosphere.[171] An official government estimate of the SCC provides a uniform figure that agencies across the federal government can easily plug into their CBAs in rulemakings for which they are able to quantify associated increases or decreases in carbon emissions.[172] The figure could be useful in other kinds of agency analyses as well. The Biden administration is considering using the figure in budgeting and procurement decisions within the executive branch.[173] Some agencies have begun using the SCC to monetize estimates of climate impacts in environmental impact statements under the National Environmental Policy Act (NEPA).[174] Some scholars also advocate using it to internalize the climate externality in the calculation of enforcement penalties, mineral royalties, and wholesale electricity rates.[175]

In 2009, President Obama directed the Council of Economic Advisors and the OMB Director to convene an Interagency Working Group on the Social Cost of Carbon tasked with reviewing the SCC literature[176] and developing the first-

170. The academic literature on the SCC dates back decades. The earliest meta-review of SCC estimates was published in 2002. *See* Richard Clarkson & Kathryn Deyes, *Estimating the Social Cost of Carbon Emissions* (Gov. Econ. Serv., Working Paper No. 140, 2002).

171. INTERAGENCY WORKING GRP. ON SOC. COST OF GREENHOUSE GASES, *supra* note 16, at 9.

172. *Id.*

173. *See* Exec. Order No. 13,990, § 5(b)(ii)(C), 86 Fed. Reg. 7037, 7040 (Jan. 20, 2021).

174. *See* Doyle Elizabeth Canning, *Zeroing Out Climate Change: A Hard Look at Trump's Social Cost of Carbon*, 48 ENV'T L. REP. 10,479 (2018).

175. *See* Richard Revesz & Max Sarinsky, *The Social Cost of Greenhouse Gases: Legal, Economic, and Institutional Perspective*, 39 YALE J. ON REGUL. 856 (2022).

176. The academic literature on the SCC goes back three decades or more. *See, e.g.*, Robert U. Ayres & Jörg Walter, *The Greenhouse Effect: Damages, Costs and Abatement*, 1 ENV'T & RES. ECON.

ever official U.S. government estimate of the SCC for use in agency decision making across the executive branch.[177] In 2010, the working group finalized a set of four values for the SCC. Three used different discount rates (2.5, 3 and 5%) and the fourth provided an "upper bound" estimate at the 95th percentile using a 3% discount rate.[178] Agencies typically used the 3% figure of $21 a ton for 2010 as the "central" estimate in their CBAs in rulemakings.[179] In 2013, the working group issued an update to the SCC that incorporated new versions of the three Integrated Assessment Models (IAMs) that had been used to develop the 2010 figures.[180] The update increased the 3% figure for 2010 to $32 per ton.[181]

The 2010 and 2013 estimates were widely criticized for being too low. First, there were a number of potentially important aspects of climate damages that the IAMs on which the SCC estimates were based had omitted from their analyses entirely. These included loss of endangered species and habitats,[182] ocean acidification,[183] the economic and political consequences of climate-induced migration,[184] increased wildfire risk, the spread of insect pests and diseases, and increased political conflict.[185]

Second, commentators criticized the Working Group's decision to rely exclusively on three particular IAMs—the DICE, FUND, and PAGE models.[186] The Working Group controversially excluded other estimates, including in particular the widely discussed Stern Review, published in 2006, which derived a relatively high SCC estimate of $85 per ton.[187] The three IAMs the Working Group did choose were criticized for making a number of controversial judgments and assumptions that were inconsistent with well-established climate

237 (1991); *see also* Richard S.J. Tol, *Estimates of the Social Cost of Carbon Have Increased Over Time*, ARXIV 1 (2021), https://arxiv.org/abs/2105.03656 [https://perma.cc/BZG5-LJ9B] (providing a meta-analysis of published SCC estimates).

177. *See* INTERAGENCY WORKING GRP. ON SOC. COST OF CARBON, U.S. GOV'T, TECHNICAL SUPPORT DOCUMENT: SOCIAL COST OF CARBON FOR REGULATORY IMPACT ANALYSIS UNDER EXECUTIVE ORDER 12866 (2010).

178. *Id.* at 1.

179. *See id.* at 17.

180. *See* INTERAGENCY WORKING GRP. ON SOC. COST OF CARBON, U.S. GOV'T, TECHNICAL SUPPORT DOCUMENT: TECHNICAL UPDATE OF THE SOCIAL COST OF CARBON FOR REGULATORY IMPACT ANALYSIS UNDER EXECUTIVE ORDER 12866 2 (2013).

181. *Id.* at 3.

182. *See* Ackerman & Stanton, *supra* note 24, at 134.

183. *See* INTERAGENCY WORKING GRP. ON SOC. COST OF CARBON, *supra* note 177, at 30 (identifying ocean acidification as an example of "a potentially large damage of CO_2 emissions" omitted from the integrated assessment models).

184. *See* Jonathan S. Masur & Eric A. Posner, *Climate Regulation and the Limits of Cost-Benefit Analysis*, 99 CALIF. L. REV. 1557, 1580 (2011).

185. *See* Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon*, INST. FOR POL'Y INTEGRITY (2014), https://policyintegrity.org/files/publications/Omitted_Damages_Whats_Missing_From_the_Social_Cost_of_Carbon.pdf [https://perma.cc/LH3P-SA86].

186. *See* Ackerman & Stanton, *supra* note 15, at 134-37; Masur & Posner, *supra* note 136, at 1584 (referring to the DICE damage function as "essentially a guess" and characterizing the Working Group's SCC estimate as "the average of three guesses").

187. *See* NICHOLAS STERN, THE ECONOMICS OF CLIMATE CHANGE: THE STERN REVIEW (2006).

science. The FUND model, for example, erroneously assumed that climate disruption will, in its early years, produce a significant reduction in mortality.[188] Indeed, it assumed net global damages would be *negative* up to nearly the first 3° C of warming.[189] Even a decade ago, this was an assumption wildly out of step with climate science, which was already engaged in a discussion of whether an increase of just 2° C might trigger tipping points in the climate system that would precipitate catastrophic and irreversible damage to the planet's life-support systems.[190]

In a similar vein, the DICE model, developed by William Nordhaus, employed an assumption that the majority of people would be willing to pay for a warmer climate and that the optimal climate is actually well above the current global average.[191] Even at a whopping 19° C of warming, the DICE model projected that only half of global GDP would be lost.[192] Yet a study published in 2010 concluded that at 11-12° C of warming, most currently populated regions of the earth would surpass the "adaptability limit" at which the human body becomes physically incapable of avoiding hyperthermia ("metabolic heat dissipation . . . become[s] impossible").[193]

Third, critics questioned the Working Group's choice of discount rates, which ranged from 2.5 to 5%. The debate over the appropriate social discount rate for cost-benefit analysis generally and in the context of the SCC more specifically is long-standing, and there is no consensus on these topics within the discipline of economics.[194] There are strong arguments for lower discount rates in the context of climate disruption, based both on the ethical implications of

188. *See* Frank Ackerman & E.A. Stanton, *A Comment on "Economy-Wide Estimates of the Implications of Climate Change: Human Health*," 66 ECOLOGICAL ECON.13 (2008).

189. *See* Ackerman & Stanton, *supra* note 24, at 139-40. This rather extreme assumption is not surprising given Tol's generally fringe views on the seriousness of the climate crisis. *See* Richard S.J. Tol, *Why Worry About Climate Change? A Research Agenda*, 17 ENV'T VALUES 437 (2009) (characterizing the Stern Review as "scaremongering" and calling "the impact of climate change . . . relatively small . . . equivalent to losing a few percent of income").

190. *See, e.g.*, James Hansen, Makiko Sato, Pushker Kharecha, David Beerling, Robert Berner, Valerie Masson-Delmotte, Mark Pagani, Maureen Raymo, Dana L. Royer & James C. Zachos, *Target Atmospheric CO2: Where Should Humanity Aim?*, 2 OPEN ATMOSPHERIC SCI. J. 217, 225 (2008); *see* Douglas A. Kysar, *Politics by Other Meanings: A Comment on "Retaking Rationality Two Years Later*," 48 HOUS. L. REV. 43, 60-61 (2011).

191. *See* WILLIAM D. NORDHAUS, & JOSEPH BOYER, WARMING THE WORLD: ECONOMIC MODELS OF GLOBAL WARMING 84-85 (2000); Ackerman & Stanton, *supra* note 24, at 136. Even today, Nordhaus maintains that an economically optimal climate policy path would aim for 3.5° C of warming by the end of the century and delay reaching net zero emissions until 2200. *See* William Nordhaus, *Climate Change: The Ultimate Challenge for Economics*, 109 AM. ECON. REV. 1991 (2019).

192. *See* Frank Ackerman, Elizabeth A. Stanton & Ramon Bueno, *Fat Tails, Exponents, Extreme Uncertainty: Simulating Catastrophic in DICE*, 69 ECOLOGICAL ECON. 1657 (2010); Kysar, *supra* note 190, at 61-62.

193. Steven C. Sherwood & Matthew Huber, *An Adaptability Limit to Climate Change Due to Heat Stress*, 107 PROC. NAT'L ACAD. SCI. 9552, 9554 (2010).

194. *See* Christian Gollier & James K. Hammitt, *The Long-Run Discount Rate Controversy*, 6 ANN. REV. RES. ECON. 273 (2014); Martin C. Hansel, *Climate Economics Support for the UN Climate Targets*, 10 NATURE CLIMATE CHANGE 781, 782 (2020).

intergenerational discounting[195] and the nature of climate damages.[196] But even those favoring lower rates differ as to just how much lower they should be.[197] And because climate impacts occur over such long time horizons, even small changes in discount rates compound dramatically over decades and centuries to produce widely diverging SCC estimates.[198]

Fourth, the IAMs were criticized for giving inadequate weight to the risk of catastrophic outcomes.[199] Climate science has identified a number of tipping points in the climate system that could trigger catastrophic harms, but because these tipping points involve the dynamics of large complex systems, deep scientific uncertainties remain about the temperature thresholds at which such tipping points might be reached.[200] Accordingly, the IAMs largely failed to

195. *See* STERN, *supra* note 187, at 31-33; CIRCULAR A-4, *supra* note 49, at 35-36 (acknowledging the ethical dilemmas raised by intergenerational discounting and recommending "[i]f your rule will have important intergenerational benefits and costs, you might consider a further sensitivity analysis using a lower . . . discount rate"); Lisa Heinzerling, *Discounting Our Future*, 34 LAND & WATER L. REV. 39, 40-41 (1999); Douglas A. Kysar, *Discounting, on Stilts*, 74 U. CHI. L. REV. 119, 119-20 (2007); Richard L. Revesz, *Environmental Regulation, Cost-Benefit Analysis, and the Discounting of Human Lives*, 99 COLUM. L. REV. 941, 955-86 (1999).

