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The Ends and Means of Pollution Control: Toward a Positive Theory of Environmental Law

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THE ENDS AND MEANS OF POLLUTION CONTROL: TOWARD A POSITIVE THEORY OF ENVIRONMENTAL LAW

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 University Professor, Syracuse University. I would like to thank Robert Adler and Kirsten Engel, the coauthors of my casebook, ENVIRONMENTAL LAW: A CONCEPTUAL AND PRAGMATIC APPROACH (3rd ed. 2016), for many useful conversations about the conceptual framework underlying environmental law. Any errors in this article, though, belong to me.

INTRODUCTION

We lack a well-developed positive theory of environmental law. A positive environmental law theory, as opposed to a normative theory, explains environmental law rather than focus on rationales for reform.[1] A positive theory focuses on what the law is, not what it should be.[2] Although a positive theory constitutes a description, some of this theory describes normative commitments underlying the choices found in environmental law. A positive theory need not endorse all aspects of existing environmental law. Positivism is not cheerleading. But to the extent a positive theory explains the reasons for existing law, it provides the basis for a well-informed debate about which reforms would improve it and which would make it worse. And a conceptual framework aids environmental advocacy, which often depends as much upon explaining policy considerations as upon specific details.[3]

Such a theory not only aids policy and legal debates, it can also improve teaching. Environmental law teaching usually focuses on the mastery of detail. The traditional environmental law course covers several complex and often lengthy environmental statutes.[4] Although nobody disputes the need to teach mastery of

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[1] *Cf.* Daniel A. Farber & Philip Frickey, *Foreword: Positive Political Theory in the Nineties*, 80 GEO. L.J. 457, 462 (1992) (defining positive political theory as "non-normative" because it explains political events rather than evaluate their desirability). *See generally* HANS KELSEN, PURE THEORY OF LAW 7–20 (Max Knight trans., Univ. of Cal. Press 1967) (1960) (describing positive law as "objectively valid norm[s]" and stating that this interpretation is possible only under the condition that a basic norm is "presupposed").

[2] *See* Adrian Vermeule, *Connecting Positive and Normative Legal Theory*, 10 U. PA. J. CONST. L. 387, 387–390 (2008) (describing positive and normative legal theory as seemingly "radically disjunct" because normative theory focuses on value and desirability while positive theory focuses on facts about the law from an internal perspective); James Paul Maniscalco, Note, *The New Positivism: An Analysis of the Role of Morality in Jurisprudence*, 68 S. CAL. L. REV. 989, 990 (1995) (describing legal theory's "separation of law as it is from law as it ought to be").

[3] *See, e.g.*, Michigan v. EPA, 135 S. Ct. 2699, 2707 (2015) (holding that EPA must consider cost in deciding whether regulation of mercury from power plants is "necessary and appropriate" based largely on philosophy supporting cost-benefit balancing).

[4] *See, e.g.*, ROBIN KUNDIS CRAIG, ENVIRONMENTAL LAW IN CONTEXT: CASES AND MATERIALS 5–15 (3d ed. 2012) (introducing sources of federal environmental law, including numerous environmental statutes); DANIEL A. FARBER & ANN E. CARLSON, CASES AND

detail to future environmental lawyers, a conceptual framework can give meaning to details. Such a complex field cries out for a positive theoretical foundation.

Yet, normative scholarship, meaning scholarship aimed at improving rather than describing the law, dominates environmental legal theory. And a lot of this takes the form of outsider scholarship with a normative orientation in some tension with the field's traditional core commitments. For example, in recent years prominent scholars have argued that rational environmental policy requires cost-benefit analysis (CBA).[5] CBA has gained a place in the corpus of environmental law, but the normative foundations most commonly associated with CBA come not from the values featured in environmental statutes, but from economics, which emphasizes the value of economic efficiency.[6] Much of the work questioning some of the economic reforms, such as the work questioning CBA, offers technocratic critiques of the proposed reform.[7] Environmental law scholars, for example, have argued that quantitative risk assessment and monetization of health and environmental effects, which provide most of the technical foundation for CBA of environmental regulations, have serious limitations.[8] These critiques make important points, but they do not by themselves establish the existence, let alone the desirability, of viable alternative forms of analysis emanating from environmental law.

Douglas Kysar, in a thoughtful critique of CBA and the search for objectivity underlying it, may speak for a lot of environmental lawyers when he emphasizes that "*[w]e already had a theory*" of environmental law.[9] Regulatory reformers' writing, however, does not suggest that they see this theory; it suggests instead that they often

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MATERIAL ON ENVIRONMENTAL LAW 125–201, 395–936 (9th ed. 2014) (covering various environmental statutes).

[5] *See, e.g.*, Cass R. Sunstein, *Cognition and Cost-Benefit Analysis*, 29 J. LEGAL STUD. 1059, 1067 (2000) (claiming that CBA ensures the public demand for regulation is not "rooted in myth").

[6] *See* Amy Sinden, *Formality and Informality in Cost-Benefit Analysis*, 2015 UTAH L. REV. 93, 100 (2015) (tracing CBA to its economic roots and utilitarianism with its goal of maximizing "the overall welfare of members of society in the aggregate"). I use the term CBA here to specify an analytical technique that aims to quantify as many of the costs and benefits of a regulatory action as possible. *Cf. id*. at 97 (noting that the term may refer either to highly formal quantitative analysis or to less formal analysis of "pros and cons").

[7] *See id.* at 105–07 (describing critics' focus on measurement difficulties in formal CBA).

[8] *See* FRANK ACKERMAN & LISA HEINZERLING, PRICELESS: ON KNOWING THE PRICE OF EVERYTHING AND THE VALUE OF NOTHING 61–90 (2004) (critiquing monetization of health and environmental benefits); John S. Applegate, *The Perils of Unreasonable Risk: Information, Regulatory Policy, and Toxic Substances Control,* 91 COLUM. L. REV. 261, 280 (1991) (describing quantitative risk assessment as providing the "framework" for CBA).

[9] DOUGLAS A. KYSAR, REGULATING FROM NOWHERE: ENVIRONMENTAL LAW AND THE SEARCH FOR OBJECTIVITY 3 (2010).

see a mass of complex statutory provisions exhibiting little rhyme or reason.[10] And Kysar himself, in the next sentence, hastens to admit that the theory we had was "messy, pluralistic, and pragmatic."[11] Even if environmental lawyers had a theory, it may be too messy to even be visible to anybody else. And visibility to non-specialists matters. After all, the people making many of the most important decisions shaping environmental law—Congressmen, judges, and Presidents—often do not specialize in environmental law.

Furthermore, positive theory, unless explicitly articulated, may prove invisible even to some scholars who devote substantial amounts of time to thinking about environmental law. And even those who see a positive theory may not understand it well absent a precise articulation of it.

This Article contributes to the construction of a positive theory of environmental law by developing an account of the ends and means of pollution control law. Environmental lawyers often use the term "environmental law" narrowly to refer to pollution control law alone, but sometimes use this term more capaciously to include natural resources law—the law governing the use of federal lands.[12] Although natural resources law lies beyond the scope of this Article, scholars in that field have found some of the elements of the theory developed here useful in thinking about natural resources law.[13] Yet, I am agnostic on the question of whether we can construct a "unified field" theory that usefully unites environmental and natural resources law. So, this Article focuses on environmental law defined narrowly as pollution control law.

The theory discussed in this Article builds on concepts familiar to experts in the field. Indeed, environmental law textbooks, including one that I coauthor, usually mention the concepts that I rely on as building blocks for this theory.[14] The

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[10] *See, e.g.*, Timur Kuran & Cass R. Sunstein, *Availability Cascades and Risk Regulation*, 51 STAN. L. REV. 683, 744 (1999) (finding our approaches to risk regulation "grossly inconsistent").

[11] KYSAR, *supra* note 9, at 3.

[12] *See* DAVID M. DRIESEN, ROBERT W. ADLER & KIRSTEN H. ENGEL, ENVIRONMENTAL LAW: A CONCEPTUAL AND PRAGMATIC APPROACH 1 (3d ed. 2016) (noting its focus on pollution control statutes while stating that a comprehensive course would address both natural resources and pollution control law). The term pollution control law refers to law that seeks to limit or clean up pollution, such as the Clean Air and Water Acts. 42 U.S.C.A §§ 13101–13109 (West 2016); 33 U.S.C.A §§ 1251–1387 (West 2016). Statutes that limit activities primarily to address ecological disturbances that do not involve only the release of foreign substances into the environment, such as the Endangered Species Act, 16 U.S.C.A §§ 1531–1544, and the Federal Land Policy and Management Act, 43 U.S.C.A §§ 1701–1787 (West 2016), fall within the domain of natural resources law.

[13] *See* Robert L. Fischman & James Salzman, *Lessons from Pollution Control: Response to Heller and Hobbs 2014*, 29 CONSERVATION BIOLOGY 950, 950–51 (2015) (positing that pollution control law's use of technology-based regulation as a step toward meeting effects-based ideals might have useful analogues for natural resource conservation).

[14] *See, e.g.*, CRAIG, *supra* note 4, at 17–30 (discussing cost-benefit balancing, effects-based standards, and technology-based standards); DRIESEN, ADLER & ENGEL, *supra* note

goals discussed include the protection from environmental harm, the realization of feasible emission reductions, and the balancing of pollution control's costs and benefits. Environmental law experts know that effects-based standards, technology-based standards, and cost-benefit balancing play a role in environmental law.[15] Similarly, the means of environmental protection emphasized here—performance standards, work practice standards, phaseouts, emissions trading, and pollution taxes—do not constitute new discoveries.[16]

Yet, environmental law experts do not share as clear an understanding of these concepts as one might think. For example, take the idea of technology-based standard setting—a form of standard setting that dominates environmental statutes. Should we understand technology-based standard setting as a way of establishing goals for environmental regulations or as a means of pollution control? To put the question a little more precisely, do technology-based statutory provisions use technological capabilities as a guide to the appropriate stringency of pollution control standards, or do they dictate the technologies that polluters must use? Analysts evince some disagreement, and some confusion, about some very basic questions.[17] Thus, elucidating basic well-known concepts with some precision facilitates discussion of important matters that have received insufficient attention in the literature.

This Article's most novel contribution, however, comes from using these concepts to paint a picture of the field as a whole. While the Article's primary contribution is analytical and descriptive, rather than normative, the analysis used to create this picture reveals some novel insights and a valuable research agenda that includes normative questions. A fragmented literature discusses many of the core concepts employed here individually, but does not bring them together to construct

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12, at 85–294 (presenting chapters devoted to the concepts addressed in this Article); ROBERT V. PERCIVAL ET AL., ENVIRONMENTAL REGULATION: LAW, SCIENCE, AND POLICY 152–156 (7th ed. 2013) (discussing the concepts featured in this Article among others); ZYGMUNT J.B. PLATER ET AL., ENVIRONMENTAL LAW AND POLICY: NATURE, LAW AND SOCIETY (4th ed. 2010) (putting significant emphasis on these concepts).

[15] *See, e.g.*, Michael A. Livermore & Richard L. Revesz, *Rethinking Health-Based Environmental Standards,* 89 N.Y.U. L. REV. 1184, 1190 (2014) (identifying cost-benefit based, health-based, and technology-based standards as the "three principle approaches for determining the stringency of environmental protection"); Thomas O. McGarity, *Media-Quality, Technology, and Cost-Benefit Balancing Strategies for Environmental Regulation,* 46 L. & CONTEMP. PROBS. 159, 159 (1983) (evaluating three different approaches to environmental regulation: technology-based, cost-benefit-based, and media-quality-based).

[16] *See, e.g.*, RICHARD L. REVESZ, ENVIRONMENTAL LAW AND POLICY 161–93 (3d ed. 2015) (discussing "command-and-control" regulation, effluent fees, and emissions trading).

[17] *See, e.g.*, March Sadowitz, Note, *Tailoring Cost-Benefit Analysis to Environmental Policy Goals: Technology- and Health Based Environmental Standards in the Age of Cost-Benefit Analysis*, 2 B.U. J. SCI. & TECH. L. 11, 16–17 (1996) (defining technology-based standards as "mandat[ing] the use of a particular technology," but then describing them two paragraphs later as sometimes requiring a "level of discharge . . . regardless of the means").

a broader theory. We have, for example, a large literature on CBA,[18] a smaller literature on technology-based standards,[19] and a bit of a literature on effects-based standards (supplemented by a large literature on the related idea of precaution and technique of risk assessment).[20] Bringing these goal concepts together allows an exploration of the relationship among our goals, taking us closer to having a positive theory of environmental law.[21] Similarly, a large literature says something about one or another of the means of environmental protection, but relationships among various means of environmental protection remain underexamined. And the relationship between ends and means has received still less attention. Thus, by further developing frequently mentioned concepts and exploring their relationship with each other and their placement within statutes, this Article provides an account of the field as a whole, at least in terms of how we craft pollution control standards.

Any legal theory requires some simplification. Thus, the positive theory developed here leaves out some details. Environmental law specialists may find these omissions troubling, as we pride ourselves on mastery of the law's details. Yet, staring at each tree does not reveal a forest. A theory of sufficient generality to prove useful in top-level policy debates and fundamental scholarship must make choices emphasizing and explaining some details, especially those crucial to a proper understating of core concepts, while leaving others. And the ideas circulating in top-level policy debates may influence more fine-grained decisions that specialists might

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[18] *See* Don Bradford Hardin, Jr., *Why Cost-Benefit Analysis? A Question (and Some Answers) About the Legal Academy*, 59 ALA. L. REV. 1135, 1136–39 (2008) (quantifying legal scholarship focused on CBA).

[19] *See, e.g.*, Adam Babich, *Too Much Science in Environmental Law*, 28 COLUM. J. ENVTL. L. 119, 131–32 (2003); David M. Driesen, *Distributing the Costs of Environmental, Health, and Safety Protection: The Feasibility Principle, Cost-Benefit Analysis, and Regulatory Reform,* 32 B.C. ENVTL. AFF. L. REV. 1, 2–4 (2005); Jonathan S. Masur & Eric A. Posner, *Against Feasibility Analysis,* 77 U. CHI. L. REV. 657, 657–60 (2010); Sidney A. Shapiro & Thomas O. McGarity, *Not So Paradoxical: The Rationale for Technology-Based Regulation,* DUKE L.J. 729, 729–30 (1991); Wendy E. Wagner, *The Triumph of Technology-Based Standards,* 2000 U. ILL. L. REV. 83, 85 (2000).

[20] *See, e.g.*, John S. Applegate, *Embracing a Precautionary Approach to Climate Change*, *in* ECONOMIC THOUGHT AND U.S. CLIMATE CHANGE POLICY 171 (David M. Driesen ed., 2010) [hereinafter ECONOMIC THOUGHT]; THE BROOKINGS INST., QUANTITATIVE RISK ASSESSMENT IN REGULATION 1 (Lester B. Lave ed., 1982); NAT'L RESEARCH COUNCIL, RISK ASSESSMENT IN THE FEDERAL GOVERNMENT: MANAGING THE PROCESS 9 (1983); THE PRECAUTIONARY PRINCIPLE IN THE 20TH CENTURY: LATE LESSONS FROM EARLY WARNINGS 1 (Paul Harremoës et al. eds., 2002) [hereinafter 20TH CENTURY PRECAUTION]; Donald T. Hornstein, *Reclaiming Environmental Law: A Normative Critique of Comparative Risk Analysis*, 92 COLUM. L. REV. 562, 562 (1992); Wendy E. Wagner, *The Science Charade in Toxic Risk Regulation*, 95 COLUM. L. REV. 1613, 1613 (1995).

[21] *See* Thomas O. McGarity, *The Goals of Environmental Legislation,* 31 B.C. ENVTL. AFF. L. REV. 529, 530–531 (2004) (employing a more elaborate typology and discussing the relationships among goals).

think arcane detail would control.[22] A positive theory can inform important choices if it has sufficient generality to prove useful to nonspecialists who make many key decisions without fully understanding each relevant detail.[23]

This Article develops a theory of environmental law's goals in part one. This part discusses the concepts of effects-based, technology-based, and cost-benefit based goals in turn. It shows how each of these goal-setting rubrics focuses on different sets of information and therefore poses different challenges for regulators establishing standards. It also discusses the normative values underlying these concepts. Part one continues with an analysis of how environmental statutes employ these concepts, thereby providing a picture of the normative structure of environmental law as a whole, something missing from the literature. It closes by showing how understanding environmental law's goal concepts together yields new insights and important research questions.

The second part describes the regulatory means of meeting these goals. It discusses performance standards, work practice standards, phaseouts, emissions trading, and pollution taxes. This part closes with an analysis of the positive theory of instrument choice found embedded in the law governing means selection.

The third part shows that putting means and ends together enhances our understanding of environmental law and reveals an important research agenda. For example, instrument choice scholars often focus on the means of environmental protection without explicitly engaging its ends. They usually describe emissions trading as the opposite of technology-based standard setting. But recently scholars studying emissions trading have found that regulators designing such programs often employ technology-based rubrics to establish trading programs' goals.[24] In other words, emissions trading programs often are technology-based. Emissions trading's reliance on technology-based standard setting raises an important question about

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[22] *See, e.g.*, Entergy Corp. v. Riverkeeper, 556 U.S. 208, 217, 220–21 (2009) (construing a requirement that standards reflect "the best technology for minimizing environmental impact" as allowing CBA, while expressing dismay about the complexity of a contrary structural argument based on detailed statutory language).

[23] I use the term "general policy choices" to refer to legislation and executive orders, but to exclude administrative actions implementing general policy choices in particular contexts. Thus, I claim that this positive theory can inform rational deliberation about ends. *See* HENRY S. RICHARDSON, PRACTICAL REASONING ABOUT FINAL ENDS 6 (1994) (defending rationale deliberation of ends as rational). At the same time, I do not claim that the concepts here necessarily suffice to fully justify all, or even most, administrative decisions about particular applications *See id.* at 150–54 (discussing the challenges of making coherent explanations for actions, while insisting that satisfactory explanations bear some relationship to broader aims).

[24] *See, e.g.*, Heinrich Tschochohei & Zan Zöckler, *Business and Emissions Trading from a Public Choice Perspective-Waiting for a New Paradigm to Emerge, in* EMISSIONS TRADING: INSTITUTIONAL DESIGN, DECISION MAKING AND CORPORATE STRATEGIES 21, 28–31 (Ralf Antes et al. eds., 2008) (concluding that the European Union (EU) emissions trading scheme "reflects a command-and-control approach" because of technology-based allocation).

what changes in normative orientation might be needed to allow emissions trading to more fully realize some of its proponents' environmental ambitions. For scholars promoting emissions trading had hoped that it would free regulators from the task of evaluating appropriate technologies, which they hoped to leave to regulated firms with superior plant-specific expertise.[25] This question about emissions trading's normative orientation matters a great deal to climate disruption law in particular, because it has relied heavily on emissions trading, with somewhat disappointing results so far.[26]

The fourth part issues an invitation to build on the theory of ends and means articulated in this Article to create a more complete theory of environmental law. It identifies some core components of a broader theory that this Article does not have space to address. It also raises the question of how we should understand environmental justice's relationship to a positive theory of environmental law.

