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## ENVIRONMENTAL LAW AND POLICY ANNUAL REVIEW

August 2012

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### In the Agencies

EPA finalizes revisions to regional haze program

### In the Courts

D.C. Circuit disallows nonconforming engine sales in exchange for penalty payments

### In the Congress

House passes energy-efficiency equivalency measure for walk-in coolers

### In the States

New Mexico completes greenhouse gas regulation repeal



ENVIRONMENTAL  
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### Jonathan H. Adler

*Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization*

With Responses by Timothy J. Brennan and Larry P. Cooper

### Daniel A. Farber

*Uncertainty*

With Responses by Alexander A. Golub and Gordon Woo

### Douglas A. Kysar

*What Climate Change Can Do About Tort Law*

With Responses by James M. Anderson; David T. Buente Jr., Quin M. Sorenson & Clayton G. Northouse; and Ellen M. Peter

### Joel B. Eisen

*Residential Renewable Energy: By Whom?*

# ENVIRONMENTAL LAW AND POLICY ANNUAL REVIEW

2011-2012

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# CONTENTS

## Comment

*Linda K. Breggin, Jacob P. Byl, Lynsey R. Gaudio, Seamus T. Kelly, and Michael P. Vandenberg*, Trends in Environmental Law Scholarship: Academic Years 2008-2009, 2009-2010, and 2010-2011 . . . . . 10711

## Articles and Responses

*Jonathan H. Adler*, Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization . . . . . 10713

*Timothy J. Brennan*, Prizes Versus Patents: A Comment on Jonathan Adler’s *Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization* . . . . . 10719

*Larry P. Cooper*, A Response to *Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization* . . . . . 10722

*Daniel A. Farber*, Uncertainty . . . . . 10725

*Alexander A. Golub*, Climate Policy and Uncertainty:  $\alpha$ -Precautionary Principle Versus Real Options Analysis . . . . . 10733

*Gordon Woo*, Comment on *Uncertainty* . . . . . 10737

*Douglas A. Kysar*, What Climate Change Can Do About Tort Law . . . . . 10739

*James M. Anderson*, Comment on Doug Kysar’s *What Climate Change Can Do About Tort Law* . . . . . 10745

*David T. Buente Jr., Quin M. Sorenson, and Clayton G. Northouse*, A Response to *What Climate Change Can Do About Tort Law* . . . . . 10749

*Ellen M. Peter*, A Comment on *What Climate Change Can Do About Tort Law* . . . 10752

*Joel B. Eisen*, Residential Renewable Energy: By Whom? . . . . . 10755

## Recent Developments

In the Congress . . . . . 10761

In the Courts . . . . . 10766

In the Federal Agencies . . . . . 10768

In the State Agencies . . . . . 10772

**Recent Journal Literature** . . . . . 10777

**Topical Index** . . . . . 10779

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## The Environmental Law and Policy Annual Review

Dear Readers:

The Environmental Law and Policy Annual Review (ELPAR) is published by the Environmental Law Institute's (ELI's) *Environmental Law Reporter* (ELR) in partnership with Vanderbilt University Law School. ELPAR provides a forum for the presentation and discussion of the best law and policy-relevant ideas on the environment from the legal academic literature each year. The publication is designed to fill the same important niche as *ELR* by helping to bridge the gap between academic scholarship and environmental policymaking.

ELI and Vanderbilt formed ELPAR to accomplish three principal goals. The first is to provide a vehicle for the movement of ideas from the academy to the policymaking realm. Academicians in the environmental law and policy arena generate hundreds of articles each year, many of which are written in a dense, footnote-heavy style. ELPAR selects the leading ideas from this large pool of articles and makes them digestible for policymakers and practitioners by reprinting them in a short, readable fashion accompanied by expert, balanced commentary. The second goal is to improve the quality of legal scholarship. Academicians have strong incentives to write theoretical work that ignores policy implications. ELPAR seeks to shift these incentives by recognizing scholars who write articles that not only advance legal theory but also reach policy-relevant conclusions. By doing so, ELPAR seeks to induce academicians to generate new policy-relevant ideas and to improve theoretical scholarship by inducing them to account for the hard choices and constraints faced by policymakers. To draw on an old joke in the academy, policymakers cannot simply assume a can opener when they need one, and theoretical scholarship will be far better if scholars cannot either. The third and most important goal is to provide a first-rate educational experience to law students interested in environmental law and policy.