196. *See* Richard G. Newell & William A. Pizer, *Uncertain Discount Rates in Climate Policy Analysis*, 32 ENERGY POL'Y 519, 521 (2004) ("Because climate policy decisions ultimately concern the future welfare of people—not firms—the consumption interest rate is more appropriate."); CIRCULAR A-4, *supra* note 49, at 33 ("When regulation primarily and directly affects private consumption . . . a lower discount rate is appropriate.").

197. *See, e.g.*, Tamma Carleton & Michael Greenstone, *Updating the United States Government's Social Cost of Carbon* 23-25 (Univ. of Chi., Working Paper No. 2021-04, 2021) (recommending a discount rate for the SCC of "no higher than 2 percent," but noting arguments for various values and methods for calculating the rate within that range); NATIONAL ACADEMIES OF SCIENCES, ENGINEERING, AND MEDICINE, VALUING CLIMATE DAMAGES: UPDATING ESTIMATION OF THE SOCIAL COST OF CARBON DIOXIDE 164 (2017) ("Over long time horizons, the discount rate is uncertain."); Nicholas Stern, *The Structure of Economic Modeling of the Potential Impacts of Climate Change: Grafting Gross Underestimation of Risk onto Already Narrow Science Models*, 51 J. ECON. LIT. 838, 851 (2013) (noting that future generations "could be much poorer than us [in which case] discount rates could be negative over long periods"). Calls to use lower discount rates in the context of climate disruption have proliferated in recent years, partly in response to declining market interest rates. *See* Richard G. Newell, William Pizer & Brian Prest, *A Discounting Rule for the Social Cost of Carbon*, Resources for the Future 14 (June 18, 2021), https://www.rff.org/publications/working-papers/a-discounting-rule-for-the-social-cost-of-carbon/ [https://perma.cc/UQK3-FGWY] ("The recent literature has begun to converge towards considering a consumption discount rate of about 2% (rather than 3%), . . . if not lower."). Michael Greenstone, chief economist of President Obama's Council on Economic Advisors who served as co-chair of the Obama Working Group, argues that profound changes in global capital markets warrant a significantly lower interest rate than the working group used in the Obama administration and that there is now "a compelling case" for reducing the discount rate to 2 percent or lower. *See* Carleton & Greenstone, *supra* note 13, at 23. In 2019, the New York State Legislature passed the Climate Leadership and Community Protection Act (signed into law on June 18, 2019) directing the Department of Environmental Conservation to establish an SCC and to use "a range of appropriate discount rates, including a rate of zero." Climate Leadership and Community Protection Act, N.Y. Env't Conserv. Law § 75-0113 (McKinney 2020).

198. *See* Hansel, *supra* note 194, at 782; Isaacs et al., *supra* note 24, at 41.

199. *See* INTERAGENCY WORKING GRP. ON SOC. COST OF CARBON, *supra* note 177, at 30 (acknowledging the SCC estimate's "incomplete treatm/ent of potential catastrophic damages"); Robert S. Pindyck, *The Climate Policy Dilemma*, 7 REV. ENV'T ECON. & POL'Y 219, 231-235 (2013) (arguing that "[t]he economic loss functions that are part of most IAMs are essentially ad hoc" and fail to account for catastrophic climate outcomes).

200. FRANK ACKERMAN, WORST-CASE ECONOMICS: EXTREME EVENTS IN CLIMATE AND FINANCE 98 (2017).

account for these potential catastrophic impacts.[201] This problem of fat-tailed uncertainty is exacerbated by the considerable uncertainties surrounding estimates of climate sensitivity—the long-run global average temperature increase associated with a doubling of CO_2 in the atmosphere.[202]

Finally, the 2010 and 2013 SCC estimates were criticized for simply being too low to accomplish the emissions reductions required to avoid catastrophic climate change. The 2010 figure of $21 per ton, for example, translates to a roughly 20-cent tax on a gallon of gasoline—not an amount that would likely be high enough to be visible above the noise of normal market fluctuations and therefore to change much behavior.[203]

Then came the 2016 election. These criticisms of the SCC for being too low were of little interest to the Trump Administration, which promptly moved in the other direction, dropping the SCC to bargain basement levels of $1 to $7 per ton.[204] Two months after taking office, President Trump signed an executive order disbanding the Working Group and withdrawing all the policy documents it had issued since its inception.[205] The executive order also instructed agencies—albeit indirectly—to use a higher discount rate and consider confining the impacts considered to those occurring within U.S. borders when calculating the SCC.[206] Agencies followed that directive, and, as it turned out, changing just those two parameters in the SCC calculation had the effect of drastically reducing its central value from $32 per ton to as low as $1 per ton.[207]

President Biden promptly re-established the Working Group—issuing an executive order to that end his first day in office.[208] He directed the Working Group to establish an interim SCC within thirty days (along with an interim

201. *See* Martin L. Weitzman, *On Modelling and Interpreting the Economics of Catastrophic Climate Change*, 91 REV. ECON. & STAT. 1 (2009).

202. *See* ACKERMAN, *supra* note 200, at 99-101; David Anthoff & Richard S.J. Tol, *The Uncertainty About the Social Cost of Carbon: A Decomposition Analysis Using Fund*, 117 CLIMATE CHANGE 515 (2013) (finding climate sensitivity to be the most important contributor to variations in SCC estimates irrespective of discount rate level); Kysar, *supra* note 192, at 63-64.

203. *See* Ackerman & Stanton, *supra* note 24, at 141.

204. *See* EPA, REGULATORY IMPACT ANALYSIS FOR THE PROPOSED EMISSION GUIDELINES FOR GREENHOUSE GAS EMISSIONS FROM EXISTING ELECTRIC UTILITY GENERATING UNITS; REVISIONS TO EMISSION GUIDELINE IMPLEMENTING REGULATIONS; REVISIONS TO NEW SOURCE REVIEW PROGRAM, at 4-4 tbl.4-4 (2018).

205. *See* Exec. Order No. 13,783, 82 Fed. Reg. 16,093 (Mar. 28, 2017).

206. Specifically, the executive order required agencies to "ensure . . . that any [SCC, SCM or SCN] estimates are consistent with OMB Circular A-4." *Id.* at 16,096. Issued in 2003, that OMB guidance document governs agency preparation of CBAs pursuant to EO 12,866, requires agencies to use both a three percent and a seven percent discount rate, and states that CBAs "should focus on benefits and costs that accrue to citizens and residents of the United States." CIRCULAR A-4, *supra* note 49, at 32. As the current Working Group has pointed out, however, Circular A-4 was issued nearly two decades ago at a time when prevailing interest rates were much higher (and had been that way for a long time) and when it was generally assumed that since "the authority to regulate only extends to a nation's own residents," the costs and benefits of such regulation would generally be confined to within the nation's borders. INTERAGENCY WORKING GRP. ON SOC. COST OF GREENHOUSE GASES, *supra* note 16, at 14-15.

207. The Trump Administration produced two values for the SCC: $1 at a 7% discount rate, and $7 per ton at a 3% discount rate. *See* Doyle Elizabeth Canning, *Zeroing Out Climate Change: A Hard Look at Trump's Social Cost of Carbon*, 48 ENV'T L. REP. 10,479 (2018).

208. *See* Exec. Order No. 13,990, § 5(b), 86 Fed. Reg. 7037, 7040 (Jan. 20, 2021).

social cost of methane (SCM) and social cost of nitrous oxide (SCN)) and a final SCC, SCM, and SCN within a year.[209] The executive order specifically directed the Working Group to ensure that its estimates "are based on the best available economics and science," "tak[e] global damages into account," "reflect the interests of future generations," and consider the recommendations in the National Academies' 2017 report[210] reviewing the Working Group's earlier SCC estimates.[211]

The new Working Group convened and published the interim values for all three figures the following month. The group simply used the Obama Working Group's most recent calculations from 2013, updating them to the year 2020 and expressing them in 2020 dollars rather than 2007 dollars. The result was a central estimate (at a 3% discount rate) of $51 per ton for the interim SCC.[212] This set of numbers came with quite a few caveats, however, stated clearly upfront in the executive summary. The Working Group took pains to say that, while it continued to use the same three discount rates used during the Obama Administration—2.5%, 3% and 5%—"new data and evidence strongly suggests that the discount rate regarded as appropriate for intergenerational analysis is lower."[213] The group invited individual agencies to "consider conducting additional sensitivity analysis using discount rates below 2.5 percent."[214] Moreover, it noted that "the IAMs used to produce these interim estimates do not include all of the important physical, ecological, and economic impacts of climate change recognized in the climate change literature."[215] And, finally, the Working Group warned that its interim SCC estimates "likely underestimate" the actual damages caused by greenhouse gas emissions.[216]

The Working Group took public comment last spring and is now hard at work on a final set of estimates for the SCC (and other greenhouse gases).[217] While it is impossible to predict exactly where the final estimates will land, some observers have said they expect to see a central value in the $125 range.[218]

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209. *See id*. § 5(b)(ii)(A)-(B).

210. COMM. ON ASSESSING APPROACHES TO UPDATING THE SOC. COST OF CARBON, BD. ON ENV'T CHANGE AND SOC'Y, NAT'L ACADS. OF SCI., ENG'G, MED., VALUING CLIMATE DAMAGES: UPDATING ESTIMATION OF THE SOCIAL COST OF CARBON DIOXIDE (2017), https://nap.nationalacademies.org/read/24651/chapter/1 [https://perma.cc/V32C-AK2G].

211. Exec. Order No. 13,990, §§ 5, 5(b)(ii)(D), 5(b)(iii), 86 Fed. Reg. 7037, 7040-41 (Jan. 20, 2021).

212. *See* INTERAGENCY WORKING GRP. ON SOC. COST OF GREENHOUSE GASES, *supra* note 16, at 5 tbl.ES-1.