I. ENVIRONMENTAL LAW'S ENDS

This Article relies on a dual conception of environmental law's goals. First, when Congress writes an environmental statute it presumably has some purposes in mind, which serve as goals for the statute as a whole. Sometimes, Congress sets out goals in the first few sections of a statute, but they may also emerge from legislative history or statutory design.[27] Second, Congress usually spells out criteria for standard setting in statutes, which guide administrative agency decisions about how much pollution control to demand in particular regulations.[28] Criteria guiding these stringency determinations establish goals for particular regulations. This Article treats both the goals of entire statutes and the criteria governing the stringency of particular pollution control decisions as goals for environmental law.

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[25] *See* Bruce A. Ackerman & Richard B. Stewart, Comment, *Reforming Environmental Law*, 37 STAN. L. REV. 1333, 1342–43 (1985) (arguing that emissions trading transfers the job of assessing technologies from "bureaucrats" to "business managers").

[26] *See* JONAS DREGER, THE EUROPEAN COMMISSION'S ENERGY AND CLIMATE POLICY: A CLIMATE OF EXPERTISE? 64 (2014) (discussing a strong academic consensus that the European Union's emissions trading scheme failed during its first few years). I use the term "climate disruption" in lieu of the more conventional terms "climate change" and "global warming" because "climate disruption" captures the reasons that climate scientists fear the particular changes associated with increasing average mean surface temperatures. *See* DRIESEN, ADLER, & ENGEL, *supra* note 12, at 24 (explaining why White House science advisor John Holdren finds the term "climate disruption" more accurate than the alternatives).

[27] *See, e.g.*, 42 U.S.C.A §§ 6902(a), 7401(b) (West 2016); Union Elec. Co. v. EPA, 427 U.S. 246, 259 (1976) (citing legislative history indicating that Congress considered protection of the "health of persons" as Congress' responsibility).

[28] *See, e.g.*, Whitman v. Am. Trucking Ass'ns, Inc., 531 U.S. 457, 465 (2001) (explaining that Congress requires national ambient air quality standards to be adequate to protect public health and has therefore precluded consideration of cost in setting these standards).

Specifying means and ends does not constitute an exact science because goals can be stated at a variety of levels of generality.[29] Stating a goal at a very high level of generality can make plausible a claim that slightly less general criteria constitute means toward a yet more general end.[30] Thus, for example, one might posit a very general goal for environmental law of improving life on earth. Described this way, an analyst might see the goals of environmental statutes as means of achieving this larger goal. If one states the goals of environmental law a little less generally as, for example, protecting public health and the environment, then one might see criteria guiding actual stringency determinations for particular pollutants as means toward that end. So, this dual conception is not inevitable.

Yet, this Article's dual conception of goals has several advantages. Importantly for a positive theory, this goal definition relies on legal texts, especially statutes. A goal that has no or little support in legal texts probably has no place in a positive theory of environmental law, as such a goal does not describe the law so much as seek to give it new normative foundations. While there is nothing wrong with normative theory, this Article seeks to help establish a positive theory of environmental law.

This Article treats statutory criteria guiding the stringency of standards set by administrative agencies as goals because decisions about pollution control standards' stringency determine what compliant polluters will achieve in practice. The criteria governing agency decisions about stringency therefore guide decisions about what we should try to achieve. When we speak of a goal, we generally mean an understanding of what we are trying to achieve. Therefore, the statutory criteria governing decisions about the stringency of standards are most usefully thought of as establishing goals for administrative agencies developing pollution control standards. The analysis below also reveals that this dual conception yields insights into environmental law's conceptual structure and core normative dilemmas. Thus, even though one might view the criteria governing standard setting as a means of achieving a statute's overall goal, this Article initially treats such criteria as goals of environmental law, but later considers these criteria's relationship to statutes' overall goals.

In particular, this part focuses on effects-based standards, feasibility-based standards, and cost-benefit based standards in turn. It then closes by describing some insights and research questions that this discussion reveals.

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[29] *See* Max Radin, *Statutory Interpretation,* 43 HARV. L. REV. 863, 876–77 (1930) (pointing out that a statute's purpose can be conceived at varying levels of generality).

[30] *See, e.g.*, John F. Manning, *Federalism and the Generality Problem in Constitutional Interpretation*, 122 HARV. L. REV. 2003, 2016–17 (2009) (noting that one can plausibly identify the aim of any statute as securing "justice and security" and suggesting that doing so permits the reaching of arbitrary results).

A. Protecting Public Health and the Environment: Effects-Based Standards

Several statutes and statutory provisions have the goal of protecting public health and the environment. Environmental lawyers refer to standards enacted under statutory provisions explicitly aiming to protect public health and the environment as effects-based standards because these standards have a goal of avoiding harmful environmental effects.[31]

1. Examples

The Clean Air Act (CAA)[32] and Clean Water Act (CWA)[33] have the explicit goals of protecting public health and the environment. These goals appear as general goals for the statutes as a whole and in some key provisions governing standard setting.

The CAA's very first section declares a "purpose" of "protect[ing] and enhanc[ing] the . . . Nation's air resources so as to promote the public health and welfare and the productive capacity of its population."[34] This language establishes a goal of protecting air quality in order to achieve the more general goals of promoting public health and welfare.[35] Thus, the CAA embraces a goal of protecting public health.[36]

It also embraces a goal of environmental protection. The Act protects air quality not only to promote public health, but also to improve public "welfare." The CAA, however, defines welfare not only in terms of economic welfare, but also in terms of environmental quality.[37] Thus, the statute promotes "welfare" by protecting the environment from air pollution.

The CAA's main operative provisions reinforce this reading of the statute's overall goals.[38] The CAA requires the Environmental Protection Agency (EPA) to establish primary national ambient air quality standards (NAAQS) to protect public health with an "adequate margin of safety."[39] It also requires "secondary" NAAQS to protect public welfare (i.e. the environment) from "known or anticipated adverse

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[31] *See, e.g.*, *Am. Trucking*, 531 U.S. at 465 (holding that the CAA's health-based air quality standards must be set at levels corresponding with the "maximum . . . concentration . . . that the public health can tolerate" decreased by a margin of safety).

[32] 42 U.S.C.A §§ 7401–7671q (West 2016).

[33] 33 U.S.C.A §§ 1251–1387 (West 2016).

[34] 42 U.S.C.A § 7401(b)(1) (West 2016).

[35] *See id.*

[36] *See Am. Trucking,* 531 U.S. at 466 (explaining that the CAA protects the "health of the public").

[37] *See* 42 U.S.C.A § 7602(h) (West 2016) (discussing inter alia effects on "soils, water, crops, vegetation . . . animals, wildlife, weather, visibility, and climate").

[38] *See* Alaska Dep't of Envtl. Conservation v. EPA, 540 U.S. 461, 469 (2004) (describing attainment of health-based air quality standards as the "aim[]" of the CAA).

[39] 42 U.S.C.A §§ 7409(a)–(b) (West 2016).

effects."[40] These provisions direct EPA to establish concrete goals that states must achieve through comprehensive pollution control programs.[41] These national "ambient" standards specify the level of pollution allowed in the ambient air—the air around us—in parts per million of pollution.[42] States must then reduce emissions from particular pollution sources to the extent necessary to achieve these effects-based numerical goals.[43] Thus, the CAA embraces the goals of protecting public health and the environment.[44]

The CWA has even stronger and more explicit environmental protection goals. Its first section declares an "objective" of "restor[ing] and maintain[ing] the chemical, physical, and biological integrity of the Nation's waters."[45] Thus, it establishes ecological integrity as an environmental goal. It then explicitly sets out ambitious subsidiary goals useful to obtaining this broad ecological goal. These goals include the elimination of discharges by 1985, the protection of fish and wildlife by 1983, and the elimination of toxic pollution in toxic amounts—showing an intent to fully protect water quality from environmental harm.[46]

The CWA also contains operational provisions that aim to carry out the Act's water quality goals. For it requires states to establish water quality standards roughly analogous to the CAA's NAAQS.[47] These effects-based standards must protect the water so that people can use it for purposes states embrace and must be consistent with the statute's ecological goals.[48] The CWA envisions state regulation of particular pollution sources to obtain these water quality standards.[49]

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[40] 42 U.S.C.A § 7409(b)(2) (West 2016).

[41] *See* Train v. Nat. Res. Def. Council, 421 U.S. 60, 65–67 (1975) (describing requirements that states adopt implementation plans providing for the attainment of the NAAQS).

[42] *See id.* at 78 (explaining that the NAAQS "deal with the quality of the outdoor air").

[43] *See id.* (discussing the requirement that states develop "emission limitations" to limit pollution from "power plants, service stations, and the like" to achieve the NAAQS).

[44] *See* Union Elec. Co. v. EPA, 427 U.S. 246, 249 (1976) (describing the requirement that states formulate plan to achieve standards designed to protect public health as the "heart" of the CAA); *cf.* Chevron U.S.A. Inc. v. Nat. Res. Def. Council, Inc., 467 U.S. 837, 851–52 (1984) (finding economic purposes relevant to section 117 of the CAA).

[45] 33 U.S.C.A§ 1251(a) (West 2016).

[46] *Id.* §§ 1251(a)(1)–(3).

[47] *See* PUD No. 1 of Jefferson Cty. v. Wash. Dep't of Ecology, 511 U.S. 700, 704 (1994) (discussing requirement that states establish water quality standards); *cf.* Miss. Comm'n on Nat. Res. v. Costle, 625 F.2d 1269, 1275–76 (5th Cir. 1980) (stating that states have the primary responsibility for establishing water quality standards, but that EPA reviews them for compliance with the CWA); Robert W. Adler, *Integrated Approaches to Water Pollution: Lessons from the Clean Air Act*, 23 HARV. ENVTL. L. REV. 203, 206 (1999) (discussing the NAAQS and water quality standards as two examples of ambient effects-based standards).

[48] *See* 33 U.S.C.A § 1313(c)(2) (West 2016).

[49] *See* Adler, *supra* note 47, at 215–40 (describing the requirements for state realization of water quality goals).

Similarly, the Resources Conservation and Recovery Act (RCRA) has a goal of promoting "protection of health and the environment and to conserve" natural resources.[50] It seeks to achieve this health and environmental protection goal by prohibiting open dumping, converting existing open dumps to "facilities" posing no "danger to the environment or to health," and "assuring" that hazardous waste management "protects human health and the environment."[51]

Environmental statutes not only employ effects-based standards as goals for state pollution control programs. They also include some statutory provisions, especially provisions regulating toxic pollution, that seek explicitly to protect public health and the environment from specific pollution sources. A fairly typical provision requires pollution levels that protect public health with an ample margin of safety.[52]

2. Analytical Features

An effects-based standard requires the assessment of pollution's environmental and/or health effects in order to determine what level of pollution to tolerate.[53] Thus, effects-based standards require either quantitative or qualitative risk assessment. So, for example, if a standard seeks to protect public health from a carcinogenic pollutant, a regulatory agency may seek to determine how often that pollutant will cause cancer at various levels.[54] The agency must then use this information to establish standards that avoid a significant number of cancer cases.[55]

Scientific uncertainty, however, usually makes it difficult to set standards based on protecting public health or the environment.[56] Indeed, this difficulty has helped

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[50] *See* 42 U.S.C.A § 6902(a) (West 2016).

[51] 42 U.S.C.A § 6902(a)(3)–(4) (West 2016).

[52] *See, e.g.*, Nat. Res. Def. Council v. EPA, 529 F.3d 1077, 1080–81 (D.C. Cir. 2008) (describing residual risk standards for hazardous air pollutants under the 1990 CAA Amendments as protecting public health with an ample margin of safety); Nat. Res. Def. Council v. EPA, 824 F.2d 1146, 1147 (D.C. Cir. 1987) (noting that EPA must establish emission standards for hazardous air pollutants that protect public health with an "ample margin of safety"); Envtl. Def. Fund, Inc. v. EPA, 598 F.2d 62, 73 (D.C. Cir. 1978) (describing EPA's responsibility to provide an "ample margin of safety" from toxic water pollution as the toxics section's "polestar").

[53] *See, e.g.*, Am. Farm Bureau Fed'n v. EPA, 559 F.3d 512, 520–522 (D.C. Cir. 2009) (finding that EPA failed to adequately take into account health effects when it rejected reliance on short-term exposure studies).

[54] *See* Wagner, *supra* note 20, at 1618–19 (describing regulation based on health effects as trying to achieve a quantitative limit on the amount of risk).

[55] *Cf.* Am. Lung Ass'n v. EPA, 134 F.3d 388, 392–393 (D.C. Cir. 1998) (reversing EPA health-based standard because EPA did not protect asthmatics from events triggering a need for hospitalization, medication, and disruption of some ongoing activities).

[56] *See* Alyson C. Flournoy, *Legislating Inaction: Asking the Wrong Questions in Protective Environmental Decision Making,* 15 HARV. ENVTL. L. REV. 327, 327 (1991) (characterizing risk assessment as "inevitably . . . characterized by uncertainty"); Wagner,

partially paralyze standard setting for toxic substances.[57] We generally do not have data that can tell us precisely what health and environmental consequences occur at various levels of tolerated pollution.[58] Most attempts to associate particular pollution levels with particular environmental and health consequences require extrapolation from very limited data based on models, and usually our understanding of pollution's effects provides little basis for knowing how to do this extrapolation.[59] Thus, in practice, effects-based standards usually require acceptance of agency guesses about the risk of pollution at various levels, and the controversy around those guesses sometimes proves paralyzing.[60]

On the other hand, establishing a safe level does not require consideration of pollution control costs.[61] For example, if we know that an air pollutant causes a significant number of cancer cases at three parts per million (ppm), we cannot allow pollution exceeding three ppm under a statutory provision demanding protection of public health from air pollution.[62] If it turns out that reducing pollution below three

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supra note 20, at 1614–15 (describing efforts to base standards on the science of health and environmental protection as a "failure").

[57] *See* Wagner, *supra* note 20, at 1677–1681 (explaining that efforts to base standards on unresolvable scientific determinations produces a great amount of inaction and delay); *see, e.g.*, Patricia Ross McCubbin, *The Risk in Technology-Based Standards*, 16 DUKE ENVTL. L. & POL'Y F. 1, 30 (2005) (attributing EPA's failure to regulate hazardous air pollutants under "the early health-based scheme . . . in large part to EPA's difficulty in deciding . . . which level of pollution should be deemed 'safe'"). *Cf.* John P. Dwyer, *The Pathology of Symbolic Legislation*, 17 ECOLOGY L.Q. 233, 251–260 (1990) (describing EPA's efforts to cope with the difficulties of implementing this health-based scheme).

[58] *See* Wagner, *supra* note 20, at 1619–22 (explaining why scientific data does not usually establish the precise risk a substance poses to humans).

[59] *See id.* at 1625–27 (explaining the need for scientifically non-verifiable assumptions to guide extrapolations from experimental data regarding health effects of high dose exposure in laboratory animals to predict effects upon large populations of human beings experiencing exposures to low doses).

[60] *See, e.g.*, Howard Latin, *Ideal Versus Real Regulatory Efficiency: Implementation of Uniform Standards and "Fine-Tuning" Regulatory Reforms*, 37 STAN. L. REV. 1267, 1307–08 (1985) (explaining that EPA failed to promulgate effects-based effluent standards for toxic water pollutants because of insufficient data to determine safe levels).

[61] *See* Whitman v. Am. Trucking Ass'ns, 531 U.S. 457, 470–71 (2001) (holding that the CAA bars consideration of costs and therefore cost-benefit analysis for establishing a NAAQS because it directs EPA to protect public health and the environment); Union Elec. Co. v. EPA, 427 U.S. 246, 256 (1976) (holding that considerations of cost and feasibility are wholly foreign to review of state implementation plans to meet the health-based NAAQS); *see also* Tenn. Valley Auth. v. Hill, 437 U.S. 153, 184–88 (1978) (holding that the Endangered Species Act (ESA) requires the protection of species from extinction "whatever the cost").

[62] Deciding what constitutes a "significant number" of cancer cases requires a policy judgment, but cost is also irrelevant to that policy judgment. If we conclude that 100 cancer cases are significant they do not become insignificant just because we discover that avoiding them would prove costly.

ppm proves insanely costly, we might wish as a policy matter to refrain from reducing pollution below three ppm. But if we planned to follow a policy of protecting public health, we would have to reduce the level below three ppm regardless. Cost is irrelevant to the question we ask when engaged in effects-based standard setting, what level of the pollutant being regulated is safe.[63]

The fact that we usually will not know exactly how many cancer cases occur at three ppm (or any other level) does not undermine the point that cost's magnitude is irrelevant to standard setting if the standard setting seeks to establish a safe level of pollution. The uncertainty just means that the regulator seeking to establish a safe level will have to make some judgment under uncertainty about what levels might be safe. That fact does not make costs relevant to determining what levels are safe.[64]

In some cases, the only safe level might be a zero level of pollution.[65] In practice, administrators may well resist zero levels because they imagine that a zero pollution requirement may cause a regulated industry to shutdown, which would pose political problems for the agency. But that political consideration does not undermine the basic point that if a zero level is the only safe level then an agency must prohibit all pollution if it plans to implement a command to only permit safe levels of pollution.[66] The resistance to a zero level of pollution, in this context on grounds of costs, constitutes a departure from a command to protect public health and the environment. Protection of public health and the environment from targeted pollution demands, in principle, that agencies ignore costs.

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[63] *See Am. Trucking,* 531 U.S. at 470–71 (holding that EPA may not consider cost when establishing a NAAQS because the statute requires protection of public health and the environment); *cf.* Natural Res. Defense Council (NRDC), Inc. v. EPA, 824 F.2d 1146, 1165 (D.C. Cir. 1987) (forbidding the consideration of cost in determining a safe level of emissions because this is consistent with the statutory emphasis on safety). Judge Bork's opinion for the court in *NRDC* went on to suggest that EPA may consider cost in deciding what margin of safety should be provided beyond the safe level. *NRDC,* 824 F.2d at 1165–66 (stating that EPA may consider feasibility in deciding how much of a margin to leave below a "safe" level of reductions). This dictum appears to conflict with the subsequent Supreme Court decision in *American Trucking* and appears incoherent, as the question of safety cannot be separated from the methodologies used to provide a margin of safety under prevailing conditions of uncertainty. *See American Trucking,* 531 U.S. at 570–71 (holding EPA may not consider cost in protecting public health with an adequate margin of safety); *NRDC,* 824 F.2d at 1165 n.11 (not requiring a two-step methodology separating safety from an ample margin of safety and recognizing that statistical methods may obviate the distinction).

[64] *See Am. Trucking,* 531 U.S. at 468 (holding that the requirement to deal with scientific uncertainty through an "adequate margin of safety" does not permit consideration of cost).

[65] *Accord NRDC,* 824 F.2d at 1165 (requiring EPA to set a standard of zero emissions if there is no level generating an "acceptable risk").

[66] *See* Union Elec. Co. v. EPA, 427 U.S. 246, 259 (1976) (explaining that Congress in requiring achievement of health-based air quality standards by a date certain had decided that plants should "meet the standard . . . or be closed down") (quoting S. Rep. No. 91-1196, 2–3 (1970)).