To nominate articles to be included in ELPAR, the ELPAR Editorial Board and Staff conducted a keyword search for "environment!" in an electronic database. The search was limited to articles published from August 1, 2010, until July 31, 2011, in the law reviews from the top 100 *U.S. News and World Report*-ranked law schools and the top 50 Washington & Lee School of Law-ranked environmental law journals. Student comments were excluded. The students then screened articles for consistency with the ELPAR selection criteria. Only those articles that met the threshold criteria of addressing an issue of environmental quality importance and offering a law or policy-relevant solution were included. Later in the process the readability and persuasiveness of the articles were considered, including whether the proposals were novel or creative and feasible to implement.

Through discussion and consultation, the students ultimately chose 20 articles for review by the ELPAR Advisory Board. The Advisory Board provided valuable insights to the students on article selection. Vanderbilt University Law School Professor Michael Vandenberg, ELI Senior Attorney Linda Breggin, and *ELR* Editor-in-Chief Scott Schang also assisted the students in the final selection process. Comments on the selected papers then were solicited from experts in both the private and public sectors.

On February 23, 2012, at Vanderbilt University Law School, and on April 13, 2012, on Capitol Hill, ELI and Vanderbilt co-sponsored conferences at which some of the authors of the articles and comments presented their ideas to an audience of business, government (federal, state, and local), think tank, media, and nonprofit representatives. The conferences were structured in a manner that encouraged dialogue among presenters and attendees. Audio recordings of these events are posted on the ELI and Vanderbilt University Law School ELPAR websites.

The students worked with the authors to shorten the original articles and to highlight the policy issues presented, as well as to edit the responses. Those articles and responses are presented as ELPAR, which is also the August issue of *ELR*.

For the first time in this 2012 edition, in addition to presenting the articles selected, ELPAR reports generally on the amount of environmental legal scholarship that was reviewed for this issue and the prior two years.

Linda K. Breggin, Senior Attorney, Environmental Law Institute,  
Adjunct Professor of Law, Vanderbilt University Law School

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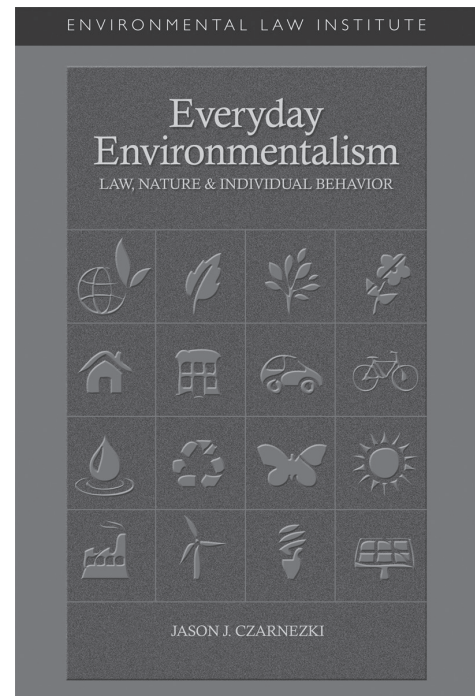
# Everyday Environmentalism: Law, Nature, and Individual Behavior

Jason J. Czarnezki

Faced with the seemingly overwhelming prospect of global climate change and its consequences, is there anything that a person can do to make a difference? “Yes, there is!” says Jason Czarnezki, in his new book, *Everyday Environmentalism*. Writing as a lawyer and environmentalist, he addresses the small personal choices that individuals can make in order to have a positive effect on the natural world.

Czarnezki compellingly describes the historical and contemporary forces in the United States that have led to a culture of “convenience, consumerism, and consumption.” He also investigates the individual decisions that have the worst environmental impacts, along with the ecological costs of our food choices and the environmental costs of sprawl.

Aware of the importance of personal choice, *Everyday Environmentalism* offers a thoughtful consideration of how public policy can positively affect individual behavior.



**Jason J. Czarnezki** is a Professor of Law in the Environmental Law Center at Vermont Law School, home to one of the nation’s leading environmental and natural resources law and policy programs. Previously, Professor Czarnezki served as a law clerk to the Honorable D. Brock Hornby of the U.S. District Court for the District of Maine and as a law clerk for the Bureau of Legal Services at the Wisconsin Department of Natural Resources. Professor Czarnezki received his undergraduate and law degrees from the University of Chicago.