213. *Id.* at 4.

214. *Id.*

215. *Id*.

216. *Id*.

217. *See* Notice of Availability and Request for Comment on Technical Support Document: Social Cost of Carbon, Methane and Nitrous Oxide Interim Estimates under Executive Order 13990, 86 Fed. Reg. 24,669 (May 7, 2021). The final figures were originally due out in January 2022 but have not been released as of this writing.

218. *See supra* note 20.

B. An Alternative Approach: The Marginal Abatement Cost

Wherever the final estimate lands, it will inevitably come under fire, likely from all sides. And the critics will have plenty to hang their hats on. While a lot of work has been done on the SCC in the last eight years,[219] big uncertainties remain.[220] Recent SCC estimates span a wide range, from less than $0 to over $2,000 per ton.[221]

For one, the sheer enormity and complexity of the enterprise make fly specking inevitable and easy. But not only is the problem large and difficult, requiring aggregation and assimilation of reams of data from across regions, sectors, and ecosystems, and not only does it involve multiple complex and overlapping systems riddled with scientific uncertainties,[222] it also presents policy questions that do not—and never will—have definitive answers from within the hard sciences or economics because they involve what are at root ethical questions. These include questions about how harms to historically marginalized communities, whose contributions to the problem of climate disruption have been minimal, should be weighed against harms to the wealthy and the privileged; the degree to which the interests of future generations should be discounted in comparison to our own;[223] and the scope of the relevant "society" across which climate damages should be measured.[224] These unanswerable questions render the SCC inevitably indeterminate,[225] subject to

219. *See* Carleton & Greenstone, *supra* note 20, at 6 (referencing "the explosion of data and research since 2010 that has dramatically expanded knowledge of the climate, economy, and the relationship between the two" that will help in calculating an updated SCC); COMM. ON ASSESSING APPROACHES TO UPDATING THE SOC. COST OF CARBON, *supra* note 210; CLIMATE IMPACT LAB (2022), https://impactlab.org [https://perma.cc/Q8YC-GALJ].

220. *See* Isaacs et al., *supra* note 24, at 40-41.

221. *See* Kaufman et al., *supra* note 17, at 1010.

222. *See* Isaacs et al., *supra* note 220, at 41 ("[T]he uncertainties around [marginal damage] SCC estimations are immense.").

223. *See* Hansel, *supra* note 194, at 782 (noting, in the context of the effort to calculate the SCC, "[t]he SDR [social discount rate] captures the ethical choices involved when policies transfer well-being between current and future generations. . . . Subjective ethical perspectives underpin often irreducible differences of opinion on the matter, making the choice of SDR the subject of disagreement").

224. *See* Ted Gayer & W. Kip Viscusi, *Determining the Proper Scope of Climate Change Policy Benefits in U.S. Regulatory Analysis: Domestic Versus Global Approaches*, 10 REV. ENV'T ECON. & POL'Y 245 (2016); Masur & Posner, *supra* note 184, at 1591-96 (cataloging arguments in favor of a domestic rather than global SCC); Peter Howard & Jason Schwartz, *Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon*, 42 COLUM. J. ENV'T L. 203 (2019); *see also* Zero Zone v. Dep't of Energy, 832 F.3d 654, 679 (7th Cir. 2016) (rejecting the argument that the use of SCC by the Department of Energy was arbitrary and capricious because of SCC's incorporation of global damages); California v. Bernhardt, 472 F. Supp. 3d 573, 613 (N.D. Cal. 2020) ("[F]ocusing solely on domestic effects has been soundly rejected by economists as improper and unsupported by science.").

225. Indeed, as the experience under the Trump Administration demonstrated, tweaking the answers to just the last two questions alone (discount rate and relevant societal scope) can have dramatic impacts on the final SCC number. Several federal agencies have explicitly declined to apply the SCC in NEPA reviews, specifically citing the scientific uncertainty and indeterminacy and the lack of consensus on discount rates. The courts have largely upheld such decisions. *See, e.g.*, EarthReports, Inc. v. FERC, 828 F.3d 949 (D.C. Circ. 2016); 350 Mont. v. Bernhardt, 443 F. Supp. 3d 1185, 1197 (D. Mont. 2020) (upholding a decision by the Office of Surface Mining Reclamation and Enforcement declining to apply the SCC to NEPA analysis because it is "too uncertain and indeterminate to be useful to the analysis");

attack regardless of where it is set, and—as the experience under the Trump Administration demonstrated—vulnerable to cynical political manipulation.[226]

These and other uncertainties, vulnerabilities, and nodes of potential controversy in the standard approach to the SCC have prompted some economists to propose an alternative approach: What has come to be referred to as the Marginal Abatement Cost approach (or "target-consistent" approach) calculates the highest marginal per-ton cost society would have to pay in order to meet a particular emissions reduction target—like the net zero by 2050 that the IPCC has said is necessary to hit the Paris Agreement's goal of no more than 1.5°C or 2°C of warming.[227] It thereby shifts the analysis from the realm of climate science and modeling of climate sensitivities and impacts to the more tractable realm of engineering.

Several European countries have adopted the MAC approach to valuing carbon emissions. The UK began considering the MAC approach in 2009.[228] Its latest estimate pegs the economy-wide MAC at $124 per metric ton of CO2-equivalent in 2030 (with a range from $62 to $186) based on an 80%-reduction-

WildEarth Guardians v. Zinke, 368 F. Supp. 3d 41, 51, 78-79 (D.D.C. 2019); Citizens for a Healthy Cmty. v. U.S. Bureau of Land Mgmt., 377 F.Supp.3d 1223, 1239–40 (D. Colo. 2019); Appalachian Voices v. FERC, 2019 U.S. App. LEXIS 4803 (D.D.C. Feb. 19, 2019) (holding that FERC satisfied NEPA requirements by stating why SCC is not an appropriate tool to measure project-level climate change impacts); Wilderness Workshop v. U.S. Bureau of Land Mgmt., 342 F. Supp. 3d 1145, 1158-59 (D. Colo. 2018). *But see* Vecinos para el Bienestar de la Comunidad Costera v. FERC, Nos. 20-1045, 20-1093, 20-1094, 2021 U.S. App. LEXIS 22881, at *16 (D.C. Cir. Aug. 3, 2021) (holding that FERC must determine if 40 C.F.R. § 1502.21(c) requires use of the SCC or another generally scientifically accepted method and if not, explain why they believe it does not); High Country Conservation Advocates v. U.S. Forest Serv., 52 F. Supp. 3d 1174 (D. Colo. 2014) (holding that the agency failed to offer a non-arbitrary reason for excluding the SCC as part of its final draft after including it in an earlier draft, and that the decision to quantify the benefits while not quantifying costs was arbitrary and capricious); Mont. Env't Info. Ctr. v. U.S. Off. of Surface Mining, 274 F. Supp. 3d 1074, 1081 (D. Mont. 2017); Ctr. for Biological Diversity v. NHTSA, 538 F.3d 1172 (9th Cir. 2008). And of course, as noted above, two groups of red state attorneys general have already filed lawsuits challenging the Biden Administration's interim SCC. *See supra* note 18. In one of those cases, a Louisiana district court has found a likelihood of success on the merits of the plaintiffs' claim that the Biden Administration's SCC estimate is arbitrary and capricious, because it "fails to justify the [SCC's] use of a global rather than domestic scope" and "arbitrarily departs from decades of prior Executive Branch cost/benefit practice" by not using the 7 % discount rate specified in OMB Circular A-4. Louisiana v. Biden, No. 2:21-cv-01074, 2022 WL 438313, *17 (W.D. La. Feb. 11, 2022), *modified*, No. 22-30087 (5th Cir. Mar. 16, 2022).

226. *See* California v. Bernhardt, 472 F. Supp.3d 573 (N.D. Cal. 2020) (holding the Bureau of Land Management's use of the Trump Administration's estimates of the SCC to be arbitrary and capricious); Carleton & Greenstone, *supra* note 20, at 3 (noting that the Trump Administration's SCC made "changes in assumptions . . . that were difficult to justify based on science and economics").

227. Lina Isaacs, Göran Finnveden, Lisbeth Dhallöf, Cecilia Håkansson, Linnea Petersson, Bengt Steen, Lennart Swanström & Anna Wikström, *Choosing a Monetary Value of Greenhouse Gases in Assessment: A Comprehensive Review*, 127 J. CLEANER PROD. 37, 40-41 (2016);*Estimating the Value of Carbon: Two Approaches*, N.Y. STATE ENERGY RSCH. AND DEV. AUTH. & RES. FOR THE FUTURE 16-17 (Apr. 2021), https://media.rff.org/documents/RFF_NYSERDA_Valuing_Carbon_Synthesis_Memo.pdf [https://perma.cc/V2RK-435L].

228. *Carbon Valuation in UK Policy Appraisal: A Revised Approach*, DEP'T OF ENERGY & CLIMATE CHANGE (July 2009), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/245334/1_20090715105804_e____carbonvaluationinukpolicyappraisal.pdf [https://perma.cc/YA9Z-W2EJ].

by-2050 target.[229] France began using the MAC approach in 2018 and, based on a net-zero-by-2050 target, estimated the MAC value for 2030 at $309 per metric ton of CO2-equivalent.[230] Ireland has also begun using a MAC approach in recent years.[231]

In 2019, the New York State legislature passed a law directing its Department of Environmental Conservation to establish a SCC for use by state agencies and specifically authorizing the Department to use either a MAC approach or a marginal damages approach.[232] Two prominent economists, Nicholas Stern and Joseph Stiglitz, released a paper in February 2021, urging the Biden Administration to take a MAC-like approach to the SCC rather than the marginal damages approach currently being pursued by the Working Group.[233] These political developments all build on an academic literature on the MAC approach that has been emerging for over a decade.[234]

The MAC approach has come under fire from CBA purists who argue, first, that it is inappropriate as a matter of good policymaking and, second, that it is prohibited by law. As the next Part will explore, both claims are at a minimum overstated and arguably outright wrong. As a matter of both legal mandate and good policy, the Biden Administration would do well to avoid the CBA orthodoxy that some commentators advocate. Instead, the Administration *should* as a matter of good policy—and *can* as a matter of law—make use of the rich variety of tools in the regulatory decision-making toolbox, including the MAC approach, in developing climate policy.