3. Normative Underpinning

Accordingly, the choice of an effects-based goal embraces a normative commitment to health and environmental protection. It gives that commitment primacy over competing values.[67]

B. Maximizing Feasible Reductions: Technology-Based Standards.

Many environmental statutes rely heavily on provisions that seek to maximize feasible reductions.[68] Many of these provisions, as I have argued elsewhere, are best understood as embodying a feasibility principle, which aims to maximize pollution reductions subject to a presumptive prohibition of regulations causing widespread plant shutdowns.[69]

1. Examples

The CWA's Best Available Technology (BAT) program, which often serves as the main example of technology-based regulation in the literature, exemplifies this feasibility principle.[70] The CWA demands "effluent limitations . . . , which (i) shall require the application of the best available technology economically achievable."[71] This provision requires the "elimination" of pollution "if . . . technologically and economically achievable."[72] This elimination language implies that if EPA can demand elimination of a pollutant without widespread plant shutdowns it should do so, but that it must, at least presumptively, refrain from establishing demanding requirements like a zero limit when such limits would cause widespread shutdowns. The demand for feasibility implies that some pollution limits—presumably those many plants can only attain by shutting down—are infeasible.

Similarly, the provision governing technology-based standards for hazardous air pollutants under the 1990 CAA Amendments exemplifies the feasibility principle. It demands that EPA "require the maximum degree of reductions in emissions . . . that the Administrator . . . determines is achievable."[73] Many other

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[67] Mary Jane Angelo, *Embracing Uncertainty, Complexity and Change: An Ecopragmatic Reinvention of a First-Generation Environmental Law,* 33 ECOLOGY L. Q. 105, 108 (2006) (describing risk-based approaches as "absolutist").

[68] Driesen, *supra* note 19, at 20–22 (providing examples of statutory provisions requiring maximization of feasible reductions).

[69] *See id.* at 8–22 (describing the feasibility principle as requiring maximization of reductions subject to a presumption against widespread plant shutdowns).

[70] *See, e.g.*, Ackerman & Stewart, *supra* note 25, at 1334–35 (describing BAT as the "primary basis" for the "existing system of pollution regulation").

[71] 33 U.S.C.A §1311(b)(2)(A) (West 2016).

[72] *Id*.

[73] 42 U.S.C.A§7412(d)(2) (West 2016).

statutory provisions instruct administrative agencies to write standards that maximize economically and technologically feasible reductions in pollution.[74] And EPA has sometimes interpreted provisions that lack superlatives requiring it to "maximize" reductions or base standards on the "best" technology—such as requirements for standards based on "reasonably available control technology"—as similarly demanding maximization of reductions to some extent.[75]

2. Analytical Features

We might think of technology-based standards as the analytical opposite of effects-based standards.[76] Setting them requires evaluation of technological and economic feasibility, but no analysis of health and environmental effects.[77] This "feasibility analysis" requires identification of potential pollution control techniques and then assessment of their pollution control potential, basically a question of engineering. The statutory provisions governing technology-based standard setting, however, clearly allow imposition of requirements not based on end-of-pipe

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[74] *See, e.g.*, Am. Textile Mfrs. Inst., Inc. v. Donovan, 452 U.S. 490, 509–510 (1981) (holding that OSHA demands a feasibility analysis and does not contemplate CBA).

[75] *See* McGarity, *supra* note 21, at 543 (noting that EPA interprets requirements for "reasonably available control technology" to demand "the *lowest* emission limitation" attainable through use of feasible technology) (emphasis added).

[76] *See, e.g.*, Natural Res. Defense Council, Inc. v. EPA, 824 F.2d 1146, 1163–64 (D.C. Cir. 1987) (reversing an EPA decision using an analysis of technology and its cost as a predicate for regulation under an effects-based statutory provision); *see generally* Adler, *supra* note 47, at 206–07 (describing technology-based and environmentally protective standards as "philosophically different" strategies because the former focuses on "economic and technological feasibility" whilst the latter "are set at levels . . . necessary to protect human health and environmental quality").

[77] *See* Chem. Mfrs. Ass'n v. EPA, 217 F.3d 861, 862 (D.C. Cir. 2000) (contrasting risk-based and technology-based regulation); Nat'l Mining Ass'n v. EPA, 59 F.3d 1351, 1353 (D.C. Cir. 1995) (noting that Congress replaced EPA's health-based regulation of hazardous air pollutants "with a . . . technology-based regulatory scheme"). Patricia McCubbin concedes that a "literal reading" of the CWA supports the idea that EPA should not consider environmental benefits in establishing BAT standards. *See* McCubbin, *supra* note 57, at 15. Nevertheless, she argues that the law does not mean what it says because considering cost without considering benefits would illogically lead to the conclusion that paying any cost for technological improvement is "unacceptable." *Id.* This argument is incorrect. It assumes that no costs should be imposed unless CBA shows that the benefits outweigh the costs. *Id.* But nothing in the statute or the legislative history supports that idea. *See id.* (citing legislative history rejecting CBA).

controls.[78] And some technology-based standards reflect evaluation of technological changes other than end-of-the-pipe controls.[79]

Feasibility analysis requires not only evaluation of technological possibilities, but also an assessment of the cost of employing promising pollution control techniques.[80] Regulators can then compare these cost estimates to the economic capabilities of regulated facilities to ensure that the promulgated pollution reduction requirements do not offend the feasibility constraint by causing widespread plant shutdowns.[81] Feasibility analysis, however, does not require assessment of environmental and health effects. It does not compare costs to the benefits of pollution control, but rather to the economic capabilities of facilities.[82]

Environmental law experts agree that this analytical task usually proves much more manageable than the assessment of environmental and health effects required for effects-based standard setting.[83] Yet, agencies frequently must cope with some uncertainty about how well technologies will work in new contexts and they often end up overestimating costs because of the difficulty of anticipating innovation.[84] But in several instances, EPA has been unable to make much progress with effects-based standards, but moved ahead when Congress or the courts authorized a technology-based approach.[85] For example, EPA only regulated eight hazardous air pollutants in the 1970s and '80s when the CAA required its hazardous air pollutant

[78] *See, e.g.*, 42 U.S.C.A §§7412(d)(2), 7429(a)(3) (West 2016).

[79] *See, e.g.*, 40 C.F.R. §63.1213 (2016); Nat'l Ass'n for Surface Finishing v. EPA, 795 F.3d 1, 4 (D.C. Cir. 2015) (describing EPA's revision of a technology-based standard to reflect demonstrated ability to phase out a toxic fume suppressant).

[80] *See, e.g.*, Whitman v. Am. Trucking Ass'ns, 531 U.S. 457, 467 (2001) (discussing technology-based statutory provisions requiring or authorizing the consideration of cost).

[81] *See, e.g.*, ConocoPhillips Co. v. EPA, 612 F.3d 822, 837 (5th Cir. 2010) (observing that EPA assessed the cost's likely impact on the regulated industry without comparing costs to benefits).

[82] Alaska Dep't of Envtl. Conservation v. EPA, 540 U.S. 461, 498 (2004) (rejecting claim that a pollution limit was infeasible when the regulated company failed to provide "financial data" showing the cost's impact on the "operation and competitiveness" of the regulated mine) (internal quotations omitted).

[83] *See* Angelo, *supra* note 67, at 129 (stating that technology-based standards have "worked best"); Adam Babich, *supra* note 19; McGarity, *supra* note 15; Shapiro & McGarity, *supra* note 19; Wagner, *supra* note 19, at 85.

[84] *See* Thomas O. McGarity & Ruth Ruttenberg, *Counting the Cost of Health, Safety, and Environmental Regulation*, 80 TEX. L. REV. 1997, 1998, 2048–49 (2002) (finding that ex ante cost estimates have usually been higher than actual costs incurred and attributing this, in part, to unanticipated innovation); *see, e.g.*, Nat'l Lime Ass'n v. EPA, 627 F.2d 416, 431–33 (D.C. Cir. 1980) (putting a burden on EPA to justify a conclusion that other plants in an industry can meet standards already obtained by some plants).

[85] *See, e.g.*, EPA v. Cal. *ex rel.* State Water Res. Control Bd., 426 U.S. 200, 202–03 (1976) (pointing out that Congress adopted technology-based standards to cure problems in implementing and enforcing effects-based standards for water pollution).

standards to protect public health.[86] Congress, fed up, amended the statute in 1990 to require a round of technology-based rulemaking before the agency resumed setting effects-based standards (if needed).[87] EPA established an array of technology-based standards regulating almost 200 pollutants.[88] Technology-based standards have proven less analytically burdensome than effects-based standards.[89]

3. *Normative Underpinning*

The feasibility principle takes cost into account, but focuses on the distribution of costs, seeking to avoid widespread unemployment as it otherwise maximizes environmental and health protection.[90] It seeks to avoid environmental and health problems that can cause devastating losses to some individuals without causing significant unemployment, which may constitute a similarly important disruption of affected workers' lives.[91] The feasibility principle gives health and environmental protection a high priority but reflects reluctance to cause perhaps equally serious hardships by causing widespread plant shutdowns.

C. *Optimal Pollution: Cost-Benefit Based Standards*

Cost-benefit balancing plays an increasing role in environmental law. The standard justification for such balancing involves a search for optimal pollution levels—defined as a level of pollution reduction that balances costs and benefits at the margin.

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[86] *See* Natural Resources Defense Council v. EPA, 529 F.3d 1077, 1079 (D.C. Cir. 2008).

[87] *See id*. (stating that Congress sought to hasten the process of standard setting by listing pollutants itself and then requiring technology-based regulation of them).

[88] *See id.* (noting that the 1990 CAA Amendments listed 191 substances for regulation); EPA, NATIONAL AIR TOXICS PROGRAM: THE SECOND INTEGRATED AIR TOXICS REPORT TO CONGRESS, at xiii (2014) (stating that EPA has issued 97 technology-based standards regulating 174 major categories of major sources of hazardous air pollutants).

[89] The CWA has a similar history. *See* Howard Latin, *Ideal Versus Real Regulatory Efficiency: Implementation of Uniform Standards and "Fine-Tuning" Regulatory Reforms*, 37 STAN. L. REV. 1267, 1307–1308 (1985) (discussing the failure of health-based standards for toxic water pollutants and the substitution of technology-based standards).

[90] *See* Driesen, *supra* note 19, at 34–35 (characterizing the feasibility principle as focusing on the distribution of costs to determine significance).

[91] *See id.* at 37 (pointing out that costs forcing plant closures "can have a devastating impact on workers' lives").

1. Examples

The environmental statutes do not require optimal pollution levels.[92] Yet, cost-benefit balancing has entered environmental law, primarily through court decisions and executive orders seeking to avoid overly burdensome pollution reduction requirements.

The courts have required cost-benefit balancing for standard setting under the Toxic Substances Control Act (TSCA)[93] and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA),[94] both of which demand protection from "unreasonable risk."[95] The most recent executive order, like its predecessors, also requires CBA "to the extent permitted by law" and authorizes White House oversight of this requirement through the Office of Management and Budget's Office of Information and Regulatory Affairs (OIRA).[96] Finally, in 1996 Congress amended the Safe Drinking Water Act (SDWA) to include CBA.[97]

Despite CBA's role in court decisions, executive orders, and the SDWA, examples of standards set through cost-benefit balancing prove hard to come by.[98] The decision interpreting TSCA to demand cost-benefit balancing led to a halt of final rules under TSCA's main standard setting provision, probably because the analytical burdens imposed made standard setting impracticable.[99] Congress recognized this problem and updated TSCA in 2016 to require health protective standards, while paradoxically continuing to require CBA.[100]

[92] *See* Indus. Union Dep't, AFL-CIO v. Am. Petroleum Inst., 448 U.S. 607, 710 n.27 (1980) (Marshall, J., dissenting) (discussing statutes requiring a "reasonable relation between costs and benefits" but not mentioning any requirement for optimal emission reductions).

[93] Corrosion Proof Fittings v. EPA, 947 F.2d 1201, 1217 (5th Cir. 1991) (requiring EPA to evaluate each regulatory option's costs and benefits).

[94] Save Our Ecosystems v. Clark, 747 F.2d 1240, 1248 (9th Cir. 1984) (describing FIFRA as a cost-benefit statute); Envtl. Def. Fund, Inc. v. EPA, 548 F.2d 998, 1005 (D.C. Cir. 1976) (approving EPA's decision to allow some uses of heptachlor and chlordane based on CBA); *cf.* Angelo, *supra* note 67, at 162 (noting that EPA has interpreted FIFRA to require cost-benefit balancing even though FIFRA does not "mandate . . . a strict cost/benefit analysis").

[95] *See* 15 U.S.C. § 2605(a) (2006); 7 U.S.C.A. §§ 136a(c)(5)(C)–(D); 136d(b) (West 2016).

[96] Exec. Order No. 13,563 §1(b), 76 Fed. Reg. 3821, 3821 (Jan. 18, 2011).

[97] *See* 42 U.S.C.A. §300g-1(b)(3)(C) (West 2016).

[98] *Cf.* National Pollutant Discharge Elimination System, 69 Fed. Reg. 41,576, 41,603 (July 9, 2004) (codified at 40 C.F.R pts. 9, 122–25) (applying a cost-benefit test to water intake regulations under the CWA).

[99] *See* Angelo, *supra* note 67, at 132 n.100 (finding that FIFRA stands virtually alone in employing a cost/benefit approach because the Fifth Circuit's TSCA decision imposing CBA rendered TSCA "impotent"); Sinden, *supra* note 6, at 130 n.128 (noting that "TSCA has come to a grinding halt" in the wake of the 5th Circuit decision overturning EPA's asbestos ban based on CBA).

[100] *See* 15 U.S.C.A. § 2605(a), (b)(4), (c)(2)(A)(iv)(II) (West 2016).

The executive orders only permit CBA "to the extent permitted by law" and the major pollution control statutes rely heavily on technology-based and effects-based goal setting.[101] As a result, CBA under the executive orders usually provides an input into debates between regulatory agencies and OIRA about what standards the agencies should promulgate, but the agencies generally do not justify their standards through cost-benefit balancing.[102] The SDWA demands CBA and has not thoroughly paralyzed rulemaking, but it only permits CBA in very limited situations and does not require cost-benefit balancing.[103]

2. Analytical Features

CBA requires a broad assessment of a proposed standard's consequences, which combines all of the analytical difficulties of effects-based standard setting with those of technology-based standard setting and then adds another step, that of monetization.[104] As a result, CBA creates an extremely difficult analytical burden.[105]

In order to identify the benefits of pollution control decisions, the analyst conducting CBA must associate particular pollution reductions with specific health and environmental consequences. Although administrative agencies sometimes base effects-based standards on *qualitative* risk assessment, the need to compare costs with benefits makes *quantitative* risk assessment essential.[106] The problem of uncertainty making reasonably precise quantitative prediction impossible for effects-standard setting arises in the cost-benefit context as well.[107]

CBA also requires an estimate of the pollution costs that polluters will incur in order to achieve a particular level of reduction. This control cost estimate almost

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[101] Exec. Order No. 12,866 § 1(b), 58 Fed. Reg. 51,735, 51,735 (Sept. 30, 1993) (requiring application of cost-benefit principles "to the extent permitted by law").

[102] *Cf.* Entergy Corp. v. Riverkeeper, Inc., 556 U.S. 208, 226 (2009) (upholding one use of CBA under the CWA).

[103] *See* City of Portland, v. EPA, 507 F.3d 706, 711 (D.C. Cir. 2007) (noting CBA cannot be used to establish a less stringent treatment technique for Cryptosporidium than the most stringent feasible); Sinden, *supra* note 6, at 40–41 (describing the SDWA as authorizing, but not requiring, departures from the feasibility principle based on CBA).

[104] *See* ACKERMAN & HEINZERLING, *supra* note 8, at 35–40 (explaining and critiquing the role of monetization in CBA); David M. Driesen, *Getting Our Priorities Straight: One Strand of the Regulatory Reform Debate,* 31 ENVTL. L. REP. 10003, 10019 n.204 (explaining why CBA is more analytically difficult than feasibility analysis).

[105] *See* THOMAS O. MCGARITY, REINVENTING RATIONALITY: THE ROLE OF REGULATORY ANALYSIS IN THE FEDERAL BUREAUCRACY 134 (1991) (discussing information gaps respecting costs and benefits).

[106] *See* Applegate, *supra* note 8, at 281–82 (describing the move from qualitative and quantitative risk assessment as facilitating CBA to limit federal regulatory action).

[107] *See, e.g.*, ConocoPhillips Co. v. EPA, 612 F.3d 822, 837, 842 (5th Cir. 2010) (upholding EPA's decision not to employ CBA because it could not reliably estimate ecosystem benefits).

always requires the same form of analysis used in technology-based rulemaking.[108] In order to predict the costs of a particular required level of pollution control, the regulator must evaluate the technological changes needed to achieve that level of control. It can then estimate the cost of employing the needed technological changes.[109]

Finally, in order to compare costs and benefits, the analyst must translate quantitative estimates of pollution controls' benefits—saved lives, avoided illness, and reduced ecological destruction—into dollar terms. This monetization process has proven controversial, difficult, and sometimes impossible.[110] Scholars have thoroughly debated this point and a review of the details of this debate will not contribute much to the elucidation of a positive theory of environmental law as a whole.[111] The main point for positive theory is simply that CBA creates analytical burdens surpassing those of combining the burdens associated with effects-based standards with the burdens encountered in establishing technology-based standards.

3. *Normative Underpinning*

Although the core normative theory that one might imagine underpins cost-benefit based standard setting appears clear enough, specifying the positive theory underlying its place in environmental law proves difficult. Most scholars associate CBA with allocative efficiency—the idea that policy makers should require an

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[108] *Cf.* Thomas O. McGarity, *The Cost of Greenhouse Gas Emission Reductions, in* ECONOMIC THOUGHT, *supra* note 20, at 213, 217–19 (pointing out that some economy-wide cost estimates for greenhouse gas reduction use "top-down" approaches that base prediction on past macroeconomic behavior rather than technological capability).

[109] *See* McGarity & Ruttenberg, *supra* note 84, at 2003 (discussing EPA guidance for CBA's reliance on studies of pollution control costs in "representative factories").

[110] *See* Jonathan S. Masur & Eric A. Posner, *Unquantified Benefits and the Problem of Regulation Under Uncertainty*, 102 CORNELL L. REV. 87, 100–01 (2016) (showing that between 2010 and 2013 government agencies fully quantified the costs and benefits of only two rules and could not quantify any benefits in 36 rules); *See*, *e.g.*, Ackerman & Heinzerling, *supra* note 8 (describing the difficulty in monetizing ecological effects); Clive L. Spash & Alex Y. Lo, *Australia's Carbon Tax: A Sheep in Wolf's Clothing?*, 23 ECON. & LAB. REL. REV. 67, 67–69 (2016) (characterizing calculation of climate disruption's "monetary costs and benefits" as "impossible").