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C O M M E N T

# Trends in Environmental Law Scholarship 2008-2011 (Revised April 2013)

by Linda K. Breggin, Jacob P. Byl, Lynsey R. Gaudio, Seamus T. Kelly,  
and Michael P. Vandenberg

Linda K. Breggin is a Senior Attorney with the Environmental Law Institute and an Adjunct Professor at Vanderbilt University Law School. Jacob P. Byl and Seamus T. Kelly are students at Vanderbilt University Law School. Lynsey R. Gaudio is a Research Associate at the Environmental Law Institute. Michael P. Vandenberg is Professor of Law and Co-Director of the Energy, Environment and Land Use Program at Vanderbilt University Law School.

The Environmental Law and Policy Annual Review (ELPAR) is published by the Environmental Law Institute's (ELI's) *Environmental Law Reporter* in partnership with Vanderbilt University Law School. ELPAR provides a forum for the presentation and discussion of the best ideas about environmental law and policy from the legal academic literature.

As part of the article selection process each year, Vanderbilt University Law School students assemble and review the environmental law articles written in the past year. In this Article, we draw on the results of the ELPAR article selection process to report on trends in environmental legal scholarship for academic years 2008-2009, 2009-2010, and 2010-2011.

Specifically, this Article reports on the number of environmental law articles published in general law reviews and environmental law journals. We find that although the total varied somewhat from year to year, more than 450 environmental law articles were published each year during the 2008-2011 period.<sup>1</sup> In future issues, ELPAR will track additional data, such as author affiliations, environmental topics, and student scholarship, for the articles reviewed each year. The goal is to provide an empirical snapshot of the environmental legal literature and to track trends over time.

## Methodology

A detailed description of the methodology is posted on the Vanderbilt University Law School and Environmental Law Institute ELPAR websites.<sup>2</sup> In brief, the ELPAR Editorial Board and Staff start with a keyword search for "environment" in an electronic legal scholarship database. The search is limited to articles published from August 1 of the prior year to July 31 of the current year, roughly corresponding to the academic year. The search is conducted in law reviews from the top 100 law schools as ranked by *U.S. News and World Report* in its most recent report and environmental law journals as listed most recently by Washington & Lee University School of Law, with certain modifications. Articles without a connection to the natural environment (e.g., "work environment" or "political environment") are removed, as are book reviews and eulogies. Non-substantive symposia introductions, case studies and editors' notes also are removed. In addition, student scholarship is removed. We recognize that all ranking systems have shortcomings and that only examining top journals imposes limitations on the value of our results. Nevertheless, this approach provides a snapshot of leading scholarship in the field.

The keyword search is the first step in the process of selecting articles for inclusion in ELPAR each year. The full process is described in the letter that introduces this issue

1. Our results are somewhat higher than the results of other similar studies. See, e.g., Dan Tarlock, *Is a Substantive, Non-Positivist United States Environmental Law Possible?*, 1 MICH. ENVTL. & ADMIN. L. 157, 168 n.39 (2012) ("The editors of the *Land Use & Environment Law Review*, which reprints the best ten to eleven articles in these two related fields . . . reported in 2010 that they started with a list of 300 plus articles."); see also Richard J. Lazarus, *Environmental Scholarship and the Harvard Difference*, 23 HARV. ENVTL. L. REV. 327 (1999).

2. *Environmental Law & Policy Annual Review*, VAND. L. SCH., <http://law.vanderbilt.edu/academics/academic-programs/environmental-law/environmental-law-policy-annual-review/index.aspx> (last visited Feb. 25, 2013); *Environmental Law & Policy Annual Review*, ENVTL. L. INST., [http://www.eli.org/program\\_areas/environmental\\_law\\_policy\\_review.cfm](http://www.eli.org/program_areas/environmental_law_policy_review.cfm) (last visited Feb. 25, 2013).

of ELPAR. For purposes of tracking trends in environmental scholarship, the next step is to cull the list generated from the initial search in an effort to ensure that the list contains only those articles that qualify as environmental law articles.

Determining whether an article qualifies as an environmental article is more of an art than a science, and our conclusions should be interpreted in that light. We have attempted, however, to use a rigorous, transparent process. Specifically, an article is considered an “environmental law article” if environmental law and policy are a substantial focus of the article. The article need not focus exclusively on environmental law, but environmental topics should be given more than incidental treatment and should be integral to the main thrust of the article. Many articles in the initial pool, for example, address subjects that influence environmental law, including administrative law topics (e.g., executive power and standing), or tort law topics (e.g., punitive damages). Although these articles may be considered for inclusion in ELPAR, they are not included for purposes of tracking environmental law scholarship because the main thrust of the articles is not environmental law.