IV. All the Tools in the Toolbox

If, as some are predicting, the Biden Administration is actually able to use the marginal damages approach to set the SCC at $125, or possibly even higher, that will represent a substantial jump from the values used by the Obama

229. Resources for the Future, Estimating the Value of Carbon: Two Approaches 19 (Oct. 2020, revised April 2021); Department of Energy & Climate Change, Carbon Valuation in UK Policy Appraisal: A Revised Approach 31 (July 2009). For the near-term, the UK calculated separate MAC values for different sectors of the economy because there are currently separate, non-fungible targets in the sector governed by the EU Emissions Trading System and those sectors not covered by that scheme. *Id.* at 29. From 2030 onwards, however, the UK calculated a single, economy-wide MAC value, based on the assumption that by that time "there will be a comprehensive global trading regime in place and therefore no distinction between the traded and non-traded sectors of the economy." *Id.* at 32.

230. RESOURCES FOR THE FUTURE, *supra* note 229, at 20.

231. *Id.* at 20-21.

232. New York Climate Leadership and Community Protection Act, N.Y. ENV'T CONSERV. LAW § 75-0113 (McKinney 2020); *see Estimating the Value of Carbon: Two Approaches*, *supra* note 227. In 2021, the New York Department of Environmental Conservation issued Guidelines announcing that it would take the damages approach to establishing a value of the SCC. *See Establishing a Value of Carbon: Guidelines for Use by State Agencies*, N.Y. STATE DEP'T OF ENV'T CONSERVATION 10-11 (2021), https://www.dec.ny.gov/docs/administration_pdf/vocguidrev.pdf [https://perma.cc/FMH2-BS4R].

233. *See* Nicholas Stern & Joseph Stiglitz, *The Social Cost of Carbon, Risk, Distribution, Market Failures: An Alternative Approach* (Nat'l Bureau of Econ. Rsch., Working Paper No. 28,472, 2021).

234. *See* Kaufman et al., *supra* note 17; Isaacs et al., *supra* note 24, at 40-41; Wagner et al., *supra* note 24; Ackerman & Stanton, *supra* note 24, at 142.

Administration (which, even when updated to 2020 values, are less than half that figure). If the Administration can actually set an ambitious figure like that and make it stick, despite the political controversy and litigation it will inevitably provoke, it could well do a lot of good. As we have seen, agencies are in most instances directed by statute to use decision tools other than formal CBA in crafting environmental rules. However, plugging a higher SCC value into the CBAs required by executive order could help to bolster political support for important future rulemakings aimed at reducing greenhouse gas emissions. A higher SCC could also go a long way toward pushing the federal government toward less carbon intensive procurement and budgeting decisions.

But regardless of its initial success in defending its SCC calculations, the Biden Administration should not shut the door on the other decision tools available to it as it begins the monumental task of shifting the national (and global) economy toward a carbon-free future. Rather, the Administration *should* as a matter of good policy—and *can* as a matter of law—avoid the CBA orthodoxy currently being proselytized in some quarters and instead keep at the ready the rich variety of decision tools in its regulatory toolbox.

A. The MAC Approach is Good Public Policy

Particularly in the wake of the 2021 Stern and Stiglitz article proposing a MAC approach as an alternative to a marginal-damages-based SCC, a number of commentaries have come out in the past year pushing back against the MAC approach.[235] These criticisms are to some degree syllogistic, beginning from an axiomatic faith in the virtues of CBA, and then arguing that because MAC departs from the CBA approach, it is ipso facto inferior.[236] They also argue that MAC is fundamentally unscientific because it is anchored to a target set by politics, not science,[237] and that it requires assessments of future technologies and their costs about which there is substantial uncertainty.[238] This Part explains why those criticisms are not ultimately convincing and why the MAC approach is, in contrast, an attractive public policy tool that has the capacity, at least in some contexts, to avoid some of the pitfalls of the marginal damages approach to the SCC.

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235. *See* Aldy et al., *supra* note 25; Gundlach & Howard, *supra* note 25; COMMENTS TO THE OFFICE OF MANAGEMENT AND BUDGET ON THE SOCIAL COST OF GREENHOUSE GASES, *supra* note 25, at 11-14.

236. *See* Gundlach & Howard, *supra* note 25 (criticizing MAC on grounds that "it cannot support an agency's crucial determination of whether a regulatory measure gives rise to positive net benefits for society as a whole"); COMMENTS TO THE OFFICE OF MANAGEMENT AND BUDGET ON THE SOCIAL COST OF GREENHOUSE GASES, *supra* note 25, at 11-12 (arguing that the SCC is "the theoretically appropriate value[] to use when conducting benefit-cost analyses of polices that affect [greenhouse gas] emissions" because it estimates the "social damages of emitting a marginal unit of greenhouse gases," and that since the MAC approach does "not specify the social damage done by those emissions" it should not be used in place of the SCC).

237. *See* Aldy et al., *supra* note 25, at 851; Gundlach & Howard, *supra* note 25.

238. Aldy et al., *supra* note 25, at 852.

Perhaps the MAC approach's most attractive feature lies in the fact that it shifts the subject of analysis from complex and difficult questions about the myriad and diverse impacts of climate disruption across the globe and for centuries into the future to a set of relatively more tractable engineering questions about the availability, effectiveness, and costs of low- and zero-carbon energy technologies to cut emissions in the near term. This simplifies the analysis along several dimensions. While these questions also inevitably confront uncertainties,[239] as any public policy tool does, those uncertainties pale in comparison to those the marginal damages SCC approach confronts. The engineering questions posed by MAC are simply inherently less complex along a whole series of different dimensions than the climate science and ethics questions posed by the marginal damages approach to the SCC.

Moreover, the MAC approach largely diffuses the debate over discount rates that hobbles the SCC approach. Because of the delay built into the dynamics of climate disruption, any attempt to tally climate damages must look decades and centuries (if not millennia) into the future to account for all the harms triggered by a ton of CO_2 released today. Conversely, the MAC approach, by focusing on emissions rather than impacts, shortens the relevant timeframe for analysis considerably. This has the salutary effect of greatly reducing the sensitivity of the relevant models to small changes in discount rates and thereby reducing the range of uncertainty in the calculation overall.[240]

By simplifying and streamlining the analysis in these ways, the MAC approach operates as a fast and frugal decision tool. Rather than attempting a comprehensive analysis of global impacts in a (perhaps futile) search for optimality, the MAC approach "exploit[s] structures of information in the [decision] environment" in order to work around limits on knowledge and cognitive capacity.[241] The MAC approach accomplishes this by shifting the focus of analysis from a set of inquiries about climate damages—in which bounded rationality problems, information gaps, discount rate debates, and ethical controversies abound—to a set of inquiries about engineering that, while still challenging, are far less intractable.

Nor does the MAC approach ignore climate science, as its critics maintain.[242] Indeed, its elegance as a fast and frugal tool lies in leveraging the wealth of information about climate science embodied in the consensus net-zero-by-mid-century target. Rather than reinventing the wheel, it uses that target as a shortcut for identifying an appropriate price on carbon. And that target, and the 1.5 °C to 2 °C limit on warming to which it corresponds, has been broadly

239. Rates of technological change, for example, can be difficult to predict. *See Establishing a Value of Carbon: Guidelines for Use by State Agencies*, *supra* note 232, at 10.

240. On the sensitivity of marginal damages models of the SCC to small changes in discount rates, see *supra* note 198.

241. Selten, *supra* note 111, at 9.

242. Aldy, *supra* note 25; Gundlach & Howard, *supra* note 25.

embraced by the global scientific community as well as the global political community.[243]

Indeed, the degree of consensus that currently exists around that net-zero target is extraordinary. Nearly every nation on the globe signed on to the Paris Agreement in 2015 with the avowed goal of "holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels."[244] These specific numeric targets reflect the ongoing work over the past three decades of the IPCC, a remarkable international body which synthesizes the work of thousands of scientists around the globe and works by consensus to issue periodic reports that are signed off on by virtually every country on the planet (195).[245] In recent reports, the IPCC has made clear that adhering to the 1.5° to 2.0° C target will require reducing greenhouse gas emissions to net zero by mid-century.[246] In recognition of this target, President Biden announced within months of taking office a pledge to reduce U.S. greenhouse gas emissions by 50% to 52% by 2030.[247] And in December 2021, he followed up with an executive order directing the federal government to achieve net-zero emissions by 2050.[248] Thus, while the criticism that the MAC approach is anchored in politics rather than science might have traction in other contexts, in the climate change context, where a remarkable degree of political and scientific consensus on the 1.5° to 2.0° C goal holds sway, such arguments fall wide of the mark.

The MAC approach is also well-grounded in economic theory. In an idealized sense, the MAC approach simply runs the standard welfare economics calculation backwards.[249] The standard welfare economics calculation finds the optimal pollution reduction target by calculating the marginal benefit curve (the converse of the SCC) and the marginal cost curve in a formal CBA, finding the

243. *See, e.g.*, IPCC CLIMATE CHANGE 2021, *supra* note 2, at 12-14; U.N. Framework Convention on Climate Change, Adoption of the Paris Agreement, U.N. Doc. FCCC/CP/2015/L.9/Rev.1, at 2 (Dec. 12, 2015); Yun Gao, Xiang Gao & Xiaohua Zhang, *The 2 °C Global Temperature Target and the Evolution of the Long-Term Goal of Addressing Climate Change—From the United Nations Framework Convention on Climate Change to the Paris Agreement*, 3 ENG'G 272 (2017).

244. U.N. Framework Convention on Climate Change, *supra* note 243.

245. *Structure of the IPCC*, IPCC, https://www.ipcc.ch/about/structure [https://perma.cc/UK5E-J22P] (last visited Mar. 26, 2022); *see also* Glasgow Climate Pact, sec. IV, ¶ 22 (Nov. 13, 2021) ("[L]imiting global warming to 1.5 ° C requires rapid, deep, and sustained reductions in global greenhouse gas emissions, including reducing global carbon dioxide emissions . . . to net zero around mid-century.").

246. *See* IPCC CLIMATE CHANGE 2021, *supra* note 2, at 27 (stating that limiting human-induced global warming to a specific level requires, among other things, reaching at least net zero CO_2 emissions).