[111] *See, e.g.*, ELIZABETH ANDERSON, VALUE IN ETHICS AND ECONOMICS 55–59 (1993); MARK SAGOFF, THE ECONOMY OF THE EARTH: PHILOSOPHY, LAW, AND THE ENVIRONMENT 1–7 (1988); Lisa Heinzerling, *Discounting Our Future,* 34 LAND & WATER L. REV. 39, 40–41 (1999); Lisa Heinzerling, *Quality Control: A Reply to Professor Sunstein,* 102 CAL. L. REV. 1457, 1465–67 (2014) (criticizing an effort to quantify the value of rape); John M. Heyde, *Is Contingent Valuation Worth the Trouble,* 62 U. CHI. L. REV. 331 (1995); Douglas Kysar, *Discounting . . . on Stilts,* 74 U. CHI. L. REV. 119, 119–20 (2007); Richard L. Revesz, *Environmental Law, Cost-Benefit Analysis, and the Discounting of Human Life,* 99 COLUM. L. REV. 941, 955–86 (1999); Cass R. Sunstein, *Incommensurability and Valuation in Law,* 92 MICH. L. REV. 779, 841–42 (1994).

efficient level of pollution control defined as a level that generates equal costs and benefits at the margin.[112] The idea of allocative efficiency treats a pollution control decision, not as protection from serious harm, but as the purchase of an environmental benefit. And it reflects a concern that we not pay too much for this benefit.

Environmental law, however, does not endorse the pursuit of allocative efficiency as a goal, as the cases and executive orders creating obligations to carry out CBA do not set up a cost-benefit equilibrium as an explicit goal for standards.[113] The current executive order on CBA, for example, demands "to the extent permitted by law" that regulatory benefits "justify" regulatory costs.[114] The executive order also references the allocative efficiency test, admonishing agencies to choose "regulatory approaches" that "maximize net benefits."[115] The reference to regulatory approaches, however, suggests that this efficiency criterion applies not to goal setting, but to choices about the means of environmental protection. Furthermore, this subsection of the executive order defines costs and benefits to include "distributive impacts . . . and equity," thereby clearly rejecting establishment of a pure allocative efficiency test.[116]

The positive law of CBA suggests a demand that the costs of environmental actions should not greatly exceed the benefits. The Supreme Court has endorsed this test, and it comports with the executive order's main test—the benefits-justify-costs test.[117] It also aligns with a view of congressional intent with respect to FIFRA that

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[112] *See, e.g.*, Angelo, *supra* note 67, at 121 (characterizing CBA as "elevat[ing] economic efficiency above all other considerations"); Sinden, *supra* note 6, at 104 (associating CBA with identifying the "point at which marginal costs just equal marginal benefits").

[113] *See, e.g.*, Entergy Corp. v. Riverkeeper, 556 U.S. 208, 217, 224 (2009) (finding that the EPA did not seek equilibrium but employed a "significantly greater than" standard in analyzing costs and benefits in a rulemaking predicated on CBA); EPA v. Nat'l Crushed Stone Ass'n, 449 U.S. 64, 71 n.10 (1980) (citing CWA legislative history suggesting that cost-benefit analysis may identify situations where benefits would be "wholly out of proportion to the costs"); National Ass'n of Homebuilders v. EPA, 682 F.3d 1032, 1039 (D.C. Cir. 2012) (holding that EPA does not have a duty under TSCA to show that its rule's benefits "outweigh" its costs even though it conducted a CBA); Weyerhaeuser Co. v. Costle, 590 F.2d 1011, 1041 n.41 (D.C. Cir. 1978) (holding that Congress rejected the concept of optimal pollution control even under a statutory provision requiring a comparison between costs and effluent reduction benefits).

[114] Exec. Order No. 13,563 §1(b)(1), 76 Fed. Reg. 3821, 3821 (January 18, 2011).

[115] *Id.* §1(b)(3).

[116] *Id.*

[117] *See Entergy*, 556 U.S. at 224–25 (approving a normative criterion precluding regulation generating compliance costs "significantly greater" than benefits); *see also* Ass'n of Pac. Fisheries v. EPA, 615 F.2d 794, 805 (9th Cir. 1980) (promulgating the best practicable technology standards under the Clean Water Act EPA may only rely on a cost-benefit comparison to relax a standard when "costs are wholly disproportionate to effluent reduction" benefits); Indus. Union Dep't, AFL-CIO v. Am. Petroleum Inst., 448 U.S. 607,

reads its cost-benefit language as only tolerating reasonably adverse effects when "overriding benefits" exist—such as controlling pests that no safer pesticide could possibly control.[118]

This gross disproportion principle differs from the effects-based principle, as it would allow serious harms to the environment or public health if wholly preventing such harms proved disproportionately costly. It also differs from the feasibility principle because it would permit serious environmental harms even when preventing them would not lead to widespread plant shutdowns. Notice that this test, however, does not function as a stand-alone test. It only constitutes a restraint on stringency and never demands that regulators address environmental hazards at all. By contrast, the other tests, and the allocative efficiency principle not found in environmental law, would demand some sort of minimum stringency.[119] As a result, this gross disproportion principle does not govern goal setting on its own, but sets up a restraint on other more complete normative criteria.

Some analysts may object to this identification of the gross disproportion principle as the standard found in the positive law on CBA on the ground that OIRA in practice imposes a much stricter test. It may well insist that costs not exceed quantified benefits even in the face of important unquantified benefits or even demand a reverse showing, that benefits far outweigh costs.[120] But this Article does

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667 (1980) (Powell, J., concurring) (reading the Occupational Safety and Health Act (OSHA) as requiring a "reasonable relationship" between a standard's costs and its benefits); *cf.* Am. Textile Mfrs. Inst. v. Donovan, 452 U.S. 490, 506–11 (1981) (rejecting argument that OSHA requires a reasonable relationship between costs and benefits); CASS R. SUNSTEIN, THE COST-BENEFIT STATE: THE FUTURE OF REGULATORY PROTECTION 21, 120 (2002) (identifying the benefits-justify-costs test with costs not exceeding benefits in most cases but commending a judicial test based on cost not being grossly disproportionate to benefits).

[118] *See* Angelo, *supra* note 67, at 176–77 (explaining the support for this reading in FIFRA's legislative history); *see, e.g.*, Envtl. Def. Fund v. EPA, 548 F.2d 998, 1005–12 (D.C. Cir. 1976) (upholding a decision to suspend some applications of a pesticide and not others based primarily on the availability of safer substitutes for some applications); *In re* Protexall Products, Inc., 2 E.A.D. 854 (E.P.A. July 26, 1989) (approving cancellation of a pesticide when applicant could not prove that the pesticide's benefits justified the health risks because it could not show any benefit not provided by safer pesticides); *In re* Chapman Chem. Co., 1 E.A.D. 199 (E.P.A. February 17, 1976) (finding a pesticide's risks outweigh its benefits in applications where safer pesticides performed the same function, but that its benefits outweigh the risks where it performed functions not performed by safer pesticides).

[119] *See* Livermore & Revesz, *supra* note 15, at 1234–46 (showing that optimal pollution levels for many NAAQS are often more stringent than the level EPA identifies as health protective).

[120] *See* Daniel H. Cole, *Law, Politics, and Cost-Benefit Analysis,* 64 ALA. L. REV. 55, 74–81 (2012) (concluding that a CBA showing only modest net benefits from a strengthened ozone standard likely contributed to OIRA opposition and Obama administration abandonment of the proposed standard); David M. Driesen, *Is Cost-Benefit Analysis Neutral?*, 77 U. COLO. L. REV. 335, 364–71 (2006) (showing that OIRA almost never

not aim to capture every nuance or even the prevailing pattern of agency practice. It seeks to identify the aspirations found in positive law—the value choices top-level policy makers, like legislatures, courts, and Presidents, have embedded in the law that they create.

Indeed, by way of a caveat, if we lower our gaze from the law's positive ideals to actual administrative practice we will paint a very different and much more muddled picture than this Article presents. For example, one might object to this Article's articulation of the feasibility principle on the ground that agencies in practice use technology-based rulemaking to enact a political compromise based on some unarticulated judgment about what advances the ball but is not too costly. And one may object to the description of health-based standards on the ground that agencies do not seriously seek to fully protect public health and the environment, but rather to make incremental progress based on what they imagine would be sensible, considering a variety of technical and political variables.[121] Although a thorough description of what administrative entities actually do might be of interest for a variety of reasons, it does little to clarify the law's fundamental normative and analytical commitments because agency decisions often reflect a muddled response to a range of political, legal, and technical considerations.[122] The fundamental commitments found in statutes, court decisions, and executive orders provide the basis for a positive theory of law, which identifies its aspirations, even if the practice does not live up to any particular ideal. These commitments also provide an important basis for debating fundamental legal reforms and for critiquing agency practice.[123]

One might object to my exclusion of agency decisions as a source of positive law on CBA's goal on the ground that agency decision making does create law. The law agencies create, however, does not articulate goals; it establishes requirements that appear in the Code of Federal Regulations. The preambles that appear in a Federal Register notice could in theory announce some principles for application of

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advocates more stringent rules and seeks to weaken rules even when CBA does not show that they are too costly).

[121] *See, e.g.*, John S. Applegate & Steven M. Wesloh, *Short Changing Short-Term Risk, A Study of Superfund Remedy Selection,* 15 YALE J. ON REG. 269, 302 (1998) (finding that EPA ignores risks arising from use of remedial technology under CERLA, even though the statute specifically requires it to take them into account); Nat. Res. Def. Council, Inc. (NRDC) v. EPA, 824 F.2d 1146, 1163 (D.C. Cir. 1987) (finding that the EPA has substituted a feasibility finding for a finding of what level of emission protects public health under an effects-based provision).

[122] *See, e.g.*, McCubbin, *supra* note 57, at 23 (describing EPA's BAT setting in practice as "a value-laden political judgment to be made by EPA policymakers").

[123] *See, e.g.*, *NRDC,* 824 F.2d at 1163 (reversing EPA's decision to base regulation of a hazardous air pollutant on feasibility when the statute requires it to protect public health).

CBA. But Federal Register notices only do so rarely if at all.[124] Moreover, preambles in the federal register do not themselves establish law binding any private party or agency, even though courts use them to help evaluate the legality of an agency's decisions and to interpret the rules themselves.[125]

The law does not articulate the criterion underlying CBA as clearly as the criteria underlying effects-based and technology-based standard setting. But the principle of avoiding disproportionate costs appears congruent with the little law we have on this.

D. Insights and Research Questions Respecting Goals

This part cashes out the promise that considering environmental law's goals together yields some fruit. It first shows how these criteria illuminate entire statutes and even the corpus of environmental law as a whole. It then reviews some of the insights the juxtaposition of competing goals reveals and identifies research questions, including normative questions that arise from an understanding of these goals' role in environmental law.

1. Goals and Environmental Law's Structure

Although environmental statutes combine goal-setting provisions in various ways, a structural analysis reveals some patterns that suggest more coherence than seems evident from just listing three competing types of goals. First of all, the major media-specific laws—the CAA, CWA, and RCRA—embrace an overarching goal of protecting the environment and public health, not a goal of achieving some sort of balance between environmental protection and other values. Yet, many of the statutory provisions governing regulation of particular groups of polluting facilities embrace the feasibility principle. Provisions maximizing feasible reductions usually serve as a step toward meeting the goal of fully protecting people from serious health and environmental effects.[126] Thus, for example, the CWA directs EPA to impose an array of technology-based standards on major pollution sources, culminating in

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[124] *Cf.* National Pollutant Discharge Elimination System*,* 69 Fed. Reg. 41,576, 41,594 (July 9, 2004) (providing for site-specific technological adjustments when the otherwise required technology generates costs "significantly greater than the benefits").

[125] *Compare* Wyeth v. Levin, 555 U.S. 555, 623 (2009) (holding that an agency regulation, but not its statements in the preamble, have the force of law), *with* Se. Alaska Conservation Council v. U.S. Army Corps of Eng'rs, 486 F.3d 638, 649 (9th Cir. 2007) (using contemporaneous explanations of regulations to interpret them), *rev'd and remanded on other grounds sub nom*. Coeur Alaska, Inc. v. Se. Alaska Conservation Council, 557 U.S. 261 (2009), *and* New York v. EPA, 413 F.3d 3, 24 (D.C. Cir. 2005) (using preamble statements to inform judgment about whether EPA's rule was a reasonable interpretation of the Clean Air Act).

[126] *Cf.* McGarity, *supra* note 21, at 545 (describing Congress as demanding that EPA achieve different goals simultaneously).

the BAT provision that conforms to the feasibility principle.[127] But it further contemplates state programs to generate additional reductions if needed to meet state water quality standards. Similarly, the CAA requires federal technology-based standards for new stationary sources and vehicles along with state technology-based standards for major existing stationary sources of the pollutants governed by the NAAQS.[128] But states must supplement these standards with additional rules if needed to meet the effects-based NAAQS.[129]

The Courts gave cost-benefit considerations primacy in statutes, namely FIFRA and TSCA, that contemplate bans of substances that we manufacture in order to provide benefits to consumers or producers.[130] These statutes do not only aim to simply control unsought pollution byproducts of productive processes, as the media-specific statutes with overarching environmental effects-based goals do.[131] Instead, they authorize outlawing some productive processes outright.[132] Thus, bringing together core understandings of goal setting in environmental law with a basic inquiry into how the law combines these goals reveals a lot about environmental law's normative structure.

2. *Insights and Research Questions with Respect to Normative Values*

The pattern described above gives rise to an important question: What is the best possible normative justification for this pattern? Without trying to answer this question (which merits an entire article), it will help to review the state of existing scholarship on the normative value of various environmental goals, which provides the building blocks for addressing this question. This analysis suggests that although we have some theory explaining the normative commitments in our environmental statutes, we have some big gaps on very fundamental questions about the goals creating the normative structure identified above. These gaps may reflect the lack of a reasonably comprehensive positive theory, which may, in turn, stem from a tendency within the field to focus on technocratic questions about analytical technique and contemporary issues arising under individual statutes.

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[127] *See, e.g.,* Ass'n of Pac. Fisheries v. EPA, 615 F.2d 794, 801 (9th Cir. 1980) (describing the sequence of best practicable control technology to BAT regulation for fish processing plants).

[128] *See* 42 U.S.C.A §§ 7411, 7502(c)(1), 7521 (West 2016).

[129] 42 U.S.C.A § 7410 (West 2016).

[130] *See* McGarity, *supra* note 21, at 537 (describing TSCA and FIFRA as "licensing statutes" because they authorize bans of chemicals).

[131] *See* Angelo, *supra* note 67, at 183 (suggesting that a technology-based approach may not work when the intended use of a product causes the risk prompting regulatory consideration).

[132] *See, e.g.,* 15 U.S.C.A § 2605(2)(A) (West 2016).

(a) Protecting Public Health and the Environment

We have very little work attempting to justify giving primacy to health or environmental considerations through effects-based goals. Indeed, some scholars find these goals either undesirable or unrealistic.[133] Some CBA advocates, however, have suggested that a justification may exist for treating protection of endangered species or the avoidance of human premature death as special cases not amenable to standard cost-benefit balancing.[134] Those suggestions invite the question of what exactly justifies those conclusions. One might also ask whether the rationales for accepting a rights-based approach to protecting some limited environmental impacts might properly extend to other impacts—such as serious illness or destruction of unique ecosystems—or even to environmental protection as a whole.

Amy Sinden has articulated a political economy justification for effects-based standards. In her article, *In Defense of Absolutes: Combating the Politics of Power in Environmental Law*,[135] she argues that the power of industry to influence standard setting justifies cost-blind effects-based environmental law.[136] In her account, this power sufficiently tempers environmental law even when statutes do not authorize consideration of cost.[137] Keeping cost out of the formal equation serves to put a thumb on the balance beam in favor of environmental protection, which will likely produce a more appropriate balance than would be obtained if cost were explicitly considered and then industry applied its lobbying muscle to exaggerate costs and use arguments about cost to inappropriately weaken standards.[138]

A related political economy justification for effects-based standards involves the role of technology-forcing in environmental law. In explaining the absolutism of the CAA's overall goals, the Supreme Court famously stated that Congress intended

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[133] *See, e.g.*, John P. Dwyer, *The Pathology of Symbolic Legislation*, 17 ECOLOGY L.Q. 233, 233–34 (1990) (characterizing mandates to protect public health as impractical and unrealistic symbolic legislation).

[134] *See* Cass R. Sunstein, *Cost-Benefit Default Principles*, 99 MICH. L. REV. 1651, 1697 (2001) (suggesting that the Endangered Species Act may be based on a "theory of rights," which may make CBA inappropriate); *cf.* Matthew D. Adler, *Risk, Death, and Time: A Comment on Judge Williams' Defense of Cost-Benefit Analysis*, 53 ADMIN. L. REV. 271, 272 (2001) (noting that "death is different" and therefore poses a challenge for CBA), Mark Geistfeld, *Reconciling Cost-Benefit Analysis with the Principle that Safety Matters More than Money*, 76 N.Y.U. L. REV. 114, 116–21 (2001) (acknowledging a principle that treats "safety as more important than money" but arguing that it can be reconciled with CBA if safety considerations are given added weight).

[135] 90 IOWA L. REV. 1405 (2005).

[136] *See id.* at 1411–12 (justifying the ESA and NAAQS as correctives to power imbalances).

[137] *See id.* at 1411 (portraying the prohibition on considering costs in the ESA as leading to politically negotiated outcomes that are "less protective of species than a literal reading of the ESA's standards might dictate").

[138] *See id.* (claiming that the ESA places "a thumb on the scale in favor of the weaker party" leading to outcomes "consistent with widely shared public values").

to get industry to do what *appears* infeasible.[139] This statement could be read as combining technological optimism with a wariness of what industry would do to a statute if cost and technical feasibility were embedded in the statutes' overall goals. Thus, one might justify effects-based standards' cost blindness pragmatically as an attempt to avoid undue industry influence and to realize improvements based on faith that industry will prove sufficiently innovative and capable to meet ambitious technology-forcing goals without serious negative economic consequences for society. Courts often cite this apparent infeasibility statement as evidence that the CAA is a technology-forcing statute.[140] In any case, technology forcing provides a potential political economy justification for effects-based standards.

Technology-forcing's role in potentially justifying effects-based standards raises a conceptual question about where technology forcing fits in a framework that contrasts technology-based standards with effects-based standards. We should consider a technology-forcing goal as a type of technology-based goal. A number of statutory provisions authorize EPA to develop standards based on the capabilities of technologies not yet fully developed.[141] These provisions, however, require EPA to evaluate future technologies and do not authorize it to demand levels of pollution that are impossible to achieve with any imaginable technology, even if such levels might be needed to protect public health.[142] They do not contemplate consideration of what levels of pollution we might tolerate without significant negative effects. On the other hand, the possibility of technological innovation in response to health-based standards, as suggested already, can provide a pragmatic justification for ignoring costs in order to protect public health. That is, we might feel more comfortable in setting standards that protect public health—standards promulgated without evaluation of technologies—because we expect that industry can innovate to continue to produce what we would like to have even if we demand full health

[139] Union Elec. Co. v. EPA, 427 U.S. 246, 257 (1976) (describing the requirements to meet the NAAQS as "technology-forcing" because "they are designed to force regulated sources to develop pollution control devices that might at the time appear to be economically or technologically infeasible").

[140] *See, e.g.*, Nat'l Steel Corp., Great Lakes Steel Div. v. Gorsuch, 700 F.2d 314, 325 (6th Cir. 1983) (citing this statement to justify the conclusion that CAA requirements have a "technology-forcing character").