The ELPAR Editorial Board and Staff work in consultation with the course instructors, Professor Michael P. Vandenberg and ELI Senior Attorney Linda K. Breggin, to determine whether articles should be considered environmental law articles for purposes of tracking scholarship. The articles included in the total for each year are identified on lists posted on the Vanderbilt University Law School and ELI ELPAR websites.<sup>3</sup>

### Data Analysis on Environmental Legal Scholarship

During the 2010-2011 ELPAR review period (July 31, 2010 to August 1, 2011), 512 environmental law articles written by professors or practitioners were published in top law reviews and environmental law journals. This is an increase of 8 percent over the 475 articles in the previous ELPAR review cycle (2009-2010). In contrast, 455 articles were published in the 2008-2009 review cycle. Of the 512 total environmental law articles in 2010-2011, 432 were published in journals that focus on environmental law and 80 were published in general law reviews.

**Number of Environmental Law Articles by Year**



	2008-2009	2009-2010	2010-2011
General Law Reviews	47	97	80
Environmental Law Journals	408	378	432
Total	455	475	512

Note: Number of environmental law articles published in legal journals during review cycle from August 1 to July 31 of the following year. The ELPAR universe consists of the general law reviews published by the top 100 law schools as ranked that year by *U.S. News & World Report* and environmental law specialty journals as categorized by Washington & Lee University School of Law. See methodology section for more details.

3. *Id.*



A R T I C L E

# Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization

by Jonathan H. Adler

Johan Verheij Memorial Professor of Law and Director of the Center for Business Law  
and Regulation, Case Western Reserve University School of Law.

## Introduction

The scope, complexity, and potential costs of global climate change are daunting. Without concerted efforts by nearly all nations to drastically reduce net greenhouse gas (GHG) emissions, atmospheric concentrations will likely double pre-industrial levels before century's end.<sup>1</sup> President Barack Obama and congressional leaders have endorsed an ambitious target for greenhouse gas emission reductions of 80% by the year 2050.<sup>2</sup> Meeting this goal would require that the United States emit less carbon dioxide than at any point in nearly a hundred years—while accommodating a much larger and much wealthier population. This will be exceedingly difficult to do, both practically and politically.

If the United States is to come anywhere close to the “80 by 50” target, substantial innovation in energy and climate related technologies is necessary.<sup>3</sup> And yet there is doubt whether such innovation is something dominant innovation policy tools can deliver. Neither traditional federal support for research and development of new technologies nor command-and-control regulations are likely to spur sufficient innovation. Nor is there reason to believe a proposed cap-and-trade system will do the trick. Such tools have not shown themselves capable of affecting dramatic technological innovation.

In the climate change context, traditional policy tools such as grants, regulatory controls, and intellectual property are likely insufficient to generate desired levels of invention, innovation, and diffusion.<sup>4</sup> Presently, there are

no meaningful economic incentives to develop technologies that reduce GHG emissions or remove carbon from the atmosphere.

Meeting the climate policy challenge will require policymakers to expand their policy toolkit. Specifically, the federal government should shift a substantial portion of climate-related research and development funding from grants to prizes. Instead of doling out billions to researchers in the hope they will invent something that will help solve the global warming challenge, the government should offer substantial rewards to those who invent or develop technologies that solve particular climate-related problems. While no policy guarantees technological innovation, greater reliance on inducement prizes would increase the likelihood of developing and deploying needed technologies in time to alter the world's climate future.

## I. The Climate Policy Challenge

Atmospheric stabilization requires global action. Yet climate change presents the ultimate commons problem on a planetary scale. No country has much incentive to reduce its emissions without assurance that other nations will follow. Those countries most essential to controlling global emissions—the United States and China in particular—have the least incentive to act.<sup>5</sup> Furthermore, so long as reducing greenhouse gas emissions is costly, most nations are unlikely to undertake meaningful emission reduction efforts.<sup>6</sup>

---

*The complete version of this Article was originally published in 35 HARV. ENVTL. L. REV. 1 (2011). It has been excerpted with permission.*