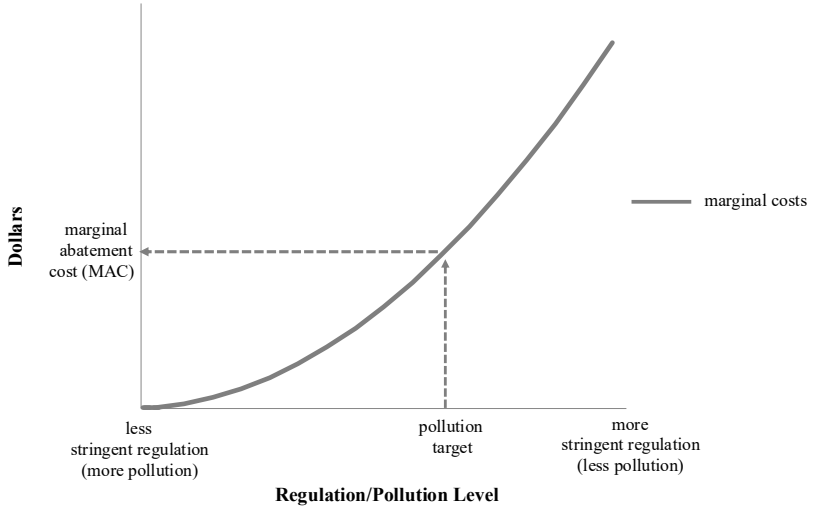
247. *See Fact Sheet: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies*, WHITE HOUSE (Apr. 22, 2021), https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/ [https://perma.cc/834T-6T4V].

248. *See* Exec. Order No. 14,057, 86 Fed. Reg. 70,935 (Dec. 8, 2021).

249. *See* Isaacs et al., *supra* note 24, at 39 ("Theoretically, estimates of SCC [under a marginal damages approach] and MAC could be equal . . . . If an emissions target is set optimally, MAC at the target level should coincide with SCC at the target level."); Stern & Stiglitz, *supra* note 233, at 1-2 (noting that the prices calculated under the MAC approach and the marginal damages should theoretically be the same but are not in practice).

point where those curves cross and tracing that point down to the X-axis to find the optimal pollution level (as in Figure 1 above[250]). The MAC approach, in contrast, calculates only the marginal cost curve. It then locates the pollution target on the X-axis and traces *up* from there to the marginal cost curve (as in Figure 2 below). If the pollution target is set optimally, that point where a line from the pollution target crosses the marginal cost curve is theoretically the same point at which the marginal cost curve crosses the marginal benefit curve (the "point of efficiency" in Figure 1). The MAC approach just allows us to estimate that point without the difficulties and controversies associated with actually estimating the marginal benefits curve. Or, said more colloquially, the MAC approach tells us how much we *should be* (or must be) willing to pay to reduce carbon emissions, given that we want to reach the net-zero-by-mid-century emissions target.

Figure 2: The MAC Approach



Running the standard welfare economics calculation backwards

While theoretically, calculations using the MAC approach and the marginal damages approach should yield the same number, the limits of bounded rationality and imperfect information cause them to diverge in practice. And because the marginal damages approach is so riddled with complexities and uncertainties, there is good reason to worry that it may produce a figure that is too low to get us where we need to go. Indeed, Stern and Stiglitz cite as a cautionary tale Nordhaus's recent conclusion, based on a marginal damages approach, that "societal optimization" means pursuing a path to 4° C of

250. *See supra* Section II.A.

warming—a path that would delay reaching net zero emissions until 2200.[251] This conclusion is way out of step with mainstream climate science and, for Stern and Stiglitz, emblematic of the dangers of a marginal damages approach.[252]

Thus, the MAC approach does deliver a figure that can be plugged into a standard CBA to provide at least a lower-bound estimate of society's willingness to pay for carbon emissions benefits. (And lower bound is, after all, all that the marginal damages approach has been able to produce in any case.[253]) While it is consistent with overall economic theory, as outlined above, because the MAC approach does not attempt to directly measure social benefits, it departs from formal CBA methodology. And that departure has been the source of much of the criticism leveled against it.[254]

The MAC approach is perhaps better conceptualized as a form of cost-effectiveness analysis.[255] It essentially aims at identifying the least-cost method for reaching a pre-determined target that has been set by other means. Precisely because of the remarkable and unprecedented political and scientific consensus around the 1.5° C to 2° C goal and the net-zero-by-2050 emissions reduction target necessary to get there, climate disruption is in some ways the perfect problem for cost-effectiveness analysis.[256]

More specifically, by pinpointing the *marginal* cost—that is, the cost of the last (and most expensive) ton of carbon emissions prevented—the MAC approach also sets a cost-effectiveness threshold. As such, it can be used as a screening tool in government procurement decisions—screening *in* those green

251. *See* William D. Nordhaus, *Climate Change: The Ultimate Challenge for Economics*, NOBEL LECTURE IN ECON. SCI. (2018); William D. Nordhaus, *Climate Change: The Ultimate Challenge for Economics*, 109 AM. ECON. REV. 1991 (2019).

252. *See* Stern & Stiglitz, *supra* note 233, at 2.

253. *A Lower Bound: Why the Social Cost of Carbon Does Not Capture Critical Climate Damages and What that Means for Policy Makers*, INST. FOR POL'Y INTEGRITY (Feb. 2019), https://policyintegrity.org/files/publications/Lower_Bound_Issue_Brief.pdf [https://perma.cc/FH37-224N].

254. *See* Aldy et al., *supra* note 25, at 851; Gundlach & Howard, *supra* note 25; COMMENTS TO THE OFFICE OF MANAGEMENT AND BUDGET ON THE SOCIAL COST OF GREENHOUSE GASES, *supra* note 25, at 11-14.

255. *See* Aldy et al., *supra* note 25, at 851; Ackerman & Stanton, *supra* note 24, at 142; TECHNICAL SUPPORT DOCUMENT, *supra* note 16, at 9 n.7 (calling the marginal abatement cost method "useful in evaluating policy cost-effectiveness"); Smith, *supra* note 26.

256. Note that in cost-effectiveness analysis, the goal or outcome can be defined at various points along the causal chain from environmentally degrading activity to actual harm. When the outcome is itself some measure of actual avoided harm to humans (e.g., lives saved), it is more likely to exclude important aspects of regulatory benefit (e.g., other health benefits, ecological benefits). On the other hand, when the outcome is some intermediate point on the causal chain several steps removed from actual effects to humans (like tons of pollution avoided), it may actually represent a more comprehensive measure of regulatory benefit. That said, performing a cost-effectiveness analysis with an outcome like "tons of phosphorus pollution avoided" may be less meaningful to the extent that the analyst (or the public) lacks an understanding of how particular pollution levels translate into actual harms to people or ecosystems. In the climate change context, however, the 1.5° C to 2° C goal allows policy makers to identify the cost-effectiveness threshold necessary to reach that goal. In this way it is unlike in certain other contexts where merely quantifying the cost per unit of pollution reduction is not particularly meaningful and does not provide much useful information to decision makers. In this sense, the climate problem is actually the perfect problem for CEA.

products for which the cost per ton of carbon abatement comes in under the MAC and screening *out* those for which the cost-per-ton exceeds the MAC.[257]

Alternatively, the MAC could be used to set emissions standards in the manner employed by the EPA (and upheld by the Supreme Court)[258] in the Cross-State Air Pollution Rule.[259] Such an approach would require particular emissions sources or groups of sources to reduce emissions by an amount equal to what could be achieved by employing every control measure available up to the MAC threshold. For example, one could imagine the Biden EPA taking such an approach to an updated version of the Clean Power Plan,[260] if it were to decide to base such a rulemaking on the health-based NAAQS provisions of the Clean Air Act rather than the Section 111(d) feasibility standards relied on by the Obama EPA in the original rule.[261] Recall that the Cross-State Air Pollution Rule used a dollar-per-ton cost-effectiveness threshold to set state-by-state emissions budgets that states incorporate into their state implementation plans to ensure compliance with the NAAQS for ozone and particulate matter pollution.[262] Similarly, one could imagine a NAAQS-based Clean Power Plan that would use a MAC value to set state-by-state carbon emissions limits keyed to achieving a CO_2 NAAQS calibrated to achieve the net-zero-by-mid-century target.[263]

257. *See also* Revesz, *supra* note 175, at 25-26 (detailing how the social cost of greenhouse gases could be used in federal government procurement decisions).

258. EPA v. EME Homer City Generation, 572 U.S. 489, 500-03 (2014).

259. *See supra* notes 96-98 and accompanying text.

260. This was the Obama EPA's 2015 rule setting greenhouse gas emissions limits on existing coal plants. *See* 80 Fed. Reg. 64,662 (Oct. 23, 2015).

261. *See* Grace Weatherall, *Immediate Executive Action: Unexplored Options for Addressing Climate Change Under the Existing Clean Air Act*, ENV'T & ENERGY L. PROGRAM (July 27, 2021), https://eelp.law.harvard.edu/2020/07/immediate-executive-action-unexplored-options-for-addressing-climate-change-under-the-existing-clean-air-act [https://perma.cc/L7S9-NTFM]; Howard M. Crystal, *Returning to Clean Air Act Fundamentals: A Renewed Call to Regulate Greenhouse Gases under the National Ambient Air Quality Standards Program*, 31 GEO. ENV'T L. REV. 233 (2019); Christina Reichert, *Revisiting the NAAQS Program for Regulating Greenhouse Gas Emissions Under the Clean Air Act* (Duke Nicholas Inst. for Env't Pol'y Sols. Working Paper, NI WP 17-01, 2017).

262. *See supra* notes 96-98 and accompanying text.