[141] *See, e.g.*, Bluewater Network v. EPA, 370 F.3d 1, 20 (D.C. Cir. 2004) (characterizing CAA section 213(a)(3) as a "technology-forcing" provision).

[142] This statement assumes a somewhat narrow view of technology. If we view shutting down plants as a technology, then a zero level is always achievable. *See Union Elec.*, 427 U.S. at 265 n.14 (noting that in a literal sense all pollution control plans are feasible, since plants can always comply by shutting down). But that is not what technology-based statutory provisions envision. *See, e.g.*, Nat'l Petrochemical & Refiners Ass'n v. EPA, 287 F.3d 1130, 1136 (D.C. Cir. 2002) (framing the issue in reviewing a technology-forcing regulation in terms of whether EPA had a reasonable basis for "predicting future success" in development of a technology); Nat. Res. Def. Council v. EPA, 655 F.2d 318, 327–328 (D.C. Cir. 1981) (basing conclusions about technological feasibility on predictions about the development of a known pollution control technology that could be employed in vehicles).

and environmental protection.[143] Thus, technological innovation as a possibility helps justify the concept of effects-based standards, but an estimate of an identified technology's potential in a given case justifies particular pollution control decisions in the context of some technology-based standard setting exercises.[144]

The arguments that cost-blindness' value in overcoming industry resistance and taking advantage of unforeseeable technological advancements might provide pragmatic justifications for effects-based standards, but they duck a more fundamental normative question: Does a philosophical normative justification implicit in our law for giving health and environmental considerations primacy exist?

The structural insights offered, however, suggest that the primacy question might be more narrowly framed. Is there some justification for effects-based standards for media-specific statutes that does not fully extend to statutes that may prohibit the use of particular toxic chemicals altogether?

(b) Maximizing Feasible Reductions

Most scholars endorse technology-based standards as pragmatic because of the relative simplicity of the analysis required to set the standards and because they do take costs into account in a workable way.[145] My previous work, however, articulates a normative justification for the feasibility principle—defending its approach to the distribution of cost as a reasonable way of addressing the centrality of health and employment to people's lives, while rejecting the notion that more widely distributed cost typically matters enough to merit significant attention.[146] This work defends the centrality of health and employment by employing Martha Nussbaum and Armataya Sen's capabilities' approach, which focuses on the importance of maintaining people's full capabilities to engage fruitfully in life.[147] It responds to the equation of cost with wealth reduction even when plants do not close by pointing to the emerging literature on happiness to raise doubts about wealth's relationship to human flourishing.[148] These justifications for the feasibility principle merit more debate and might be usefully considered in light of technology-based

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[143] *See generally Union Elec.*, 427 U.S. at 265 (affirming that states may attain the NAAQS ahead of schedule if they are willing to force technology to bring this result about).

[144] *Cf.* Livermore & Revesz, *supra* note 15, at 1257 (noting that technology-forcing cannot justify a particular health-based standard because EPA may not consider technological feasibility in making health-based decisions).

[145] *See, e.g.*, Babich, *supra* note 19, at 170–183; Shapiro & McGarity, *supra* note 19, at 739–744; Wagner, *supra* note 19, at 88–107.

[146] *See* Driesen, *supra* note 19, at 34–40.

[147] *See* David M. Driesen, *Two Cheers for Feasible Regulation: A Modest Response to Masur and Posner,* 35 HARV. ENVTL. L. REV. 313, 321–326 (2011); *cf.* Masur & Posner, *supra* note 19 (criticizing feasibility analysis).

[148] *See* Driesen, *supra* note 147, at 325 (discussing the lack of correlation between increased wealth and happiness).

regulation's role as a step toward full protection of public health and the environment in many statutes.

(c) Restraining Disproportionately Costly Regulation

Surprisingly, nobody has articulated a normative justification for the principle that costs should not grossly exceed benefits. A normative theory that adequately addressed this question in light of a positive theory of environmental law's means and ends more generally would have to address the question of whether widely dispersed costs should matter when the "benefits" involve avoiding such drastic concentrated losses as death or serious illness. Thus, the positive theory identifies new questions and arguments about cost-benefit balancing.

This lacuna in the scholarship appears surprising because a rich literature seeks to justify CBA's role in environmental law. This literature, however, focuses overwhelmingly on claims that bypass fundamental normative questions, as Kysar has pointed out.[149] Thus, proponents have argued that CBA enhances rationality,[150] facilitates political control of rulemaking,[151] and serves democracy by counteracting hysterical fears.[152] I do not mean to dismiss the importance of these arguments by highlighting their failure to address the fundamental normative question of why the particular balance sought in environmental law constitutes a good goal.

Matthew Adler and Eric Posner, however, have sought to establish a normative foundation for CBA by developing a concept of overall well-being.[153] The concept of overall well-being has a lot in common with allocative efficiency, but it rejects a complete reliance on consumer preferences as revealed in purchase decisions as the basis for assessing costs and benefits.[154] Traditionally, economic theory has treated what people are willing to pay for goods and services (or willing to accept to part

[149] *See* KYSAR, *supra* note 9, at x (arguing that "dominant ways of thinking about environmental law . . . aspire to objectivity" and thereby mask fundamental questions about our responsibilities).

[150] *See* RICHARD L. REVESZ & MICHAEL A. LIVERMORE, RETAKING RATIONALITY: HOW COST-BENEFIT ANALYSIS CAN BETTER PROTECT THE ENVIRONMENT AND OUR HEALTH 12 (2008) (characterizing CBA as "a requirement of basic rationality").

[151] *See* Eric A. Posner, *Controlling Agencies with Cost-Benefit Analysis: A Positive Political Theory Perspective*, 68 U. CHI. L. REV. 1137, 1140 (2001) (positing that CBA facilitates political control by the President and Congress under some common conditions).

[152] *See* Timur Kuran & Cass R. Sunstein, *Availability Cascades and Risk Regulation,* 51 STAN. L. REV. 683, 685–91 (1999) (offering CBA as an antidote to "mass delusions").

[153] *See* MATTHEW D. ADLER & ERIC A. POSNER, NEW FOUNDATIONS FOR COST-BENEFIT ANALYSIS 6–8 (2006); *see also* MATTHEW D. ADLER, WELL-BEING AND FAIR DISTRIBUTION: BEYOND COST-BENEFIT ANALYSIS 155–159 (2012) (further developing the overall well-being concept).

[154] *See* Matthew D. Adler & Eric A. Posner, *Rethinking Cost-Benefit Analysis*, 109 YALE L.J. 165, 177 (1999) (rejecting reliance on "unrestricted preferences" as "implausible and unnecessary").

with goods and services they possess) as a measurement of goods and services' value.[155] Environmental CBA seeks, through various techniques, to apply this concept to the public goods that environmental protection provides—such as protection of health and ecosystems.[156] Adler and Posner, however, recognize that sometimes people do not know what is good for them.[157] It would be odd, for example, to treat the high price paid for heroin as a measure of its great positive value. So, they base overall well-being on a concept of measuring people's "desires" in ways that "launder" preferences, i.e., to clean out perverse preferences.[158] This brief summary cannot do full justice to their work, but it suffices to ground further discussion of how a positive theory might inform future work on cost-benefit balancing's normative foundations. Although intended as a normative theory, it offers a plausible positive theory as well, which might explain the actual normative basis for current law on cost-benefit balancing.[159]

Still, Adler and Posner's concept of overall well-being, whatever its value for normative theory, establishes such a general goal that its utility for positive theory—justifying a specific norm guiding CBA's use— becomes hard to see. To be a little more precise, their theory does not foreclose the possibility that overall well-being requires the preservation of human life at any cost.[160] Their theory is capacious enough to accept a health-based criterion for a pollutant killing people or to instead demand some sort of unspecified tradeoff between the benefit of preserving life and the cost of doing so.[161] In spite of this problem, future work might consider whether the concept of overall well-being, or some new variant of it, supports the criterion found in the law of CBA, the idea that costs should not greatly outweigh benefits. I suspect that Adler and Posner would say it does, but it is hard to see why that would always be true in light of Adler's recognition that preservation of life poses challenges for CBA, as many people will not be willing to accept a payment (at any price) to allow polluters to kill them.[162]

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[155] *See id.* at 220.

[156] *See* Sinden, *supra* note 6, at 105–107 (discussing various methods of valuing environmental benefits based on individual preferences).

[157] *See* Adler & Posner, *supra* note 154, at 203–04 (discussing ways in which a person's preferences may not advance well-being).

[158] *See id.* at 246 (claiming that CBA may have to be adjusted to reflect distorted preferences).

[159] *See* Matthew D. Adler, *Beyond Efficiency and Procedure: A Welfarist Theory of Regulation*, 28 FLA. ST. U. L. REV. 241, 327 (2000) (arguing that regulatory agencies generally *deviate* from the unrestricted preference-based view of welfare).

[160] *See* Adler, *supra* note 134, at 272 (explaining why the rational for CBA may break down for actions involving death).

[161] *See* Driesen, *supra* note 19, at 70–71 (explaining why the overall well-being does not rule out giving primacy to avoiding death and destruction of species).

[162] *See* David M. Driesen, *The Societal Cost of Environmental Regulation: Beyond Administrative Cost-Benefit Analysis,* 24 ECOLOGY L. Q. 545, 590 (1997) (noting that many people might not be willing to accept a payment to give up a right to be free from pollution

So, in spite of the reams of ink spilled over CBA, we still have work to do on providing a normative justification for a goal that costs should not greatly outweigh benefits. Part of the problem stems from the regulatory reform literature's tendency to focus on the analytical technique of CBA, rather than a specific cost-benefit criterion. Indeed, CBA scholars often fail to specify what criterion they have in mind or embrace several different criteria at once.[163] This makes normative debate difficult.

3. On the Relationship Between Norms and Analysis

The positive theory developed here has a structure that suggests a fundamental problem with focusing normative theory on an analytical technique. The theory developed here focuses normative explanation on statutory goals and the criteria governing standard setting—the goals of environmental law—not on the analytical technique employed to craft standards designed to achieve those goals. It treats the analytical techniques as an implication of the goal choice. Thus, for example, if one believes that ethics and morality require that public health and environmental protection have absolute priority, then one should not consider costs in crafting environmental standards, and therefore CBA becomes an inappropriate technique. Similarly, if one thinks that health and environmental benefits should have primacy except when the costs of that primacy have devastating effects on employment, then feasibility analysis, not CBA, makes sense. On the other hand, if one embraces the proposition that costs should not greatly outweigh benefits, even when the benefits accrue to public health or the environment, then some sort of comparison between costs and benefits becomes an essential technique.

This approach to the relationship between goals and analytical technique comports with common sense and central tenets of administrative law. Administrators must make a lot of decisions, and they should choose a form of analysis that fits the particular decision they have to make without wasting resources generating a lot of irrelevant analysis, while carefully considering all information made relevant by the statutory mandates they operate under. The statutory criteria found in environmental statutes represent elected representatives' decisions about the goals of environmental law. The legislature implements its normative values, in part, by specifying the factors agencies should consider in making decisions. For that reason, consideration of factors not included in germane statutory provisions, or neglect of factors included, constitutes arbitrary and capricious rulemaking.[164]

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threatening their health); *cf.* ADLER, *supra* note 134, at 272 (recognizing that the price a person might be willing to accept for her own death might be infinite).

[163] *See* Driesen, *supra* note 120, at 341–42, 387–94 (discussing CBA proponents' "indeterminate position" that says nothing about criteria and several criteria sometimes advocated).

[164] *See* Motor Vehicle Mfrs. Ass'n. Inc. v. State Farm Mutual Auto. Ins. Co., 463 U.S. 29, 43 (1983) (forbidding consideration of factors Congress had not intended the agency to consider); *cf.* Michigan v. EPA, 135 S. Ct. 2699, 2707 (2015) (holding that cost is a relevant

Agencies must confine their analysis to the factors made relevant in governing law to remain faithful to the goals elected officials have chosen when they delegated authority to make these sorts of decisions.[165]

Debates about analytical technique, however, remain important on pragmatic grounds. Daniel Farber, Robert Glicksman, and Sidney Shapiro have developed theories of eco-pragmatism, which link environmental law to the philosophical tradition of American pragmatism.[166] They tend to like technology-based regulation, partly because feasibility analysis proves much simpler than competing forms of analysis.[167] In evaluating this preference, however, it remains useful to consider norms and analytical technique separately. If one finds the norms underlying technology-based regulation attractive, then the advantage of relatively simple analytical technique seals the deal. But those, like Eric Posner and Jonathan Masur, who find the feasibility principle unattractive, may find the complexity of CBA worth putting up with in order to arrive at a better normative place (in their view).[168] My main point is that the tendency of us technocratic lawyers to focus on analytical technique may obscure normative questions. On the other hand, those most dedicated to particular norms still need to see that questions of analytical technique matter to how law functions in practice and should not too readily assume that law can cope with infinite analytical complexity.

4. On Precaution

Kysar's book, *Regulating from Nowhere*, focuses heavily on a defense of the precautionary principle, which Cass Sunstein and others have heavily criticized.[169] This Article will not join the debate about the precautionary principle's value. But it will prove useful to situate the precautionary principle in this discussion of

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factor that EPA must consider in deciding whether regulation of power plant mercury emissions is "necessary and appropriate").

[165] *Cf.* RICHARDSON, *supra* note 23, at 159–90 (constructing a model where an individual is free to refine her view of her own ends to resolve conflicts among them in particular cases).

[166] *See* DANIEL FARBER, ECO-PRAGMATISM: MAKING SENSIBLE ENVIRONMENTAL DECISIONS IN AN UNCERTAIN WORLD 10 (1999); SIDNEY A. SHAPIRO & ROBERT L. GLICKSMAN, RISK REGULATION AT RISK: RESTORING A PRAGMATIC APPROACH 49–53 (2003).

[167] *See* FARBER, *supra* note 166, at 9–14; SHAPIRO & GLICKSMAN, *supra* note 166, at 46–72.

[168] *See* Masur & Posner, *supra* note 19, at 699–712 (explaining in detail why they dislike the feasibility principle and suggesting that cost-benefit balancing is better).

[169] KYSAR, *supra* note 9, at 19 (characterizing the precautionary principle as "well suited to safeguarding life and the environmental under conditions of uncertainty and ignorance"); *see, e.g.*, CASS R. SUNSTEIN, WORST-CASE SCENARIOS 31 (2007); Cass R. Sunstein, *Beyond the Precautionary Principle,* 151 U. PA. L. REV. 1003, 1008 (2003).

environmental law's goals, as it constitutes an important piece of the fragmented positive theory puzzle.[170]

The precautionary principle rejects postponing cost effective action on significant environmental problems based on scientific uncertainty.[171] Its critics have castigated it for not usefully guiding standard setting decisions.[172] In other words, they fault it for not stating a specific goal. The theory developed here describes the principles that guide goal setting and imply a question about where the precautionary principle fits within this framework.

The primary use of the precautionary principle does not implicate goals. The courts and commentators have emphasized the precautionary principle's role as a trigger.[173] That is, before one can decide what sorts of standards to set for particular pollutants, one must decide which pollutants pose a sufficient danger to merit any regulatory attention at all. The precautionary principle helps guide this decision, permitting policy-makers to list pollutants for regulatory decisions before we have complete knowledge about their effects.[174] A prominent example comes from the Supreme Court's decision in *Massachusetts v. EPA*,[175] which required EPA to determine whether greenhouse gases endanger public health or the environment under a precautionary approach.[176] Once EPA did determine that greenhouse gases pose a serious risk, it had to regulate them, but did so primarily under statutory provisions that do not call for reconsidering the risks involved, but instead, demand rules mandating technologically feasible emission reductions.[177]

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[170] *See, e.g.*, KYSAR, *supra* note 9, at 12 (describing the precautionary principle as "one aspect of a much more elaborate regulatory process"); Christopher D. Stone, *Is There a Precautionary Principle?*, 31 ENVTL. L. REP. 10,790 (2001).

[171] *See* United Nations Conference on Environment and Development, *Rio Declaration on Environment and Development*, ¶ 15, U.N. Doc.A/CONF.151/26/Rev.1 (Vol. 1), Annex 1, Princ. 15 (August 22, 1992). Although this constitutes a leading and oft-reiterated statement of the precautionary principle, statements of the principle vary. *See* 20TH CENTURY PRECAUTION, *supra* note 20, at 6; James E. Hickey, Jr. & Vern R. Walker, *Refining the Precautionary Principle in International Environmental Law,* 14 VA. J. ENVTL. L. 423, 432–36 (1995) (collecting statements of the principle in international legal instruments).

[172] *See* SUNSTEIN, *supra* note 169, at 131; Todd J. Zywicki, *Baptists?: The Political Economy of Environmental Interest Groups,* 53 CASE W. RES. L. REV. 315, 333 (2002); Stone, *supra* note 170, at 10,799.

[173] *See, e.g.*, Ethyl Corp. v. EPA, 541 F.2d 1, 6–7 (D.C. Cir. 1976) (en banc) (defining the issue as whether EPA may regulate lead based on a finding of a significant risk of harm).

[174] *See id.* at 9, 13 (characterizing the statutory endangerment trigger as precautionary and explaining the lack of certainty about leaded gasoline's effects).

[175] 549 U.S. 497 (2007).

[176] *Id.* at 532–34 (rejecting a host of policy arguments against regulating greenhouse gases and directing EPA to simply determine whether these gases endanger public health or the environment).

[177] *See, e.g.*, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 79 Fed. Reg. 34,830, 34,851 (June 18, 2014) (to be codified at 40 C.F.R pt. 60) (proposing a power plant rule for existing sources under the technology-

Yet, most scholars accept a role for precaution in standard setting as well, implying that it has some relevance to setting goals.[178] Its most obvious application takes place when regulators establish effects-based standards. The precautionary principle implies a conservative approach to risk assessment in setting standards designed to protect the environment or public health.[179]

Scholars also sometimes identify technology-based standards as precautionary.[180] They may simply mean that technology-based standards do not conflict with precaution, as they do not use scientific uncertainty as a basis for postponing cost effective measures. The theory sketched above, though, suggests that precaution does not provide much guidance to agencies setting technology-based standards because science about environmental effects should not influence these standards. Therefore, a cautious attitude toward risk assessment is not relevant to technology-based standard setting. Rather, the relevant question becomes what can we achieve with feasible technological improvements. One might ask whether precaution can play a role in justifying technology-based criteria as a goal choice even if it should play no role in crafting standards under technology-based provisions.

The conventional wisdom holds that cost-benefit balancing conflicts with precaution. But the framework sketched above calls that wisdom into doubt.[181] For the framework identifies risk assessment as common to both effects-based and cost-benefit-based standard setting. If regulators establishing cost-benefit based standards adopt a precautionary approach to the risk assessment underlying CBA and toward the treatment of unquantified benefits, then they presumably have conformed to the precautionary principle. For the precautionary principle seems to

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based section 111 of the CAA); Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units, 79 Fed. Reg. 1430, 1443–44 (Jan. 8, 2014) (to be codified at 40 C.F.R pts. 60, 71–72, 98) (proposing a power plant rule for new sources under the technology-based section 111 of the CAA); Proposed Rulemaking to Establish Light-duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, 74 Fed. Reg. 49,454, 49,461 (Sept. 28, 2009) (codified at 40 C.F.R. pts. 86, 600) (summarizing technology-based statutory provisions providing the authority to regulate greenhouse gas emissions from cars and light trucks); *see generally* Coalition for Responsible Regulation v. EPA, 684 F.3d 102, 114, 116–126 (D.C. Cir. 2012), *rev'd on other grounds,* 134 S. Ct. 2427 (2014) (upholding EPA's finding that greenhouse gases endanger public health and the environment).