1. See INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC), CLIMATE CHANGE 2007: SYNTHESIS REPORT; FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 45 (2007).
2. See *The Obama-Biden Plan Agenda, Energy & Environment*, CHANGE.GOV, [http://change.gov/agenda/energy\\_and\\_environment\\_agenda](http://change.gov/agenda/energy_and_environment_agenda).
3. See *infra* Part I.
4. See Adam B. Jaffe, Richard G. Newell & Robert N. Stavins, *Technological Change and the Environment*, in 1 HANDBOOK OF ENVIRONMENTAL ECO-

- NOMICS, 464-65 (Karl-Göran Maler & Jeffery R. Vincent eds., 2003) (distinguishing between invention, “the first development of a scientifically or technically new product or process,” innovation, “when the new product or process is commercialized” or “made available on the market,” and diffusion, when an innovation becomes “widely available for use in relevant applications through adoption by firms or individuals”).
5. See Cass R. Sunstein, *The World vs. the United States and China? The Complex Climate Change Incentives of the Leading Greenhouse Gas Emitters*, 55 UCLA L. REV. 1675, 1678-90 (2008); see also Robert W. Hahn, *Climate Policy: Separating Fact From Fantasy*, 33 HARV. ENVTL. L. REV. 557, 566 (2009).
6. See ROGER PIELKE JR., THE CLIMATE FIX: WHAT SCIENTISTS AND POLITICIANS WON'T TELL YOU ABOUT GLOBAL WARMING 46 (2010).

Technological innovation is necessary to make climate stabilization achievable and affordable. The price tag associated with greenhouse gas emission limits has discouraged the adoption and enforcement of emission limits. Developing nations, in particular, have made clear they will not adopt climate policies that hamper economic growth.

The level of technological innovation necessary to make atmospheric stabilization an affordable—and therefore politically viable—proposition is unlikely to happen without government intervention. The competitive pressures of a market economy provide substantial incentives for firms to increase efficiency, but not to reduce GHG emissions, as such. Because GHGs are emitted into the atmospheric commons, there is no direct economic incentive to reduce such emissions, and little market for GHG-limiting innovations. This is the problem technology inducement prizes could solve.

## II. Innovation-Inducing Prizes

The idea behind technology inducement prizes is simple: incentives matter. If the goal is greater effort toward solving a particular problem, then one way to achieve that goal is to provide economic incentives for individuals to act accordingly. Inducement prizes do this by offering rewards for pre-specified scientific or technological achievements, such as the solution to a mathematical problem, a device or method to perform a particular function within given parameters, or the completion of a particular task.<sup>7</sup> Like patents, prizes offer the promise of a greater economic return than that which would be obtained in a competitive market.<sup>8</sup> With a patent, the increased return is provided by the monopoly right. With a prize, the increased return comes from the value of the prize itself.

One virtue of the patent system that prizes simulate is decentralization.<sup>9</sup> Because technological innovation is unpredictable, can arise from unexpected directions, and may involve a degree of serendipity, prizes have a distinct advantage over centrally allocated research grants insofar as they do not preclude potentially promising directions for innovation.<sup>10</sup> Decentralized systems are also more able to draw from a wider pool of ideas and potential innovators.<sup>11</sup> By offering a potential award to all comers, prizes encourage diverse research and innovation strategies, and

allow for the success of outliers.<sup>12</sup> Inducement prizes allow the government to establish a goal without being prescriptive as to how that goal should be met or who is the best position to meet it.<sup>13</sup> Further, with a prize there is no need to apply for a government grant, comply with complex eligibility requirements, or ingratiate oneself with grant-making authorities.<sup>14</sup>

Prizes have the capacity to stimulate increased investment in a given technological problem from a wide range of sources. Because the prize is a competition, multiple innovators may invest in trying to obtain the prize.<sup>15</sup> Competitors may also be motivated by prestige and publicity.<sup>16</sup> As a consequence, prizes “can stimulate philanthropic and private-sector investment that is greater than the value of the prize.”<sup>17</sup> One value of the patent system that prize systems do not duplicate is the added incentive for commercialization of an innovation.<sup>18</sup> A prize winner, however, may receive the prize simply for the invention itself. In order to avoid this potential problem, prize specifications can include criteria to ensure potential marketability.

Prizes can also be particularly important to spur investment in technological innovations that would be of primary benefit to low-income consumers and people in developing nations. Few profit-seeking firms are likely to make significant investments in serving such markets. Few firms see massive profit opportunities in developing low-carbon energy options for developing nations. Yet, the welfare benefits from improved energy efficiency and a less carbon-intensive development path in much of the world could be quite substantial.