263. The statutory language EPA relied on to justify the cost-effectiveness threshold approach in the Cross-State Air Pollution Rule is admittedly different from the statutory language that would govern a NAAQS-based Clean Power Plan. The Cross-State Air Pollution Rule required EPA to determine the threshold at which pollution emitted from one state would "contribute significantly to nonattainment" of the NAAQS in another state, 42 U.S.C. § 7410(a)(2)(D)(i), and then craft an emissions budget for each state designed to stay below that threshold. EPA's task of crafting emissions limits for State Implementation Plans in order to comply with a CO_2 NAAQS, on the other hand, would require setting emissions budgets for states that reflect the emissions reductions that "may be necessary or appropriate" to meet the NAAQS. 42 U.S.C. § 7410(a)(2)(A). The global nature of CO_2 and other greenhouse gas pollutants, of course, creates some awkwardness in any attempt to use these sections of the Clean Air Act to tackle the climate crisis. Because a ton of CO_2 emitted anywhere in the world mixes in the atmosphere and becomes evenly distributed across the globe, no individual state has the power to control the ambient concentration of CO_2 in the air within its borders. And consequently, no individual state would have the capacity to achieve a CO_2 NAAQS on its own. But the phrase "necessary and appropriate" arguably moderates to some degree the tightness of the fit necessary between a CO_2 NAAQS and the specific emissions limits any one state is required to put in place to achieve such a NAAQS. Moreover, the Supreme Court's holding in *Michigan v. EPA*, that the phrase "appropriate and necessary" (as used in a different section of the Act) requires EPA to consider costs, 576 U.S. 743, 752 (2015), would also provide support for EPA employing a MAC approach to setting emissions budgets for each state aimed at complying with a CO_2 NAAQS.

This illustrates a larger point: The success of a decision tool depends very much on the context in which decision-making occurs. Successful tools must be tailored to the decision environment. Accordingly, there can be no one-size-fits-all tool. As described above, Congress recognized this in crafting our environmental statutes, and, as the next Section will show, the Supreme Court has left agencies broad discretion to pick and choose from their diverse toolbox as context demands.

It is also important to note that while either the marginal damages SCC or the MAC approach produces a value that can be plugged into a formal CBA that purports to perform the standard-setting function, in practice at the federal agencies, CBA rarely succeeds in actually performing that function. The vast majority of CBAs leave significant benefits unquantified.[264] Thus, even if, in a given rulemaking, greenhouse gas emissions reductions can be quantified and monetized using the SCC or MAC, other important benefits will likely not be. Moreover, the majority of CBAs do not estimate costs and benefits for more than a few alternatives.[265] Accordingly, these CBAs are not in practice actually equipped to perform the standard-setting function but instead operate as simple screening tools to ensure costs are not unreasonable or disproportionate. When it comes to this function, formal CBA loses its normative grounding in Kaldor-Hicks efficiency or overall welfare and, with it, its claim to superiority over other cost-based screening tools.[266] As noted above, a cost-effectiveness approach grounded in MAC is well-suited to performing this screening function too. Alternatively, in some contexts, an informal CBA might simply ask whether costs are grossly disproportionate to benefits and thereby dispense with the need to fully monetize all variables. Or, if a rulemaking to limit greenhouse gas emissions occurs under one of the sections of the Clean Air Act that employs feasibility analysis or various forms of open-ended balancing, one of those might provide the most suitable decision tool.

Finally, if President Biden's expressed commitment to environmental and energy justice issues is to be realized, regulatory review will have to adopt tools and methods other than formal CBA. There is no question that the climate crisis implicates deep and worrying distributional justice concerns. Across the globe, it is the poorest populations least responsible for greenhouse gas emissions that are already suffering the worst impacts of climate disruption and will continue

264. *See* Hahn et al., *supra* note 164, at 869-70; Masur & Posner, *supra* note 164; McGartland et al., *supra* note 164; Levin, *supra* note 166, at 230 ("Serious gaps in data and methodology constrain the utility of [CBA]. Typically, only a few potential health or other benefits can be quantified, and even fewer can be valued monetarily. Consequently, when the sum of the limited subset of benefits that can be quantified and monetized is shown to be less than the estimated costs, it is often impossible to conclude anything about the relative magnitude of the full benefits."); Sinden, *supra* note 165; Driesen, *supra* note 139, at 371-77 (stating that in an empirical study of OIRA review of 25 rules, numerous instances were found in which significant benefits were left unquantified).

265. *See* Sinden, *supra* note 165, at 110-11.

266. *See id*.

to bear that disproportionate burden in the decades ahead.[267] Even within the United States, the poorest 5% of counties are projected by the end of the century to suffer economic damages from climate change nine times larger on average than the richest 5%.[268] But CBA's foundational focus on aggregate impacts makes it fundamentally incompatible with a focus on distribution.[269] Moreover, CBA privileges the status quo distribution of wealth.[270] Thus, given the singular focus on formal CBA as the primary tool of regulatory review in recent decades, it is perhaps no surprise that despite executive orders requiring analysis of distributional impacts and environmental justice concerns in regulatory review, such analyses are rarely conducted.[271] And, given CBA's analytic incompatibility with attention to distribution, nor is it surprising that most proposals for expanding regulatory review to incorporate distributional concerns at bottom amount to doing a separate analysis alongside CBA.[272] Again, different contexts call for different analytic tools.

The only prominent proposal to actually integrate distributional concerns within the framework of CBA is to incorporate distributional weights to increase the relative value of benefits and costs accruing to low income individuals.[273] While these proposals are longstanding in the academic literature, they are challenging to implement and accordingly rarely used in practice.[274] Moreover, they arguably provide at best a blunt instrument for attempting to capture the nuance and texture of the complex and intersectional challenges facing communities long burdened by disinvestment, cumulative toxic exposures, and a legacy of systemic racism in housing, education, and employment.

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267. *See, e.g.*, Akihiko Nishio, *When Poverty Meets Climate Change: A Critical Challenge that Demands Cross-Cutting Solutions*, WORLD BANK BLOGS (Nov. 5, 2021), https://blogsworldbank.org/climatechange/when-poverty-meets-climate-change-critical-challenge-demands-cross-cutting-solutions [https://perma.cc/2S7A-9UYW].

268. *See* Solomon Hsiang, Robert Kopp, Amir Jina, James Rising, Michael Delgado, Shashank Mohan, D. J. Rasmussen, Robert Muir-Wood, Paul Wilson, Michael Oppenheimer, Kate Larsen & Trevor Houser, *Estimating Economic Damages from Climate Change in the United States*, 356 SCI. 1362 (2017).

269. *See* Stuart Shapiro, *Regulatory Analysis Needs to Catch Up on Distribution*, REGUL. REV. (Feb. 15, 2021), https://www.theregreview.org/2021/02/15/shapiro-regulatory-analysis-needs-distribution/ [https://perma.cc/N82R-2DRM].

270. RICHARD O. ZERBE JR. & ALLEN S. BELLAS, A PRIMER FOR BENEFIT-COST ANALYSIS 14-15 (2006) (noting that CBA measures costs and benefits "from the legal status quo, inherently acknowledging existing property rights"); Kennedy, *supra* note 128, at 422-44; Baker, *supra* note 128, at 12-13.

271. *See* Richard L. Revesz & Samantha P. Yi, *Distributional Consequences and Regulatory Analysis*, 52 ENV'T L. 53 (2022); Lisa Robinson, James Hammitt & Richard Zeckhauser, *The Role of Distribution in Regulatory Analysis and Decision Making* 4 (Harv. Kennedy Sch., Working Paper No. 2014-02, 2014), https://www.hks.harvard.edu/sites/default/files/centers/mrcbg/files/Zeckhauser_final.pdf [https://perma.cc/VMR7-GPWZ] ("[A]gencies typically provide little or no information on distribution across population subgroups [in Regulatory Impact Analyses].").

272. *See, e.g.*, Revesz & Yi, *supra* note 271.

273. *See* Matthew D. Adler, *Benefit-Cost Analysis and Distributional Weights: An Overview*, 10 REV. ENV'T ECON. & POL'Y 264 (2016).

274. *See* Robinson et al., *supra* note 271, at 4. The UK government authorizes the use of distributional weights in cost-benefit analysis but calls their use in practice "challenging." HM TREASURY, THE GREEN BOOK: CENTRAL GOVERNMENT GUIDANCE ON APPRAISAL AND EVALUATION 54 (2020). *But see* Isaacs et al., *supra* note 24, at 40 (suggesting that equity weighting is used in some SCC estimates).

B. The MAC Approach is Legal

Those criticizing the MAC approach often assert that it would be prohibited by law. This contention appears to be based on the belief that agencies are required to base environmental regulatory decision making on a formal CBA that weighs monetized costs and benefits against each other. As the discussion below will demonstrate, this belief appears to be based on a misunderstanding of the relevant statutes, executive orders, and case law.

As noted above, the vast majority of our federal environmental statutes direct agencies to set standards using some decision tool other than formal CBA. The CBA executive orders overlay on top of those substantive commands a procedural CBA requirement, but when it comes to actually deciding where to set the standard, or which regulatory alternative to choose, agencies must hew to their statutory directives.

There have over the years been a number of attempts to pass through Congress a "CBA super-mandate" that would essentially rewrite all of the myriad standard-setting provisions in the environmental laws to make CBA the decision criterion.[275] While one such bill came within two votes of passing in 1995, none of these efforts have been successful.[276] Some point to the Unfunded Mandates Reform Act (UMRA), passed in 1994 as part of the 104th Congress's Contract with America, as imposing an overarching statutory CBA mandate on agencies, but that is a mischaracterization.

The UMRA directs agencies to prepare a "written statement" in connection with major rules (costing $1 million or more) that assesses costs and benefits (quantitatively and qualitatively),[277] and to "select [from among a reasonable number of alternatives] the least costly, most cost-effective or least burdensome

275. For example, the Regulatory Accountability Act, which passed the House on January 11, 2017, but never passed the Senate, would have required agencies to include in all rulemakings "a reasoned . . . determination that the benefits of the rule . . . justify the rule's costs." Regulatory Accountability Act, H.R. 5, 115th Cong. §§ 103(d)(1)(F), (f)(4)(C) (2017). The UMRA is also filled with innumerable caveats that qualify considerably the force of its commands. *See, e.g.*, 2 U.S.C. § 1531 (requiring each agency to "assess the effects of Federal regulatory actions on State, local, and tribal governments, and the private sector" but only "unless otherwise prohibited by law" and "other than to the extent that such regulations incorporate requirements specifically set forth in law"); 2 U.S.C. § 1532(a) (requiring the written statement referenced above "unless otherwise prohibited by law"); 2 U.S.C. § 1532(a)(4) (requiring the written statement to include estimates of the effects of the rulemaking on the national economy but only "if and to the extent that the agency in its sole discretion determines that accurate estimates are reasonably feasible and that such effect is relevant and material").