[178] *See* David M. Driesen, *Cost-Benefit Analysis and the Precautionary Principle: Can They Be Reconciled?*, 2013 MICH. ST. L. REV. 771, 789 (2013) (stating that many scholars think that the precautionary principle has something to say about levels of standards).

[179] *See id*. at 798.

[180] *See, e.g.*, Nigel Haigh, *The Introduction of the Precautionary Principle into the UK*, *in* INTERPRETING THE PRECAUTIONARY PRINCIPLE 224, 241 (Timothy O'Riordan & James Cameron eds., 1994) (pointing out that the precautionary principle is often seen as synonymous with basing regulation on technical feasibility).

[181] *See, e.g.*, APPLEGATE, *supra* note 20, at 171 (characterizing CBA as "an alternative" to the precautionary principle); Stone, *supra* note 170, at 10796 (claiming that the precautionary principle demands a curtailment of CBA once a harm threshold is reached).

allow governments to reject pollution control standards on the ground that they cost too much; it only eliminates scientific uncertainty as a basis for rejecting standards. On the other hand, CBA that ignores important unquantified benefits or treats uncertainty as a reason to devalue pollution control's benefits would violate the principle.

Cost-benefit balancing may conflict with a normative judgment about the primacy society should give to protection of public health and the environment, and a similar normative judgment may underlie the precautionary principle. But that does not mean that CBA violates the precautionary principle itself. The normative justification for the precautionary principle and for rejecting CBA must be closely related to the justification for effects-based standards. For a decision to be conservative about targeted health and environmental risks, rather than, say the economic effects of spending money on pollution control, implies giving primacy to public health and the environment. Thus, further work on justifying health and effects-based standards would also contribute to a normative defense of the precautionary principle.

5. A Brief Summary of Payoffs

Thus, we see that a precise systematic understanding of environmental goals on a very basic level yields important insights into environmental law as a whole and reveals a valuable research agenda. It helps reveal environmental law's underlying structure. It yields a series of questions about the normative justification for the structure and its components. It also highlights some pragmatic considerations about analytical technique and invites us to think more about the relationship between pragmatism and normative philosophy. Finally, it helps us understand the role of precaution in environmental law.

II. THE MEANS OF ENVIRONMENTAL LAW

Government agencies and regulated firms have a variety of tools at their disposal to achieve environmental standards, *i.e.* to meet society's goals for environmental law. Much of the scholarship about instrument choice—government choices about the regulatory means of environmental protection—has a goal of promoting the use of economic incentives, especially emissions trading, rather than of analyzing or explaining existing law.[182] This Article uses the term "emissions

[182] *See* Sanja Bogojević, *Ending the Honeymoon: Deconstructing Emissions Trading Discources,* 21 J. ENVTL. L. 443, 447 (2009) (describing the emissions trading literature as having a "promotional" rather than an analytic nature). The rationale for referring to an emissions trading program as an economic incentive program is not entirely clear either. *See* David M. Driesen, *Is Emissions Trading an Economic Incentive Program?: Beyond the Command and Control/Economic Incentive Dichotomy,* 55 WASH. & LEE L. REV. 289, 289 (1998) [hereinafter *Emissions Trading*]. Trading proponents tend to think of it these days as putting a price on pollution. *See* David M. Driesen, *Putting a Price on Carbon: The*

trading" in a broad sense to include any program that allows for trading of environmental benefits, a usage consistent with that found in the promotional literature on instrument choice. This promotional scholarship has proven quite successful, so that now any discussion of positive law must include emissions trading, as it plays an important, increasing role in environmental protection.[183] This scholarship, however, has sometimes demonized other means of meeting environmental goals, lumping many of them together with technology-based goal setting under the very imprecise rubric of "command-and-control" regulation.[184] This approach may have been useful when emissions trading struggled to achieve a place in environmental law and policy. But at this juncture, a positive theory of the means of environmental protection would add much needed clarity to the debate about instrument choice, greatly contribute to an emerging third generation debate on instrument design, and prompt a new discussion of the relationship between means and ends.

This part begins with a treatment of traditional regulation—performance standards, work practice standards, and phaseouts. It then continues with a discussion of emissions trading and pollution taxes.

This account focuses solely on legal means that regulators use to achieve particular environmental goals, such as the goals elaborated above, thereby facilitating a discussion of the relationship of means to ends in part three. This narrow approach makes the topic of means and ends manageable and facilitates concise and coherent analysis of the relationship between them. Yet it leaves out other aspects of environmental law that can be thought of as means of environmental protection. Specifically, it leaves out legal mechanisms that encourage environmental improvements without aiming at specific goals, namely informational approaches and liability. It also does not specifically focus on

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Metaphor, 44 ENVTL. L. 695, 696 (2014) (discussing the recent rhetorical shift that treats emissions trading to reduce greenhouse gas emissions as "putting a price on carbon"). But a traditional regulation does that as well. *See* Todd Gerarden, Richard G. Newell, & Robert N. Stavins, *Deconstructing the Energy-Efficiency Gap: Conceptual Frameworks and Evidence,* 105 AM. ECON. REV. PAPERS AND PROC. 183, 184 (2015) (noting that regulation directly or indirectly prices environmental externalities).

[183] *See* David M. Driesen, *Alternatives to Regulation? Market Mechanisms and the Environment, in* THE OXFORD HANDBOOK OF REGULATION 203, 209–215 (Robert Baldwin, Martin Cave, & Martin Lodge eds., 2010) [hereinafter OXFORD HANDBOOK] (describing the increased use of trading over time).

[184] *See, e.g.*, Ackerman & Stewart, *supra* note 25, at 1334–39 (treating "serious inefficiency of . . . command-and-control regulation" as evidence that a strategy of requiring installation of available technology wastes money); Daniel J. Dudek & John Palmisano, *Emissions Trading: Why Is this Thoroughbred Hobbled?*, 13 COLUM. J. ENVTL. L. 217, 220 (1988) (equating "command-and-control" with "technology forcing"); *see also* Andrew McFee Thompson, Comment, *Free Market Environmentalism and the Common Law: Confusion, Nostalgia and Inconsistency*, 45 EMORY L.J. 1329, 1336 (1996) (characterizing "free market advocates" as offering only two, diametrically opposed options: "command and control" regulation and a "market-dominated system").

technological approaches that polluters can use to protect the environment, namely end-of-the-pipe controls, pollution prevention, and recycling. Much work remains to be done on specifying the relationships among these three types of means. But a focus on legal means of meeting specified goals facilitates development of a concise theory of means *and* ends.

A. *Traditional Regulation*

1. *Performance Standards*

The media-specific statutes rely heavily on performance standards as a major means of environmental protection. Performance standards, as the name implies, demand a particular level of environmental performance. For example, air pollution standards for electric utilities typically limit the pounds of a pollutant per British Thermal Unit (BTU) of energy produced.[185] Thus, performance standards do not dictate a technological approach. Formally, at least, they leave polluters free to choose whatever technology they wish to employ, as long as their facility or product reaches the required pollution control level. Because performance standards offer plant operators some flexibility, the pollution control statutes usually require their use when pollution levels can be monitored to allow for practical enforcement of a performance standard.[186]

2. *Work Practice Standards*

Sometimes, however, agencies promulgate standards that tell polluters how to reduce pollution, instead of mandating that they achieve a particular level of pollution reduction.[187] Let us call these standards work practice standards.[188] The statutes authorize work practice standards when designing or enforcing a

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[185] *See, e.g.*, 40 C.F.R. § 60.43Da (West 2016).

[186] *See* Am. Petroleum Inst. v. EPA, 52 F.3d 1113, 1120 (D.C. Cir. 1995) (EPA may not limit use of ethanol in reformulated gasoline, because the Clean Air Act mandates performance standards); PPG Indus., Inc. v. Harrison, 660 F.2d 628, 636 (5th Cir. 1981) (authority to set performance standards does not include authority to specify fuels).

[187] *See, e.g.*, Adamo Wrecking Co. v. United States, 434 U.S. 275, 277, 294–95 (1978), *superseded by statute,* 42 U.S.C. § 7412 (majority and dissenting opinions) (discussing a regulation that requires watering down asbestos during building demolition but does not specify an emissions limit).

[188] An illustrative statutory provision authorizes promulgation of "design, equipment, work practice, or operational standards." *See, e.g.*, 42 U.S.C.A. §7412(h) (2016 West). I use the term "work practice standard" generically to refer to all of these sorts of prescriptive standards.

performance standard appears infeasible.[189] It is usually not possible to enforce an emissions standard when it is impossible to measure the level of pollution.[190]

3. Phaseouts

Although rarely employed, environmental statutes do authorize and sometimes require phaseouts of hazardous substances. For example, we phased out lead from gasoline, many ozone depleting chemicals, and DDT.[191] A phaseout resembles, at first glance, a very strict performance standard, requiring a zero level of pollution. But a performance standard set at zero only eliminates pollution in a single medium. A phaseout of a chemical, by contrast, eliminates pollution caused by the production and use of the phased-out substance in all media—land, air, and water.

B. Emissions Trading and Pollution Taxes

Although used sparingly in the United States, economists have long recommended pollution taxes as a means of pollution control. Faced with a tax on pollution, polluters would presumably pay for pollution control if doing so is cheaper than paying the tax. As a result, a tax provides a cost effective means of reducing emissions. Those with only expensive pollution abatement opportunities would presumably pay the tax instead of reducing emissions. Those with relatively inexpensive available pollution abatement possibilities would abate emissions to avoid (or reduce) the tax. Other countries have used pollution taxes and the United States has made some limited use of fees and taxes that bear some relationship to pollution.[192]

The United States has made extensive use of another technique for cost effective pollution reductions—emissions trading.[193] Emissions trading builds on the idea of a performance standard, which establishes a quantitative reduction obligation. A regulator creating a trading program establishes quantitative limits on emissions for regulated pollution sources, but makes the reduction obligations tradable. Under such an approach a polluter with an obligation to reduce emissions

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[189] *See, e.g.*, 42 U.S.C.A. §7412(h)(1) (West 2016); *cf.* 42 U.S.C.A. §6924(m)(1) (West 2016) (authorizing the EPA to create treatment standards for the disposal of solid waste).

[190] *See* 42 U.S.C.A. §7412(h)(2) (West 2016); Nat. Res. Def. Council, Inc. v. EPA, 824 F.2d 1146, 1157 n.4 (D.C. Cir. 1987) (noting that the provision authorizing work practice standards for hazardous air pollutants does so only when emissions cannot be measured); *e.g.*, *Adamo Wrecking,* 434 U.S. at 286–87, 298 (majority and dissenting opinion) (noting that EPA chose a work practice standard because EPA could not regulate emissions since the emissions could not be measured).

[191] 42 U.S.C.A §§ 7545(n), 7671c-7671e (West 2016); Envtl. Def. Fund, Inc. v. EPA, 489 F.2d 1247, 1257 (D.C. Cir. 1973) (affirming the DDT ban).

[192] OXFORD HANDBOOK*, supra* note 183, at 209 (discussing the use of pollution taxes primarily in Europe).

[193] *See id.* at 210–11 (discussing trading's growing influence in the US).

can avoid this obligation if she pays somebody else to make extra reductions in her stead.[194] Given this flexibility, some polluters with relatively cheap abatement opportunities will likely provide more reductions than required in order to sell credits for the extra reductions to polluters needing credits.[195] Conversely, polluters facing expensive local abatement costs will likely purchase credits from over-complying polluters in lieu of local abatement.[196] Thus, trading generally facilitates cost effective abatement, by permitting reallocation of reduction obligations to those with the cheapest pollution abatement opportunities.

C. Insights

The juxtaposition of the various regulatory means of pollution control aimed at specific goals yields some useful insights that help clarify understanding of instrument choice and design. First of all, the juxtaposition of performance standards and work practice standards highlights the importance of monitoring in instrument choice. Simply put, a performance standard offers desirable technological flexibility, but does not work as a practical matter when we cannot monitor pollution levels. Accordingly, the statutes usually favor performance standards but contemplate substituting work practice standards when performance standards appear infeasible.

Since emissions trading constitutes a variant on a performance standard, it follows that emissions trading cannot work properly when we cannot reliably monitor emissions. Most emissions trading proponents recognize that measurement of emissions proves critical to the enforcement of an emissions trading program and therefore do not recommend trading absent reliable monitoring.[197] Yet this insight has received insufficient attention, as it implies that a standard recommendation that regulators should make emissions trading "comprehensive" needs qualification.[198]

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[194] *See Emissions Trading*, *supra* note 182, at 290 ("Emissions trading programs allow polluters to avoid pollution reductions at a regulated pollution source, if they provide an equivalent reduction elsewhere.").

[195] *See id.* at 334 (explaining that emissions trading encourages those with low marginal pollution abatement cost to go beyond compliance).

[196] *Id.* (explaining how those with high marginal control cost may forego local abatement and buy credits instead).

[197] *See, e.g.*, Jeffrey C. Fort & Cynthia A. Faur, *Can Emissions Trading Work Beyond a National Program?: Some Practical Observations on the Available Tools,* 18 U. PA. J. INT'L ECON. L. 463, 467 (1997) (arguing that trading only works with accurate monitoring); Ann Powers, *Reducing Nitrogen Pollution on Long Island Sound: Is There a Place for Pollution Trading?*, 23 COLUM. J. ENVTL. L. 137, 212 (1998) (characterizing thorough monitoring as an essential element of a trading program).

[198] *See, e.g.*, Richard B. Stewart & Jonathan B. Wiener, *The Comprehensive Approach to Global Climate Policy: Issues of Design and Practicality,* 9 ARIZ. J. INT'L & COMP. L. 83, 103–108 (1992) (advocating comprehensive trading of greenhouse gases in spite of monitoring challenges). Stewart and Wiener argue that "monitoring will be required in order to secure compliance with any agreed-on limitations" even without trading. *Id.* at 108. This overlooks several points. First, allowing trading in poorly monitored pollutants can

When an environmental problem arises in part from pollutants that cannot be reliably monitored, emissions trading schemes probably should focus on those pollutants that can be, rather than regulating comprehensively but poorly. Considering all of these mechanisms together yields some additional insights along these same lines.

The observation that trading depends on adequate monitoring invites an inquiry into whether other mechanisms depend on adequate monitoring as well. Pollution taxes, upon reflection, also depend on adequate monitoring and therefore may prove inappropriate where adequate monitoring is not possible.[199] If tax authorities cannot determine how much pollution is being emitted, they cannot determine the correct amount of tax to collect.

By contrast, a phaseout can function even when pollution cannot be measured. A phaseout usually limits the production of a particular substance and one can verify compliance with a phaseout without measuring the pollution emitted in a particular medium. One need only measure production levels or purchase records to see whether a manufacturer has complied with a phaseout requirement.

This recognition of a phaseout's ability to function when polluters and inspectors cannot monitor pollution levels reveals a potential way around the technical limits monitoring weaknesses can place on effective emissions trading programs and pollution taxes. Even when regulators cannot measure emissions, they can tax or limit production of products causing emissions, and we did this when we phased out lead and ozone-depleting chemicals. Production limits can also be made tradable. Amy Sinden and I have analyzed the potential of "dirty input limits" (DILs), which limit the production of products rather than emissions, to work well as an instrument of environmental protection, including tradable DILs.[200]

The possibility of phasing-out or limiting the production of products that cause pollution might prove useful in addressing the largest environmental problem we face, that of global climate disruption. Currently, many policies addressing climate disruption focus on emission reductions. Some of these programs prove awkward to design and implement, partly because of measurement difficulties.[201] DILs might prove useful in overcoming these limitations and in facilitating the eventual phaseout of fossil fuels that scientists recommend.[202]

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compound the effect of monitoring limitations, because exaggerated claims of emission reductions can be strategically combined with minimization of debits to create greater losses of planned emission reductions. Second, one can circumvent monitoring limitations with dirty input limits or work practice standards and could plausibly write international commitments in those terms as well.

[199] *See* Daniel H. Cole & Peter Z. Grossman, *When Is Command-and-Control Efficient? Institutions, Technology, and the Comparative Efficiency of Alternative Regulatory Regimes for Environmental Protection,* 1999 WIS. L. REV. 887, 921–22 (characterizing "continuous emissions monitoring" as "necessary" for accurate tax assessment).

[200] *See* David M. Driesen & Amy Sinden, *The Missing Instrument: Dirty Input Limits*, 33 HARV. ENVTL. L. REV. 65, 67 (2009) (describing and evaluating DILs).

[201] *See, e.g.*, *id.* at 80 (describing the problems in addressing transportation emissions of greenhouse gases through emissions trading).

[202] *See id.* at 104–09 (discussing the design and value of a fossil fuel DIL).

This part deliberately leaves out many insights in the instrument choice literature, including insights in my own articles on the subject. It simply shows that a more precise account of the means of environmental protection provides some insights into both limits of highly touted approaches and new possibilities meriting more attention. A good understanding of the principle means of meeting specific pollution control goals yields insights, just as an understanding of goals does. Putting means and ends together reveals still more.

III. THE RELATIONSHIP BETWEEN MEANS AND ENDS

Understanding specific normative goals and regulatory means enables us to better understand the relationship between means and ends. Analysts sometimes confuse environmental law's means with its ends in the discussion of technology-based regulation, sometimes called "command-and-control" regulation. As we shall see, avoiding this conflation provides a clearer understanding of environmental law as a whole and insights into a host of important issues.

This part begins by creating a framework for understanding the range of means-ends relationships, which it derives primarily from a close analysis of the concept of technology-based regulation. It then shows how this framework illuminates establishment of goals for economic incentive programs (trading and then taxes) and the problem of addressing risk/risk issues—where addressing one environmental risk creates another.

A. Separating Means and Ends to Understand Technology-Based Regulation and the Wide Variety of Potential Means-Ends Combinations

Some scholarship characterizes technology-based standards and "command and control" regulations as standards that mandate the use of a particular technology. [203] Some scholarship, however, characterizes technology-based regulation as specifying *pollutant levels* or technologies.[204] Although this variation suggests some confusion, both of these descriptions treat technology-based regulation as a means of environmental protection, not as a goal-setting mechanism.

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[203] KYSAR, *supra* note 9, at 5 (summarizing the case "against conventional environmental health and safety regulation" as equating "command-and-control regulation" with "mandating a single compliance technique . . . .") (internal quotation omitted); *see* Robert W. Hahn & Gordon L. Hester, *Where Did All the Markets Go? An Analysis of EPA's Emissions Trading Program*, 6 YALE J. ON REG. 109, 109–10 (1989) (stating that "command and control regulations . . . specify methods and technologies [that] firms must use to control pollution. . . ."); Sadowitz, *supra* note 17, at 18 (characterizing "[t]echnology-based standards" as "mandat[ing] the use of a particular technology. . . .").