Technology inducement prizes are particularly well suited for climate change policy. Climate change policy depends less upon additional basic research than the development and deployment of practical technological innovations, and the utility of such innovations can be readily evaluated. While there are substantial market incentives encouraging the development of environmentally friendly technologies in other contexts, the commons nature of the climate problem and lack of a price on carbon emissions discourages optimal private investment in climate-related innovation.

## III. Prize History

Prizes for scientific and technological innovation used to be common. Prizes were awarded for basic science just as for technical advance, from mathematics to food preservation, alkali production to air travel. Among the most famous

7. See generally Brian D. Wright, *The Economics of Invention Incentives: Patents, Prizes and Research Contracts*, 73 AM. ECON. REV. 691 (1983).

8. See Kenneth W. Dam, *The Economic Underpinnings of Patent Law*, 23 J. LEGAL STUD. 247, 250 (1994).

9. See Peter S. Menell & Suzanne Scotchmer, *Intellectual Property Law*, in HANDBOOK OF LAW & ECONOMICS 1473, 1477 (A. Mitchell Polinsky & Steven Shavell eds., 2007).

10. According to William Baumol, “the independent innovator and the independent entrepreneur have tended to account for most of the true, fundamentally novel innovations.” William J. Baumol, *Education for Innovation: Entrepreneurial Breakthroughs vs. Corporate Incremental Improvements 5* (Nat’l Bureau of Econ. Research, Working Paper No. 10578, 2004).

11. *Id.*; see also NAT’L ACAD. OF SCI., INNOVATION INDUCEMENT PRIZES AT THE NATIONAL SCIENCE FOUNDATION 13 (2007) (“[C]ompared with grant programs, prize programs may be expected to attract more individuals, informal teams, and for-profit firms of various sizes and perhaps not as many academic institutions.”).

12. See Thomas Kalil, *Prizes for Technological Innovation*, Hamilton Discussion Paper 2006-08, The Brookings Institution, at 5 (Dec. 2006).

13. See *Id.*

14. See SUZANNE SCOTCHMER, INNOVATION AND INCENTIVES 41-42 (2004).

15. See John F. Duffy, *Rethinking the Prospect Theory of Patents*, 71 U. CHI. L. REV. 439 (2004).

16. See MCKINSEY & COMPANY, “AND THE WINNER IS . . .”: CAPTURING THE PROMISE OF PHILANTHROPIC PRIZES 19, 26 (2009).

17. See Kalil, *supra* note 12, at 7.

18. See generally F. Scott Kieff, *Property Rights and Property Rules for Commercializing Inventions*, 85 MINN. L. REV. 697 (2001).

prizes was the British government's longitude prize, which led to the development of a revolutionary clock that aided navigation.<sup>19</sup> Despite the success of prizes in the 18th and 19th centuries, they gradually went out of favor. However, the 1990s saw a "renaissance" of prize awards, largely funded by private philanthropists.<sup>20</sup> The X-Prize Foundation created the "Ansari X-Prize," an award of \$10 million for the private development of a reusable, manned spacecraft. In 2004, a team bankrolled by Microsoft co-founder Paul Allen claimed the prize for their SpaceShipOne, which managed to make two suborbital flights in less than two weeks. Although only \$10 million was awarded, the prize spurred over \$100 million in privately funded research.<sup>21</sup>

The federal government has also showed a renewed interest in prizes. In 2005, Congress directed the National Science Foundation (NSF) to begin utilizing "innovation inducement prizes" with portions of its annual appropriations.<sup>22</sup> The NSF arranged for a study on how it could administer prizes to "achieve novel solutions to specified social or research needs or capitalize on recognized research opportunities."<sup>23</sup> The resulting report, published in 2007, concluded there are "many possibilities for employing innovation inducement prizes to overcome technical and scientific challenges in low-carbon energy supply, demand, and storage technologies."<sup>24</sup> The Obama Administration has also shown interest in the use of prizes.<sup>25</sup>

#### IV. Prizes Versus Grants

Additional funding of energy-related research and development will be necessary to spur the technological innovation necessary to reduce GHG emissions.<sup>26</sup> However, both public and private investment in such R&D has declined over the past few decades,<sup>27</sup> as has the number of patents issued for energy-related technologies.<sup>28</sup> Energy R&D accounted for approximately 25% of nondefense federal R&D spending in the 1970s, but was only 7% in 2008.<sup>29</sup> The question

is less whether there should be more R&D funding, but the form such funding should take.<sup>30</sup>

Traditional grant-driven funding for R&D has several limitations.<sup>31</sup> First, decisions about projects or efforts to fund are centralized, limiting the range of promising ventures that receive funding while increasing the risk that research funding will not result in useful technological innovations. Second, with ex ante grants, the government pays for R&D whether or not the R&D produces anything of value. Third, grant funding is more subject to political pressure and may create negative incentives among researchers.