276. The bill that came the closest to being enacted, the Risk Assessment and Cost-Benefit Act of 1995, passed the House 277 to 141. H.R. 9, 104th Cong. tit. II, div. D (1995). The Senate counterpart, the Comprehensive Regulatory Reform Act of 1995, would have essentially codified the Clinton executive order, requiring agencies to perform formal cost-benefit analyses of all proposed "major rules" (a rule that is likely to have an annual effect on the economy of $50 million or more or has a significant impact on a sector of the economy), and prohibiting promulgation of any final rule unless "(1) the rule's potential benefits justify its potential costs; and (2) such rule will produce the most cost-effective result of any of the reasonable alternatives that the agency has discretion to adopt." S. 343, 104th Cong. (1995). However, it narrowly failed to meet cloture requirements, falling just two votes short of overcoming a filibuster. *Id.*

277. 2 U.S.C. §1532(a) (2018) (requiring a "written statement containing . . . a qualitative and quantitative assessment of the anticipated costs and benefits").

alternative that achieves the objectives of the rule."[278] But the statute contains no language requiring a direct comparison of costs and benefits, or calculation or maximization of net benefits. As such, it does not require agencies to choose formal CBA over any other regulatory decision tool. Indeed, if anything, the language of the Act appears to contemplate cost-effectiveness analysis as the method for taking account of costs and benefits.[279] Moreover, the UMRA provides an exception to that requirement where it is "inconsistent with law."[280] Accordingly, like the executive orders, the UMRA does not trump other statutes.

Despite the absence of any broad statutory command for CBA, it has become fashionable lately to assert that the Supreme Court has adopted a requirement (or perhaps presumption) that agencies must as a matter of administrative law conduct formal CBA of the sort required by OIRA for compliance with the executive orders.[281] Those criticizing the MAC approach to valuing carbon emissions have adopted this argument.[282] The claim often comes from the Supreme Court's 2015 decision in *Michigan v. EPA*,[283] which challenged the Obama EPA's finding that regulating emissions of mercury and other air toxins from power plants under Section 112 of the Clean Air Act was—in the words of the statute—"appropriate and necessary."[284] Industry challenged the rule on the ground that EPA had improperly refused to consider costs in making this determination, and the Supreme Court, in an opinion authored by Justice Scalia, agreed: "[I]t was unreasonable for EPA to read § [112(n)(1)(A)] to mean that cost is irrelevant to the initial decision to regulate power plants. The

278. 2 U.S.C. § 1535(a). The UMRA is also filled with innumerable caveats that qualify considerably the force of its commands. *See, e.g.*, 2 U.S.C. § 1531 (requiring each agency to "assess the effects of Federal regulatory actions on State, local, and tribal governments, and the private sector" but only "unless otherwise prohibited by law" and "other than to the extent that such regulations incorporate requirements specifically set forth in law"); 2 U.S.C. § 1532(a) (requiring the written statement referenced above "unless otherwise prohibited by law"); 2 U.S.C. § 1532(a)(4) (requiring the written statement to include estimates of the effects of the rulemaking on the national economy but only "if and to the extent that the agency in its sole discretion determines that accurate estimates are reasonably feasible and that such effect is relevant and material").

279. A command to "select the least costly, most cost-effective or least burdensome alternative that achieves the objectives of the rule" is a classic articulation of CEA. *See, e.g.*, TIETENBERG, *supra* note 50, at 54 (noting that in CEA, the policy objective is determined on some other basis (e.g. health-based standards), and that "once the policy target is specified . . . [CEA provides] a systematic method for finding the lowest cost means of accomplishing the objective"); E.J. MISHAN & EUSTON QUAH, COST-BENEFIT ANALYSIS 8 (5th ed. 2007) ("[In CEA], the problem facing the economist is that of discovering the lowest cost of achieving a particular objective regarded as desirable by the community.").

280. 2 U.S.C. § 1535(b)(2).

281. *See* John D. Graham & Paul R. Noe, *A Paradigm Shift in the Cost-Benefit State*, REGUL. REV. (Apr. 26, 2016), https://www.theregreview.org/2016/04/26/graham-noe-shift-in-the-cost-benefit-state/ [https://perma.cc/62UN-BZDD]; Cass R. Sunstein, *Cost-Benefit Analysis and Arbitrariness Review*, 41 HARV. ENV'T L. REV. 1 (2017) [hereinafter Sunstein, *Cost-Benefit Analysis and Arbitrariness Review*]; Cass R. Sunstein, *Thanks, Justice Scalia, for the Cost-Benefit State*, BLOOMBERG VIEW (July 7, 2015, 1:00 PM), https://www.bloomberg.com/opinion/articles/2015-07-07/thanks-justice-scalia-for-the-cost-benefit-state [https://perma.cc/2N22-7LLQ].

282. *See* Gundlach & Howard, *supra* note 25; Inst. for Pol'y Integrity, *supra* note 25, at 11, 13; Aldy et al., *supra* note 25, at 852.

283. 576 U.S. 743 (2015).

284. 42 U.S.C. § 7412(n)(1)(A).

Agency must consider cost—including, most importantly, cost of compliance—before deciding whether regulation is appropriate and necessary."[285]

Thus, the Supreme Court framed its holding in that case explicitly in terms of "consider[ing] cost" and not in terms of cost-benefit analysis. As we have seen, there are plenty of tools agencies use to consider costs that are distinct from CBA. And indeed, Justice Scalia's opinion went to some pains to make clear that the choice of precisely *how* to consider costs was left squarely within the Agency's discretion: "It will be up to the Agency to decide (as always, within the limits of reasonable interpretation) how to account for cost."[286] Indeed, in its supplemental finding, published ten months later in response to the Supreme Court's opinion, EPA relied primarily on feasibility analysis and open-ended balancing to conclude that the costs were reasonable and the regulation was therefore "appropriate and necessary."[287] It also presented the formal CBA the Agency had completed in compliance with the executive order, but only as "a second independent approach" in support of its finding. Feasibility and open-ended balancing remained the Agency's "preferred approach."[288]

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285. Michigan v. EPA, 576 U.S. 743, 758-59 (2015).

286. *Id*. at 759. Despite the fact that the Court's holding explicitly refers only to cost consideration, *Michigan* has been repeatedly cited as requiring agencies to engage in CBA. *See* Sunstein, *Cost-Benefit Analysis and Arbitrariness Review*, *supra* note 281, at 2 (describing *Michigan v. EPA* as an "important decision[] on the question of whether agencies are required to engage in some form of cost-benefit analysis"); *id*. at 14 ("At a minimum, [*Michigan v. EPA*] implicitly requires agencies to weigh costs against benefits, at least in some sense; it is not possible to 'consider' costs without engaging in such weighing. And with that implicit requirement, the Court may also have required agencies to make some effort to quantify costs, at least if it is feasible to do so. Is it possible to 'consider' costs without knowing what they are? . . . [The] holding can easily be read to make trouble for any agency that fails to show that the benefits of a regulation justify the costs."); Graham & Noe, *supra* note 281.

287. Supplemental Finding that It Is Appropriate and Necessary to Regulate Hazardous Air Pollutants from Coal- and Oil-fired Electric Utility Steam Generating Units, 81 Fed. Reg. 24,420 (Apr. 25, 2016). EPA used several different metrics to analyze feasibility, finding (1) that the projected annual costs of the rule would amount to 2.7 to 3.5% of annual revenues industry-wide, (2) that the annual capital expenditures required to comply with the rule would amount to "3.0 percent of the power sector's overall capital expenditures in recent years [which was] well within the range of annual variability between 2000 and 2011," and (3) that "the projected impact of [the rule] on electricity rates was 0.3 cents/kWh or 3.1 percent [which] is well within the range of price fluctuations in recent years." *Id.* at 24,424. The Agency then performed an open-ended balancing analysis, in which it weighed the reasonableness of the rule's cost (as evaluated by the foregoing feasibility analysis) "against a number of other factors, including the agency's prior conclusions about the significant hazards to public health and the environment, . . . the volume of [hazardous air pollutants] that would be reduced by regulation," *id*. at 24,423, "Congress' concern about the hazardous nature of these pollutants, the wealth of public health and environmental effects research examined under the agency's prior findings showing substantial risks from the emission of HAP . . . and the fact that the power sector is the largest remaining anthropogenic source of many HAP in the U.S," *id*. at 24,420-21.

288. *Id*. The Trump Administration subsequently issued a rule rescinding the Obama EPA's supplemental appropriate and necessary finding, even though the underlying rule remained in place, the affected industry having already complied with its requirements. National Emissions Standards for Hazardous Air Pollutants: Coal- and Oil-fired Electric Utility Steam Generating Units—Reconsideration of Supplemental Finding and Residual Risk and Technology Review, 85 Fed. Reg. 31,286 (May 22, 2020) (to be codified at 430 C.F.R. pt. 63). The Biden EPA has issued a proposed rule rescinding the Trump EPA's reconsideration. National Emissions Standards for Hazardous Air Pollutants: Coal- and Oil-fired Electric Utility Steam Generating Units—Revocation of the 2020 Reconsideration, and Affirmation of the Appropriate and Necessary Supplemental Finding; Notice of Proposed Rulemaking, 87 Fed. Reg. 7624 (Feb. 9, 2022) (to be codified at 40 C.F.R. pt. 63).

Moreover, the Court went out of its way to include a specific disclaimer of formal CBA: "We need not and do not hold that the law unambiguously required the Agency, when making this preliminary estimate, to conduct a formal cost-benefit analysis in which each advantage and disadvantage is assigned a monetary value."[289] This was one point on which all nine justices clearly agreed. In her dissent, Justice Kagan made a point of reiterating this disclaimer of formal CBA as a kind of caveat to her pro-cost presumption: "As the Court notes, [the pro-cost presumption] does not require an agency to conduct a formal cost-benefit analysis of every administrative action."[290] Nor was this the first time the Court had expressed reluctance to require a formal, fully quantified and monetized CBA.[291]

Thus, *Michigan* stands only for the proposition that in some instances, open-ended statutory language will be read to require agencies to consider costs, and that, in such instances, agencies have discretion to select their preferred cost-consideration tool. It most definitely does *not* stand for the proposition that agencies are required to conduct CBA in connection with all rulemakings or all decision-making. And the suggestion that it requires a *formal* CBA that "assign[s] a monetary value" to the benefits of greenhouse gas reductions is difficult if not impossible to maintain in light of the explicit disclaimers of formal CBA in both the majority and dissenting opinions.