[204] *See, e.g.*, Robert W. Hahn & Robert N. Stavins, *Incentive-Based Environmental Regulation: A New Era from an Old Idea*, 18 ECOLOGY L.Q. 1, 5 (1991) (defining command and control regulation to include commands to use particular pollution controls and performance standards).

Careful parsing of the language in key standard setting provisions supports the conceptualization offered in part one, which treats technology-based regulation as embracing a goal of realizing technologically feasible emission reductions. This parsing also helps clarify the relationship between this goal and various means of environmental protection.

Let us begin the parsing with the classic technology-based program—the CWA BAT program. The most pertinent BAT provision requires EPA to "identify . . . the degree of effluent reduction attainable through the application of the best control measures and practices."[205] This provision does not leave EPA free to choose the general policy goal guiding decisions about the "degree" of water pollution reduction EPA may demand. It requires the amount of reduction in water pollution "attainable through the application of the *best* control measures and practices."[206] In other words, it demands that EPA, in setting effluent limitations assess the capabilities of technology. This means that EPA must establish effluent limitations that meet the goal of getting polluters to achieve the pollution reductions that the best technologies can achieve, neither more nor less. This technology-based criterion thereby establishes a goal for EPA standard setting.

The BAT example also shows that the identification of technology-based standard setting with technological specification, i.e. with work practice standards, is usually incorrect. The CWA's BAT provisions require EPA to write "effluent limitations."[207] The term effluent limitation implies a limit on the amount of effluent discharged—a kind of performance standard. The phrase "degree of effluent reduction" refers to the amount of reduction in water pollution that will be demanded.[208] And a review of the Code of Federal Regulations shows that effluent limitation guidelines, the actual requirements that polluters must meet, usually take the form of a performance standard—generally limiting the parts per million of a pollutant allowed in water or the pounds of pollutant permitted per unit of production.[209]

Some BAT limits, however, do take the form of a requirement to employ a particular technology.[210] But the fact that some BAT limits take the form of work practice standards only cements the point that BAT limits sometimes specify technologies, but usually do not. All BAT limits, however, reflect EPA's assessment of what the best technology can achieve and therefore serve the goal of maximizing feasible emission reductions.

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[205] 33 U.S.C.A §1314(b)(2)(A) (West 2016).

[206] *Id*. (emphasis added).

[207] *See* 33 U.S.C.A § 1311(b)(2)(A) (West 2016).

[208] *Cf.* Adamo Wrecking Co. v. United States, 434 U.S. 275, 286 (1978) (distinguishing the establishment of level of reduction from the technologies used to attain this level).

[209] *See* 40 C.F.R. Ch. I. Subch. N. pt. 400–71 (West 2016).

[210] *See, e.g.*, Ass'n of Pac. Fisheries v. E.P.A., 615 F.2d 794, 802 (9th Cir. 1980) (noting that EPA requires the use of a dissolved air flotation unit to limit water pollution from fish processing operations).

The same basic structure governs every technology-based statutory provision that I am aware of, even though the details of these provisions vary in a number of respects.[211] Thus, for example, the provision governing EPA's recently promulgated rules regulating power plants' carbon dioxide emissions—section 111 of the CAA—requires "emission limitation[s]" attainable with application of the "best" demonstrated "system of emission reduction."[212] Like the BAT provisions, section 111 makes the capabilities of the best systems of emission reduction the measuring rod for the degree of stringency required.

Furthermore, an emission limitation, like an effluent limitation, constitutes a performance standard. A different subsection of section 111, however, authorizes work practice standards when setting an emission limitation is impracticable.[213] Hence, even though these standards are technology-based in the sense that they reflect an assessment of what level of reductions the best demonstrated emission reduction system can achieve, they usually take the form of a performance standard, not a work practice standard.[214]

Richard Stewart, however, has suggested that in practice technology-based performance standards provide "strong incentives to adopt the . . . technology underlying the [performance] standard" in spite of the formal structure that I have identified.[215] The empirical literature shows that in some cases polluters have adopted new technologies not anticipated by the agency in response to technology-based standards.[216] At the same time, if EPA has in fact based a standard on the best

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[211] *See, e.g.*, Am. Petroleum Inst. v. EPA, 52 F.3d 1113, 1121 (D.C. Cir. 1995) (holding that EPA may not limit use of ethanol in reformulated gasoline, because the CAA mandates performance standards); PPG Indus., Inc. v. Harrison, 660 F.2d 628, 636 (5th Cir. 1981) (holding that the authority to set a performance standard does not include the authority to specify fuels); *cf.* 42 U.S.C. § 6924(m)(1) (West 2016) (distinguishing between specifying "levels" and treatment methods, but not expressing a policy preference for performance standards).

[212] *See* 42 U.S.C.A. § 7411(a)(1) (West 2016); *cf.* 33 U.S.C. § 1316(a)(1) (West 2016) (defining new source standards under the CWA in very similar terms).

[213] *See* 42 U.S.C.A. § 7411(b)(5), (h) (West 2016).

[214] *See* Adamo Wrecking Co. v. United States, 434 U.S. 275, 285–86 (distinguishing between a quantitative "level" of emissions and the technological means employed to meet the level); Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units, 79 Fed. Reg. 1429, 1444 (proposed Jan. 8, 2014) (to be codified at 40 C.F.R. pts. 60, 70, 71) (stating that EPA does not generally specify a technology that must be used to comply with new source performance standards under CAA section 111).

[215] *See* Richard Stewart, *Regulation, Innovation, and Administrative Law: A Conceptual Framework,* 69 CAL. L. REV. 1256, 1268–69 (1981).

[216] *See* Nicholas Ashford et al., *Using Regulations to Change the Market for Innovation,* 9 HARV. ENVTL. L. REV. 419, 436–443 (1985) (discussing innovative responses to technology-based and other types of regulation); U.S. CONG., OFFICE OF TECH. ASSESSMENT OTA-ENV-635, GAUGING CONTROL TECHNOLOGY AND REGULATORY IMPACTS OF

and most cost effective technology, one would expect industry to use that technology unless it can cheaply eliminate the pollutant involved or develop an adequate alternative not known to EPA. But the basic point remains, as a formal matter technology-based standards do not always, or even usually, directly require a particular technology. Instead, a technology-based standard reflects a goal of maximizing reductions realizable through use of feasible technologies and often produces performance standards while sometimes producing work practice standards.

Technology-based standards uniquely rely on technological capability to identify degrees of pollution control—i.e., as a measuring rod for goal setting. Their expression in the form of performance or work practice standards, however, does not constitute a unique characteristic of technology-based regulation. Other goal setting provisions also lead to establishment of performance or work practice standards. For example, effects-based provisions that are not technology-based, but instead focused on protecting public health, also generate work practice and performance standards.

Section 112 of the pre-1990 CAA illustrates how effects-based goals generate performance standards—or, occasionally, work practice standards—as means toward ends that have little to do with technology. Before 1990, section 112 of that Act authorized health-based standards for hazardous air pollutants—not technology-based standards.[217] Section 112, however, contained (and still contains) a provision that exactly parallels the provision in section 111 authorizing work practice standards while creating a presumption in favor of performance standards.[218] In other words, when Congress adopted a health protection goal, rather than a feasibility goal, it still recognized that EPA might mandate employment of specific pollution control technologies and created the same policy about when to do so as that found in many technology-based statutory provisions—a preference for performance standards combined with authorization to dictate technologies when enforcement of a performance standard proves impractical. Section 112 therefore suggests that the policy issue of selecting the means of environmental protection remains basically the same regardless of what principle establishes the goal for a particular standard.

This analysis suggests that a wide variety of goal setting procedures can lead to specification of a performance or work practice standard. The literature, however, sometimes wrongly suggests that specification of a performance standard or technology constitutes a unique attribute of technology-based rulemaking.

OCCUPATIONAL SAFETY AND HEALTH—AN APPRAISAL OF OSHA'S ANALYTICAL APPROACH 64 (1995) (discussing innovation in response to OSHA standards).

[217] *See* Nat. Res. Def. Council, Inc. v. E.P.A., 824 F.2d 1146, 1147 (D.C. Cir. 1987) (noting that EPA must establish emission standards for hazardous air pollutants that protect public health with an "ample margin of safety").

[218] *See Adamo Wrecking*, 434 U.S. at 286 (discussing the provision of the 1977 Amendments authorizing work practice standards when "it is not feasible" to establish or enforce an "emission[s] standard").

Separating means and ends rather than conflating them yields the insight that a wide combination of means and ends can exist, even when confining the analysis to means of achieving precisely specified regulatory goals. The chart below illustrates the full range of potential combinations suggested by the analysis provided in parts one and two:

ENDS MEANS	Effects-based	Technology-Based	Cost-Benefit Based
Work Practice	X	X	X
Performance	X	X	X
Emissions Trading	X	X	X
Taxes	X	X	X

B. Understanding the Problem of Goal Setting for Emissions Trading Programs and the Future of Climate Disruption Policy

Like performance and work practice standards, an emissions trading program can provide a means of environmental protection serving a variety of goals.[219] This point proves significant because it runs counter to the impression that the instrument choice literature creates and it yields very important insights and questions about the design of emissions trading programs. Since policies throughout the world have placed emissions trading at the heart of their efforts to address global climate disruption, insights into trading design matter a great deal.

In order to establish an emissions trading program, one must set a goal for the program. This goal determines how many allowances the regulator distributes to polluters.[220] The conventional way of thinking about establishing a goal for pollution trading involves reliance on CBA to determine an optimal level of pollution. I know of no case in which a government has based a trading program on an estimation of optimal pollution levels.[221] But we do have examples of effects-based and technology-based trading goals.[222] Generally, tradable fishing quota programs aim to establish a limit for the overall catch that prevents depletion of the fishery—an effects-based standard.[223] Trading programs aimed at limiting pollution have

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[219] *See* David M. Driesen, *Capping Carbon,* 40 ENVTL. L. 1, 20–27 (2010) (describing various cap setting goals).

[220] *See id.* at 13–15 (describing cap setting and allocation of allowances).

[221] *Cf. id.* at 31–32 (explaining that CBA has sometimes been used to influence cap setting decisions but not to produce optimal pollution levels).

[222] *See id.* at 28–31 (collecting examples of both effects-based and technology-based cap setting).

[223] *See id.* at 31 (discussing allowable catch limits for tradable fishing quota programs).

generally been technology-based.[224] Examples include the acid rain program and the first phases of the European Union's Emissions Trading Scheme.[225]

Trading proponents, however, sometimes write about trading as an antidote to the problems they associate with technology-based rulemaking.[226] They claim that emissions trading frees agencies from the technically arduous task of evaluating technologies, leaving that task to experts within individual companies complying with a trading program's limits.[227]

An analysis of the relationship between means and ends casts doubt upon this vision. For part one's comparison between cost-benefit-based and technology-based goal setting reveals that they both depend on technological assessment, since cost estimates generally require technological assessment.[228] In other words, to the extent that regulators wish to consider cost in establishing emissions trading programs, they generally must evaluate technologies.

The goal setting analysis offered in part one suggests a way around this problem. One could set goals for trading programs based on protection of public health and the environment, regardless of cost. But the analysis in part one suggests that using effects-based goal setting to establish the number of allowances distributed would make goal setting more complicated in most cases than it would be if we employed a technology-based approach to goal setting.

The writers most responsible for this view of trading as a cure for the supposed disease of technology-based rulemaking (Richard Stewart and Bruce Ackerman), however, envisioned legislative goal setting for trading.[229] No formal criterion limits the factors politicians can consider when they establish a trading program. Although a wholly fact-free and utterly irrational political process establishing goals for a

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[224] *See id.* at 28–30 (describing various technology-based emissions trading programs).

[225] *See id.* at 28–29, 32–33 (describing the use of BAT to guide the acid rain program and the first two phases of the EU emissions trading scheme).

[226] *See* Ackerman & Stewart, *supra* note 25, at 1335–37 (setting out an "indictment" of BAT).

[227] *See id.* at.1342–43 (claiming that trading transfers the technological assessment task from "bureaucrats" to "business managers and engineers").

[228] Economists have sometimes based assessment of greenhouse gas abatement costs for the economy as a whole on past relationships between fuel prices and carbon dioxide emissions, rather than on technologies. *See* McGarity, *supra* note 108, at 218 (discussing top-down macroeconomic models that assume that consumers respond efficiently to energy price increases). These top-down estimation procedures, however, produce relatively high estimates of abatement costs and do not reflect cost reductions available because of technological advancement in the period since costly fuel prices produced a data set. *See id.* Accordingly, most carbon cost studies these days include some bottom-up analysis—analysis based on evaluation of technologies capable of abating carbon dioxide. Not only is a top down methodology likely inappropriate for policy analysis aimed at informing specific regulatory decisions, it is simply unavailable for many sectors emitting greenhouse gases and generally not useful for other kinds of environmental problems.

[229] *See* Ackerman & Stewart, *supra* note 25, at 1354 (proposing that Congress specify the levels of pollution reduction to be achieved).

trading program could sidestep all the technical difficulties that afflict regulators setting goals for pollution reduction programs, any rational process would have to consider some information. And the teachings derived from the analysis of goal setting would apply to the norms and factual considerations rational politicians consider as they establish goals. Political decision making's opacity has obscured this point—that politicians rationally establishing emission limits for trading programs necessarily confront the same technical difficulties that administrators confront in establishing emissions limits for polluters. But the legislatively enacted acid rain program, for example, had a technology-based rationale for the overarching goal Congress chose. EPA had previously promulgated a new source performance standard for sulfur dioxide through technology-based rulemaking under section 111 of the CAA.[230] This number became the basis, if not the sole determinant, of the goal that Congress chose for the acid rain program.[231] Had the analysis not already been done, legislators might well have to ask experts for fresh evaluations of technological options and costs.

None of this denies that a legislative process involves compromise and might include political considerations other than the normative considerations identified here. For example, even though the acid rain program's core goal comes rather directly from a technology-based rulemaking, legislators adjusted the allocation of allowances in various ways to accommodate specific particular electric utilities.[232] But unless the process is wholly irrational, something like the normative structure and the analytical questions it raises will play some role in the process.

Furthermore, administrative agencies often establish trading programs.[233] When they do, they do so under law that embodies the goals canvassed in part one.

The recognition that emissions trading must inevitably be paired with goal setting and a clear-eyed view of the difficulties extant goal setting mechanisms create for regulators should lead to further research on emissions trading's political economy. Such research will likely prove vital to addressing the greatest

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[230] *See* Standards of Performance for New Stationary Sources, 36 Fed. Reg. 24,875, 24,879 (Dec. 23, 1971) (codified at 40 C.F.R. § 60.43(b)).

[231] *See* A. DENNY ELLERMAN ET AL., ALLOCATION IN THE EUROPEAN EMISSIONS TRADING SCHEME: RIGHTS, RENTS, AND FAIRNESS 339, 353 (A. Denny Ellerman et al. eds., 2007) (describing the 1.2 lbs./mBTU limit as based on "the best available control technology"); Lesley K. McAllister, *The Overallocation Problem in Cap-and-Trade: Moving Toward Stringency*, 34 COLUM. J. ENVTL. L. 395, 400–01 (2009) (noting that the "basic formula" underlying the goal for phase two allowances represented the multiplication of this emissions rate by the baseline emissions for electric utilities).

[232] Paul L. Joskow & Richard Schmallensee, *The Political Economy of Market-Based Environmental Policy: The U.S. Acid Rain Program,* 41 J.L. & ECON. 37, 55–56 (1998) (discussing individual variations from the basic rule for setting allowances and the motivations for them).

[233] *See, e.g.*, North Carolina v. E.P.A., 531 F.3d 896, 903 (D.C. Cir.), *on reh'g in part*, 550 F.3d 1176 (D.C. Cir. 2008) (discussing EPA's creation of a trading program to address interstate air pollution).

environmental challenge we face, global climate disruption, because of governments' heavy reliance on emissions trading to address this problem.

Emissions trading programs, including trading programs addressing climate disruption, have often suffered from insufficiently ambitious underlying emission limitations.[234] Some of this laxness arises from regulators succumbing to polluters' insistence that the limits not demand anything more than reasonably available technologies can achieve.[235] Economists reviewing the European Union's emissions trading scheme have found this consideration of technological capabilities surprising and suggest that this reflects a failure to fully embrace the philosophy of emissions trading.[236] But the literature on emissions trading has very little to say about how the flexibility trading offers should influence goal setting, instead treating ambitious goal setting as likely under trading simply because trading lowers cost.[237]

The question of what sort of shift in goal setting and the philosophy underlying it would make sense and appropriately take advantage of trading's capacity to lower costs requires much greater attention. Can we project trading's cost savings sufficiently well *a priori* to take the savings into account when we consider what goals are appropriate? Should trading justify a philosophical approach similar to that underlying technology-forcing? That is, in light of trading's capacity to make compliance much cheaper than anticipated, should we simply have faith and put less emphasis on formal cost estimation? Should we get cost considerations wholly off the table in some cases based on alignment of trading with political commitments made in international negotiations or simply a philosophy of protecting public health? The failure to understand that trading is only a means toward some larger end and does not automatically avoid the philosophical and technical problems we confront in establishing goals for environmental law has distracted us from even seeing, much less addressing, these vital questions.

C. Goal Setting and Pollution Taxes

Most economists envision pollution taxes based on the concept of optimal pollution.[238] A regulator setting an optimal pollution tax would estimate the dollar

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[234] *See* Cento Veljanovski, *Economic Approaches to Regulation, in* OXFORD HANDBOOK, *supra* note 183, at 17, 31 (characterizing the over allocation of allowances in the EU's emissions trading scheme in phase one as producing "no expected reduction" of emissions).

[235] *See* Tschochohei & Zöckler, *supra* note 24, at 31 (describing the cap setting under the EU's emissions trading scheme as driven by special interests and using a "command-and-control approach").

[236] *See id.* at 32 (suggesting that emissions trading should have changed the "pattern of thought" in some unspecified way from that of "command-and-control").

[237] *Cf.* Ackerman & Stewart, *supra* note 25, at 1351–59 (coupling trading with a proposal for legislative establishment of quantitative pollution reduction mandates).

[238] *See* William J. Baumol & Wallace E. Oates, *The Use of Standards and Prices for the Protection of the Environment,* 73 SWED. J. ECON. 42, 43–44 (1971) (describing the

value of the harms the taxed pollution generates and establish a tax rate at that level.[239] By doing so the regulator encourages polluters to equalize costs and benefits at the margin, producing an optimal level of pollution.

The economists Baumol and Oates, however, have assumed in some of their work that policy makers enacting a pollution tax might calibrate it to achieve a quantitative pollution target.[240] Since a tax does not specify a target, but rather leads polluters to adopt whatever technological improvements might save them money at a given tax rate, they envision an iterative process in which economists estimated a tax's effect on pollution and then policy makers adjust the tax rate iteratively until the polluters make the desired reductions.[241]

The analysis above, however, shows that a rational politically chosen goal to guide selection of a tax rate will have something in common with the feasibility principle, protecting public health and the environment, or cost-benefit balancing and all of the analytical difficulties those considerations imply. This implies that choosing a tax rate implicates the philosophical and analytical questions that arise in establishing standards regulating pollution.