Prizes, like patents, impose the R&D costs of the invention on the inventors. Prize sponsors only pay for an inventor's work if she is ultimately successful.<sup>32</sup> Unsuccessful innovators, and their sponsors, are left to bear their R&D costs themselves. This has clear fiscal benefits for the government, and taxpayers.<sup>33</sup> If R&D is funded ex ante, there is no assurance that the investment will produce any benefits to the funder at all.<sup>34</sup> With prizes the financial payment is conditional upon the prize conditions being fulfilled. Provided the prize is properly designed—and a would-be innovator succeeds—the funder gets its money's worth.

The same characteristics that make innovation prizes effective discourage their use by politicians. Grant programs empower government officials to dole out funds to favored constituencies and institutional insiders. Even where efforts are made to insulate the decision-making process, grant-making officials are influenced by knowledge of who will receive grant support, and the grants go out whether or not a grant recipient delivers or a problem is solved. Prize money is only paid out if someone fulfills the preset conditions and is available to all comers, irrespective of their political influence or institutional connections.

Prizes are not without their drawbacks. Setting the appropriate level for a prize can be difficult, particularly if the prize is expected to substitute for patent protection.<sup>35</sup> A prize that is too small will fail to stimulate sufficient investment, but a prize that is too high will waste resources.<sup>36</sup> Additionally, prize systems require researchers

19. See DAVA SOBEL, *LONGITUDE* (1995).

20. See SCOTCHMER, *supra* note 14, at 44. See also MCKINSEY, *supra* note 16, at 16 (noting "prizes are booming once again" and citing increase in prizes since 2000). In 1972, President Richard Nixon proposed the use of prizes to "foster useful innovation," but Congress did not act upon his proposal. See Harry Goldsmith, *An Olympiad of Science*, 177 *SCI.* 35, 35 (July 7, 1972).

21. See MCKINSEY, *supra* note 16, at 25.

22. Science, State, Justice, Commerce, and Related Agencies Appropriations Act, Pub. L. No. 109-108, 119 Stat. 2290, 2318 (2006).

23. See NAT'L ACAD. OF SCI., *supra* note 11, at vii.

24. See *id.* at 42.

25. For example, in 2010, the White House Office of Management and Budget issued guidance to federal agencies on the use of prizes to spur technological innovation. See Memorandum from Jeffrey D. Zienst, Deputy Director for Management, Office of Management and Budget, to the Heads of Executive Departments and Agencies (Mar. 8, 2010).

26. See Gwyn Prins & Steve Rayner, *Time to Ditch Kyoto*, 449 *NATURE* 973, 974 (2007).

27. Gregory F. Nemet & Daniel M. Kammen, *U.S. Energy Research and Development: Declining Investment, Increasing Need, and the Feasibility of Expansion*, 35 *ENERGY POL'Y* 746, 746 (2007). Of note, energy R&D funding has declined, while overall R&D funding has increased. *Id.* at 747.

28. *Id.* at 749-50; see also John Alic et al., *A New Strategy for Energy Innovation*, 466 *NATURE* 316, 316 (2010).

29. See Richard G. Newell, *The Energy Innovation System: A Historical Perspective*, in *ACCELERATING INNOVATION IN ENERGY: INSIGHTS FROM MULTIPLE*

SECTORS (Rebecca Henderson & Richard Newell eds., forthcoming) (manuscript at 13). See also NAT'L ACAD. OF SCI., *LIMITING THE FUTURE MAGNITUDE OF CLIMATE CHANGE* 120 (2010) (noting decline in energy R&D as percentage of non-defense federal spending from 1980 to 2008).

30. See Newell, *supra* note 29.

31. See Alic et al., *supra* note 28, at 316.

32. In the case of patents, on the other hand, the costs of developing successful innovations are passed through to consumers.

33. As Scotchmer notes, "When innovations are funded out of general revenue, there is no guarantee that the benefits received by any individual taxpayer outweigh that taxpayer's share of the costs," if, that is, the funding generates any innovation benefits at all. See SCOTCHMER, *supra* note 14, at 38.