CBA proponents also point to a Ninth Circuit decision from 2008, *Center for Biological Diversity v. National Highway Traffic Safety Administration*,[292] as the origin of a purported requirement that agencies quantify the SCC using a marginal damages approach.[293] This too is a misreading of case law. This case was a challenge by states and public interest groups to the National Highway Traffic Safety Administration's (NHTSA) rule setting Corporate Average Fuel Efficiency (CAFE) standards for light trucks under the Energy Policy and Conservation Act of 1975 (EPCA).[294] Interestingly, the relevant provision of the statute, like so many environmental statutes, calls for a feasibility analysis. It directs the Secretary of Transportation to set CAFE standards at "the maximum feasible average fuel economy level that the Secretary decides the manufacturers can achieve in the model year."[295] While in the early years of EPCA's implementation, NHTSA followed a standard feasibility approach in setting these standards,[296] it later shifted to basing the standards on a highly formal CBA.

289. *Michigan*, 576 U.S. at 758-59.

290. *Id*. at 769-70 (Kagan, J., dissenting).

291. *See* Entergy v. Riverkeeper, 556 U.S. 208 (2009); Sinden, *supra* note 168.

292. 538 F.3d 1172 (9th Cir. 2008).

293. *See* Gundlach & Howard, *supra* note 25; COMMENTS TO THE OFFICE OF MANAGEMENT AND BUDGET ON THE SOCIAL COST OF GREENHOUSE GASES, *supra* note 25, at 12, 13.

294. *See* 49 U.S.C. §§ 32901-32919 (2018).

295. 49 U.S.C. § 32902(a).

296. In its 1977 rulemaking setting the passenger car CAFE standards for model years 1981-1984, for example, NHTSA stated that "not equating cost-benefit considerations with economic practicability is consistent with the goal of achieving maximum feasible fuel economy by allowing

Indeed, this was the sort of optimizing CBA, designed to set the standard precisely at the point of net benefits maximization, that economic theory aspires to but that is so rarely achieved by agencies in practice.[297] In the rule at issue in the case, NHTSA had actually measured costs and benefits for a whole range of fuel economy levels and set the standard "at the point where marginal costs equaled marginal benefits."[298]

The states and public interest groups argued first that NHTSA's formal CBA violated the plain meaning of the statute's feasibility provision, and, in the alternative, that even if the agency's formal CBA was permissible, NHTSA had erred in assigning a zero value to benefits of carbon dioxide emissions reductions.[299] The Ninth Circuit rejected the first claim, but not on the grounds that formal CBA was required. Rather, the court emphasized that the agency had broad discretion in fashioning the tools it would use to set standards and that formal CBA was accordingly not prohibited.[300] This ruling, then, leaves a future NHTSA free to abandon the use of formal CBA in setting CAFE standards and to return instead to its prior feasibility approach.

The court went on to rule in the public interest groups' favor on their second argument. And it is this second holding that CBA proponents mischaracterize as requiring the calculation of a marginal-damages-based SCC. While NHTSA had conducted a highly formal CBA, quantifying and monetizing a variety of costs and benefits for a whole range of fuel economy levels, the agency had declined to quantify or monetize the benefits of reducing carbon dioxide emissions. NHTSA based this decision on a judgment that the benefits of CO_2 reductions were "too uncertain," citing "the extremely wide variation in published estimates

economically and technologically possible standards which will improve fuel economy but which an analysis, subject to many practical limitations, might indicate are not cost-beneficial." Final Rule: Passenger Automobile Average Fuel Economy Standards, 42 Fed. Reg. 33,534, 33,536 (1977). The reference to "economic practicability" comes from a subsequent section of the statute further elucidating the factors the agency should consider in its feasibility analysis. *See* 49 U.S.C. § 32902(f) ("When deciding maximum feasible average fuel economy under this section, the Secretary of Transportation shall consider technological feasibility, economic practicability, the effect of other motor vehicle standards of the Government on fuel economy, and the need of the United States to conserve energy.").

297. NHTSA began its CBA with "the fuel economy levels that manufacturers were planning to achieve in those years," Average Fuel Economy Standards for Light Trucks Model Years 2008-2011, 71 Fed. Reg. 17,566, 17,581(Apr. 6, 2006) (to be codified at 49 C.F.R pts. 523, 533, 537), and then "add[ed] fuel saving technologies to each manufacturer's fleet until the incremental cost of improving its fuel economy further just equal[ed] the incremental value of fuel savings and other benefits from doing so," *id.* at 17,596. These incremental adjustments were made "until industry-wide net benefits [were] maximized. Maximization occurs when the incremental change in industry-wide compliance costs from adjusting it further would be exactly offset by the resulting incremental change in benefits." *Id.*

298. Ctr. for Biological Diversity v. NHTSA, 538 F.3d 1172, 1191 (9th Cir. 2008). The statute itself did not explicitly call for formal CBA, or necessarily for CBA at all. It simply directed NHTSA to set fuel economy standards at "the maximum feasible . . . level," and to take into account in that determination "technological feasibility, economic practicability, the effect of other motor vehicle standards . . . on fuel economy, and the need of the United States to conserve energy." Energy Policy and Conservation Act of 1975, 49 U.S.C. § 32902(a), (f) (2012).

299. *See Ctr. for Biological Diversity*, 538 F.3d at 1187-89.

300. *See id.* at 1197 ("We agree with NHTSA that 'EPCA neither requires nor prohibits the setting of standards at the level at which net benefits are maximized.'").

of damage costs from greenhouse gas emissions."[301] The court found NHTSA's failure to monetize the benefits of CO_2 emissions reduction arbitrary and capricious,[302] but the court grounded this holding very much in the fact that the agency had, of its own volition, chosen to employ a highly formal CBA but then failed to apply it in a consistent manner. Thus, the court faulted the agency for "putting a thumb on the scale" by failing to monetize carbon emissions reductions, even though it had managed to "monetize[] other uncertain benefits."[303] Moreover, the court noted that "[u]nder this methodology, the values that NHTSA applies to benefits are critical," implying that if the agency had chosen a methodology other than a highly formal CBA, monetization of carbon emissions reductions might not have been necessary.[304]

Thus, the Ninth Circuit's holding in *Center for Biological Diversity* hardly amounts to a general requirement that agencies use formal CBA or that they employ a monetized marginal-damages-based SCC in doing so. On the contrary, it simply stands for the proposition that where an agency *elects on its own* to employ a highly formal variety of CBA, it must be consistent by quantifying and monetizing *all* relevant benefits.[305] Moreover, even if this case might be read to require some method of putting a dollar value on carbon emissions in some instances, there is nothing in the opinion that suggests that the method for monetization would have to follow the marginal damages approach rather than the MAC approach. Indeed, the court's emphasis on the agency's discretion in fashioning the decision tools it employs suggests the opposite.

In sum, a closer look at *Michigan* and *Center for Biological Diversity*, reveals that neither case can bear the weight the MAC critics have placed on them. Neither case requires agencies to use CBA in environmental decision making. Nor does either case require agencies to perform formal CBA "in which each [benefit] and [cost] is assigned a monetary value."[306] Indeed, all nine justices went out of their way in *Michigan* to make clear that even when agencies choose to do CBAs, they don't need to monetize relevant values.[307] In short, there's no basis for the claim that agencies are legally required to use a marginal-damages based SCC.

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301. *Id.* at 1192.

302. *See id.* at 1203.

303. *Id.* at 1202.

304. *Id.* at 1199.

305. *See id.* at 1198-1203 ("Under this methodology, the values that NHTSA assigns to benefits are critical. Yet NHTSA assigned no value to the most significant benefit of more stringent CAFE standards: reduction in carbon emissions."). A subsequent district court case involving a challenge to an environmental impact statement issued in connection with coal leasing on federal lands reached a similar conclusion. *See* High Country Conservation Advocates v. U.S. Forest Serv., 52 F. Supp. 3d 1174, 1191 (D. Colo. 2014) ("Even though NEPA does not require a cost-benefit analysis, it was nonetheless arbitrary and capricious to quantify the *benefits* of the lease modifications and then explain that a similar analysis of the *costs* was impossible when such an analysis was in fact possible [by use of the social cost of carbon]."). For more on NEPA, see *supra* note 174.

306. Michigan v. EPA, 576 U.S. 743, 758-59 (2015).

307. *See supra* notes 289-290 and accompanying text.

Conclusion

The Biden Administration has rightly recognized that in the face of a code red emergency, putting all of one's eggs in a single policy basket is likely not the best approach. The President is instead attempting to push a broad and diverse package of climate measures through Congress and is taking an all-of-government approach, directing every agency to make the thousands of policy changes, big and small, in myriad policy contexts, that will be necessary to begin the massive task of transitioning the global economy to a carbon-free future. The same wisdom applies to regulatory review. Formal, quantified CBA is just one of the tools in the regulatory toolbox that agencies have at their disposal for environmental rulemaking, and the best tool for the job often varies with context.

Accordingly, contrary to the claims of some CBA adherents, a marginal damages approach to setting the SCC that hews closely to formal CBA orthodoxy is neither clearly superior to the alternative MAC approach as a matter of policy nor required as a matter of law. As a legal matter, the Biden Administration is free to choose the decision tools it employs in regulatory decision making and regulatory review within the limits set forth in the applicable statutes, and most of those statutes specify tools other than formal CBA. In many instances, the legally permissible tools in the toolbox will include the MAC approach.

From a policy standpoint, the Administration would do well to keep an open mind, resist the CBA-orthodoxy that has taken hold of the regulatory review process, and remember the virtues of fast and frugal decision tools of the sort that Congress has so frequently (and successfully) employed in our environmental statutes. Tools like the MAC approach that take into account and work around bounded rationality limits and information gaps can sometimes prove more effective and durable than optimization tools like formal CBA and the SCC that may seem elegant in theory, but often prove cumbersome and ineffective in practice.