This similarity may seem odd to those accustomed to thinking of a tax within an optimality framework, but the first pollution tax proposed in the United States was technology-based.[242] That is, legislators proposed a tax rate based on the estimated cost of available control technology. Such a tax rate would presumably encourage the adoption of the available technology. Indeed, rational regulators cannot avoid the issues described in this Article's goal setting section if they plan to rely on a tax as a principle strategy to address an environmental problem. A tax rate set at a price exceeding the cost of available pollution control technologies might be needed to achieve a health-based goal and might have the consequence of either forcing technological innovation or closing facilities. Conversely, setting a tax rate below the cost of any available pollution control method would produce revenue but might not reduce pollution.[243] Rational regulators, even if they are elected political officials, will likely consider the technical and normative questions that the goal setting analysis raises, at least implicitly, in establishing a tax rate.

"proper level" of a "Pigouvian tax" as equal to the marginal damages caused by the targeted pollutant and describing economists as reluctant "to give up the Pigouvian solution").

[239] *Id.* at 43.

[240] *See id.* at 44–45 (positing using taxes to obtain "somewhat arbitrary standards" for an acceptable environment).

[241] *See id.* at 45 (describing the iterative process).

[242] *See* Shapiro & McGarity, *supra* note 19, at 745 n.88.

[243] Faced with a pollution tax, polluters will pass the price increase on to consumers if they can. But if doing so will likely cause too great a consumption decline, they may simply absorb the tax. Conversely, if producers pass the tax on to consumers with the expectation that consumers will not greatly reduce consumption in response, then the tax may decrease consumers' wealth without significant reduction in consumption of the product producing the targeted pollution. Only if the price increase is passed on to consumers and produces a decline in consumption of the taxed producers' products will production and hence pollution decline in the taxed industry.

To be sure, a regulator wholly dedicated to allocative efficiency could set the tax rate equal to the social cost of pollution. This would represent a normative shift in positive law, which has almost never embraced allocative efficiency as a goal. It would also change the form of analysis found in the positive law, but not in a way that simplifies analysis. To establish the social cost of pollution, the regulator would have to engage in quantitative risk assessment and monetization, the most difficult steps involved in CBA. The regulator could, however, avoid analyzing technology and its cost. In short, only taxation provides a means of shifting the analytical predicate for standard goal setting, but, alas, it does so in a way that does not shed the key analytical complexities that have beset CBA.

D. Privatizing Technological Choice, Setting Goals, and Risk/Risk Problems

This discussion of technological evaluation's centrality when regulators consider cost in establishing a program's goals brings us to a related question about the framework developed in this Article. Does this framework aid us in confronting risk/risk dilemmas that several prominent commentators have emphasized?[244] The risk/risk dilemma usually arises because technological changes adopted to address one environmental problem can create another. Thus, for example, United States electric utilities have helped lower carbon emissions from power plants in recent years by switching from coal to natural gas, which has become very cheap because of the development of hydraulic fracturing (fracking)—obtaining natural gas through horizontal drilling aided by the use of fluids to fracture underground rock formations.[245] Yet, fracking poses risks to water quality, usually increases emissions of a very potent greenhouse gas—methane, and can cause earthquakes.[246]

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[244] *See generally* John D. Graham & Jonathan Baert Wiener, *Confronting Risk Tradeoffs*, *in* RISK VERSUS RISK: TRADEOFFS IN PROTECTING HEALTH AND THE ENVIRONMENT 1, 1–2 (John D. Graham & Jonathan Baert Wiener eds., 1995) (explaining that "efforts to combat a 'target risk'" can increase other risks); W. KIP VISCUSI, FATAL TRADEOFFS: PUBLIC AND PRIVATE RESPONSIBILITY FOR RISK vii (1992) (noting the inevitability of tradeoffs); Cass R. Sunstein, *Health-Health Tradeoffs*, 63 U. CHI. L. REV. 1533, 1535 (1996).

[245] *See* Thomas W. Merrill, *Four Questions About Fracking*, 63 CASE W. RES. L. REV. 971, 972–74 (2013) (explaining fracking and discussing the significance of the price declines it has caused).

[246] *See* Walter H. Boone & Mandie B. Robinson, *"Whole Lotta Shakin' Going on": Recent Studies Link Fracking and Earthquakes*, 82 DEF. COUNS. J. 68, 69 (2015) (discussing "[t]he documented and undisputed rise in the number of earthquakes in close proximity to . . . fracking operations"); William J. Brady & James P. Crannell, *Hydraulic Fracturing Regulation in the United States: The Laissez-Faire Approach of the Federal Government and Varying State Regulations*, 14 VT. J. ENVTL. L. 39, 42–3 (2012) (discussing risks to water and methane emissions); Jeffrey M. Gaba, *Flowback: Federal Regulation of Wastewater from Hydraulic Fracturing*, 39 COLUM. J. ENVTL. L. 251, 265–68 (2014) (describing the generation of waste water from fracking and the hazards associated with it).

Accordingly, EPA's regulations reducing power plant carbon dioxide emissions, for example, might increase these ancillary risks if utilities respond by using more natural gas. The framework developed above helps provide an even-handed analysis of risk/risk issues and reveals dilemmas not widely appreciated in the risk/risk literature.

One might think that risk/risk issues provide a reason to increase CBA's use. If CBA comprehensively addresses all costs and benefits, it would address risk/risk issues.

The framework provided, and for that matter, simply the idea of taking positive law seriously in evaluating regulatory reforms, suggests that one should at least ask whether other goal setting provisions and, for that matter, the selection of means of environmental protection, might account for, or cause neglect of, risk/risk considerations.

It turns out that the environmental statutes require the consideration of ancillary risks in promulgating both effects-based and technology-based standards in various ways.[247] It also turns out that CBA sometimes does not address ancillary risks. The existing and modified power plant rulemaking's CBA, for example, did not consider ancillary risks from fracking as a cost.[248] Taking the positive law into account would greatly change the debate on how to address risk/risk problems. One might ask, for example, whether an analytical approach that seeks to quantify and monetize everything offers the best method of evaluating risk/risk issues in light of uncertainties and questions about the appropriate scope of analysis.

Furthermore, the positive law suggests something implicit in this presentation of risk/risk problems—that they often depend on the selection of technologies. Select natural gas as a technology for reducing carbon dioxide emissions, and one gets water quality, methane, and earthquake concerns. Select windmills, and one gets concerns about aesthetics and birds. Thus, evaluation of risk/risk problems requires an evaluation of the particular technologies polluters employ to meet environmental goals.

Those urging adoption of CBA in order to address risk/risk problems, however, in the same breath often recommend turning technological selection over to private parties through emissions trading.[249] This privatization of technological choice

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[247] *See, e.g.*, 42 U.S.C.A § 7408(f)(2)(C); § 7409(d)(2(C)(iv); § 7411(a)(1); § 7412(d)(2), (f)(2)(A) (West 2016).

[248] EPA, REGULATORY IMPACT ANALYSIS FOR THE PROPOSED CARBON POLLUTION GUIDELINES FOR EXISTING POWER PLANTS AND EMISSION STANDARDS FOR MODIFIED AND RECONSTRUCTED POWER PLANTS, at ES-3–ES-48 (June 2014) (defining costs in terms of compliance costs alone). In fairness to the EPA, if it were to count the environmental costs from fracking in the CBA, symmetry would require it to count the benefits from reduced deaths, disease, and injuries in coal mines. And it did estimate the impact of its rule on methane emissions from natural gas and coal, although it did not monetize these results. *Id.* at 4-13–4-14, 8-3.

[249] *See, e,g.,* Cass Sunstein, *Reinventing the Regulatory State,* 62 U. CHI. L. REV. 1, 10 (1995) (recommending more use of "economic incentives" and CBA).

should pose issues for those who argue that environmental law pays insufficient attention to risk/risk dilemmas. After all, the selection of technologies to actually use, rather than the establishment of emission limits underlying a trading program, directly causes most risk/risk problems. The risk/risk issue from this perspective presents a dilemma. Allowing private control over technological choices maximizes cost effectiveness and engages firms' expert knowledge. At the same time, private control over technological choice negates the public evaluation of the seriousness of risk/risk problems that CBA proponents advocate.[250]

To sum up, understanding the array of means and ends found in environmental law and juxtaposing them significantly increases our understanding of environmental law and the issues it raises. It suggests that more combinations of means and ends exist than commonly thought. It undercuts stereotypical thinking about both the nature of "command-and-control" regulation and economic incentives, showing that the former is more variegated, complex, and sometimes necessary than we thought, and that the latter, whatever their advantages as means of environmental protection do not automatically solve or even finesse questions about goals. Furthermore, private technological flexibility, while desirable in a number of respects, poses some risk/risk issues. These insights open up a variety of questions important to environmental law in general and to climate disruption law in particular.

IV. FURTHER STEPS TOWARD A POSITIVE THEORY

The material above demonstrates that a clear account of the means and ends of environmental law yields important insights and research questions. Yet, a positive theory of environmental law must go beyond means and ends to reach some other matters. This part aims to encourage future work filling out the positive theory of environmental law by identifying two elements that such a theory should include—namely accounts of environmental federalism and enforcement. It then preliminarily explores a question that those contributing to a positive theory of environmental law should address—whether such a theory has anything to say about environmental justice.

A. Environmental Federalism

Most federalism scholarship focuses on constitutional law, which can be relevant to environmental law. So, for example, courts have addressed the constitutionality of environmental statutes under the Commerce Clause.[251] A whole

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[250] *See* David M. Driesen, *Trading and Its Limits,* 14 PA. ST. ENVTL. L. REV. 169, 173 (2006) (leaving the choice of technologies to regulated parties leaves the government with no timely means of evaluating risk/risk tradeoffs).

[251] *See e.g.,* Hodel v. Va. Surface Mining and Reclamation Ass'n, 452 U.S. 264, 268, 281 (1981) (upholding a statute protecting the environment from coal mining's adverse

line of cases under the dormant Commerce Clause (judicial limits on state authority derived from the Constitution's affirmative grant of Commerce Clause authority to Congress) has addressed municipal regulation of solid waste.[252] And the leading case on the anticommandeering principle now associated with the Tenth Amendment resolved a dispute regarding federal mechanisms to secure state cooperation in addressing radioactive waste disposal issues.[253] An enormous amount of scholarship focuses on understanding the doctrines underlying these environmental cases.[254]

More importantly for environmental law's core commitments, environmental statutes embody a host of political decisions about when to exercise federal authority and when to leave policy or enforcement in state hands. Richard Revesz and Kirsten Engel have addressed a core rationale for the move made in the 1970s to give substantial authority over environmental policy to the federal government—the fear of a "race to the bottom" where states lowered environmental standards to attract business.[255] This is a key rationale for an important feature of environmental law. And this scholarship addresses another important rationale for a substantial federal role—the need for federal help in solving contentious problems of interstate pollution not within the control of any one state.[256]

But this scholarship says little about the particular arrangement of authorities found in environmental statutes, which often leaves substantial authority with state

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effects); Hodel v. Indiana, 452 U.S. 314, 327–29 (1981) (upholding specific environmental restrictions on mining).

[252] *See, e.g.*, Lisa Heinzerling, *The Commercial Constitution,* 1995 SUP. CT. REV. 217, 224–35 (1996) (discussing three Supreme Court environmental dormant Commerce Clause cases decided in the 1993 term).

[253] *See* New York v. United States, 505 U.S. 144, 149 (1992) (invalidating two provisions of the Low-Level Radioactive Waste Policy Amendments Act of 1985 because the Constitution does not permit the federal government to compel states to provide for disposal of waste generated with their borders).

[254] *See, e.g.*, Evan H. Caminker, *State Sovereignty and Subordinacy: May Congress Commandeer State Officers to Implement Federal Law*?, 95 COLUM. L. REV. 1001, 1004–007 (1995) (discussing the anti–commandeering principle established in the radioactive waste siting case); Heinzerling, *supra* note 252, at 224–31, 242–46 (discussing the dormant Commerce Clause cases based on solid waste); John Copeland Nagle, *The Commerce Clause Meets the Delhi Sands Flower-Loving Fly,* 97 MICH. L. REV. 174, 209 (1998) (discussing the application of Commerce Clause limitations to the ESA).

[255] *See* Kirsten H. Engel, *State Environmental Standard-Setting: Is There a "Race" and Is It "To the Bottom"?*, 48 HASTINGS L.J. 271, 274–80 (1997) (supporting the race-to-the-bottom rationale); Richard L. Revesz, *Rehabilitating Interstate Competition: Rethinking the "Race-to-the-Bottom" Rationale for Federal Environmental Regulation*, 67 N.Y.U. L. REV. 1210, 1211 (1992) (disputing the race-to-the-bottom rationale for federal regulation of the environment).

[256] *See, e.g.,* Engel, *supra* note 255, at 371–74 (generally endorsing rather than critiquing the existing system); Revesz, *supra* note 255, at 1222 (arguing that interstate externalities justify federal regulation).

governments.[257] William Buzbee has addressed a key aspect of that arrangement of authority, a pattern of preempting state standards less strict than the federal standards while usually allowing states to regulate more strictly than the federal government does.[258]

The environmental statues, however, often not only allow for stand-alone state law addressing pollution, they often envision a substantial state role in implementing *federal* environmental law.[259] For example, the CAA requires EPA to establish the NAAQS but charges states with the fundamental responsibility to come up with most of the specific pollution limits needed to meet these ambient standards.[260] Conversely, the CWA gives states the primary responsibility for formulating water quality standards but makes basic regulation of most major dischargers (point sources in the jargon of the Act) primarily an EPA responsibility.[261] A positive theory of environmental federalism should note and seek to explain this discrepancy. Furthermore, several statutes do *not* contemplate a substantial state policy role.[262] A positive theory might seek to explain what justifies coupling a substantial state role for the media specific statutes with nationalization of the regulation of toxics under FIFRA and TSCA. In any case, a positive theory should provide a description and normative explanation of key federalism policy decisions found in environmental law.

B. Enforcement

Clifford Rechtschaffen has ably described the normative theory underlying environmental enforcement in *Deterrence vs. Cooperation and the Evolving Theory*

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[257] *See* Engel, *supra* note 255, at 369–74 (not describing the arrangement of authorities generally, but offering certain regional governance provisions in the Clean Air Act as a model); *cf.* Revesz, *supra* note 255, at 1224–27 (describing some of the division of authority between the federal and state governments under the Clean Air Act, but not providing a trans-statutory description of the arrangement of authority).

[258] *See* William W. Buzbee*, Asymmetrical Regulation: Risk, Preemption, and the Floor/Ceiling Distinction,* 82 N.Y.U. L. REV. 1547, 1555 (2007) (arguing that principled rationales support a "one-way ratchet" that preempts less stringent state regulation while preserving state authority to go beyond federal minimums).

[259] *See id.* at 1550 (pointing out that under cooperative federalism statutes state and local governments assume critically important regulatory duties).

[260] *See* Train v. Nat. Res. Def. Council, 421 U.S. 60, 65–67 (1975).

[261] *See* Ass'n of Pac. Fisheries v. EPA, 615 F.2d 794, 801 (1980) (explaining that Congress charged EPA with the duty to establish BAT and best practicable control technology standards); Adler, *supra* note 47, at 213 (explaining that states usually promulgate water quality standards).

[262] *See* 15 U.S.C.A. § 2617(a) (West 2016); Bates v. Dow Agrosciences LLC, 544 U.S. 431, 437–38, (2005) (explaining that EPA, rather than the states, administers the pesticide registration requirements and determines the appropriate labeling for pesticides); *cf.* Wisconsin Pub. Intervenor v. Mortier, 501 U.S. 597, 600 (1991) (holding that FIFRA does not preempt local governments' pesticide regulation).

of Environmental Enforcement.[263] He points out that the law governing enforcement of environmental standards has traditionally relied heavily on a theory of adequate deterrence.[264] In recent decades, however, a model of cooperative enforcement has emerged, which places more emphasis on voluntarily eliciting compliance rather than deterring law breaking through enforcement actions.[265] He also shows how in practice agency officials usually combine elements of both philosophies.[266] He shows how the deterrence model underlies key features of the enforcement regime, such as substantial civil penalties, criminal penalties for deliberate noncompliance, and the availability of citizen suits when government fails to enforce the law adequately.[267] A positive theory of environmental enforcement along these lines constitutes an important element of a positive theory of environmental law.

C. Environmental Justice

In recent years, a movement for environmental justice has grown up, which has influenced environmental law and our thinking about it. Environmental justice scholars highlight issues of distribution.[268] In particular, they allege that communities of color suffer from disproportionate pollution burdens.[269] They also advocate close consultation with minority communities about siting industrial facilities and other environmental decisions affecting those communities.[270]

A theory of positive law raises questions about how to think about environmental justice's relationship to environmental law. Perhaps most fundamentally, should we think of it as a critique of the existing positive law from the outside but obtaining some influence, more or less like law and economics? Or does it highlight something about the positive theory of environmental law?

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[263] 71 S. CAL. L. REV. 1181, 1191–93 (1998).

[264] *See id.* at 1186 (pointing out that environmental law has traditionally been based on a deterrence theory).

[265] *See id.* at 1203 (describing the push toward a more cooperative model).

[266] *See id.* at 1189 (stating that in practice enforcers combine deterrence and cooperation).

[267] *See id.* at 1186–89, 1230–33 (linking substantial penalties and citizen suits to the deterrence model).

[268] *See* Anne K. No, *Environmental Justice: Concentration on Education and Public Participation as an Alternative Solution to Legislation*, 20 WM. & MARY ENVTL. L. & POL'Y REV. 373, 378 (1996) (equating environmental justice with the equitable sharing of pollution burdens).

[269] *See* CLIFFORD RECHTSCHAFFEN & EILEEN GUANA, ENVIRONMENTAL JUSTICE: LAW, POLICY, AND REGULATION 55–76 (2002) (reviewing disparate impact claims).

[270] *See* No, *supra* note 268, at 391 (identifying expansion of public participation in minority communities as a major advantage of President Clinton's environmental justice policy); Scott Kuhn, *Expanding Public Participation Is Essential to Environmental Justice and the Democratic Decisionmaking Process*, 25 ECOLOGY L.Q. 647, 648 (1999) (identifying meaningful public participation as a "central tenet" of the environmental justice movement).

It bears mention that the positive law has always reflected some concerns akin to those that environmental justice advocates highlight. The CAA, for example, has always demanded that the NAAQS adequately protect vulnerable subpopulations.[271] Environmental justice may do both; it may provide a normative challenge to some aspects of environmental law while helping to rationalize several features of existing law. But more work on these issues might help advance our understanding of both environmental justice and the positive theory of environmental law.

CONCLUSION

Thus, an understanding of environmental law's means and ends makes it possible to understand the field as a whole, both in terms of the overall structure of statutes and relationships between means and ends. This analysis of means and ends yields a host of valuable insights and significant research questions. It also provides an important foundation for evaluating proposed regulatory reforms. A reasonably complete theory, at a minimum, should also explain key features of the enforcement regime and the allocation of authority among governments. The theory of means and ends articulated here constitutes a very substantial step forward in constructing a positive theory of environmental law as a whole.

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[271] *See, e.g.* Am. Farm Bureau Fed'n v. EPA, 559 F.3d 512, 526 (D.C. Cir. 2009) (remanding a NAAQS for particulate to EPA because EPA has not explained how its rule will adequately protect children and other vulnerable subpopulations).