34. Contrary to some claims, it is unclear how much government science and R&D funding directly contribute to economic growth. See Julia Lane, *Assessing the Impact of Science Funding*, 324 *SCI.* 1273, 1273 (2009).

35. See Michael Abramowicz, *Perfecting Patent Prizes*, 56 *VAND. L. REV.* 115, 121 (2003).

36. Marlynn Wei, *Should Prizes Replace Patents? A Critique of the Medical Innovation Prize Act of 2005*, 13 *B.U. J. SCI. & TECH.* 25, 32 (2007) ("If the prize is too low, then the system will inadequately stimulate R&D investment. If the prize is too high, then costs such as resource duplication and the problem of favoritism will be exacerbated.").

to obtain funding for their research up front. For some types of research, particularly where expensive equipment is required, this can create a significant obstacle. Prizes are not well suited to situations in which the funding authority cannot articulate clear criteria upon which the prize would be awarded. For this reason, prizes are not likely well suited for the funding of basic research. In the climate change context, however, there is a need for practical innovations that are commercially viable. This makes prizes particularly well-suited for the climate policy challenge.

## V. Innovation and Regulation

Using traditional regulatory tools to drive technological innovation requires detailed knowledge about the desired course of technological change and what sorts of innovations are likely or foreseeable. Yet, government regulators rarely have the necessary information or foresight to drive innovation this way.<sup>37</sup> Even if regulators were able to identify a proper target initially, the regulatory process changes so slowly that regulatory standards would be unlikely to keep up with technological change or account for new information.

Regulatory measures often have compliance periods that are too short to induce large-scale innovation or significant technological breakthroughs.<sup>38</sup> The regulatory environment can also generate uncertainty that discourages investments in technological innovation.<sup>39</sup> Insofar as governmental commitments to future levels of regulation are of “questionable credibility,” this diminishes the incentives for innovation that environmental regulations could otherwise provide.<sup>40</sup>

Technology-based standards, in particular, can “play a key role in discouraging innovation,” as they can result in the locking-in of an administratively anointed technology, discouraging efforts to develop more advanced alternatives.<sup>41</sup> As a consequence, “technology-based standards provide the weakest incentives for both abatement tech-

nology and output technology innovation.”<sup>42</sup> Yet, even performance-based standards can discourage innovation as such standards may be based upon established reference technologies in order to facilitate implementation and enforcement. In such cases, companies and regulators are likely to prefer reference technologies they are confident will meet standards, rather than innovative approaches that are less certain.<sup>43</sup>

Market-based regulatory approaches are likely to be more effective in encouraging technological innovation than command-and-control regulations. Yet, there is little evidence that even market-oriented instruments can produce more than incremental improvements. The Clean Air Act’s acid rain program, for instance, is widely credited with achieving substantial pollution reductions at a relatively low cost, yet it does not appear to have spurred much innovation.<sup>44</sup>

## VI. A Prize Proposal

Richard Branson and other private individuals may continue to offer technological inducement prizes for climate-related innovations. These prize awards could be important, but they are unlikely to produce the degree of technological innovation necessary to achieve current climate policy goals in a cost-effective manner. Encouraging the desired level of innovation will require far more. Thomas Kalil believes that the federal government should offer \$100-200 million annually in prize awards for the innovations in zero-energy building design, reductions in urban greenhouse gas emissions, and increased development of fuel-efficient vehicles.<sup>45</sup> Yet, even this could be insufficient. If one uses the potential social benefits of averting climate change as the benchmark, the investment in technological innovation should be far greater.

The federal government currently spends approximately \$3 billion annually on research and development of climate-related technologies. The U.S. Climate Change Technology Program (USCCTP) funds research efforts into technological improvements that could potentially be achieved in the near, medium, and long term.<sup>46</sup> Projects range from vehicle and building design to fuel cell technology, agricultural methods, and carbon sequestration technologies.<sup>47</sup>

Assuming current funding levels continue, the federal government will spend approximately \$30 billion on

37. See Hahn, *supra* note 5, at 580 (“The regulator typically lacks the kind of information needed to set standards appropriately for forcing innovation.”); Gary E. Marchant, *Sustainable Energy Technologies: Ten Lessons From the History of Technology Regulation*, 18 WIDENER L.J. 831, 836 (2009) (“[I]t is difficult to predict the ingenious and creative innovations” scientists and inventors might develop.).

38. See Kenneth J. Arrow et al., *A Statement on the Appropriate Role for Research and Development in Climate Policy*, ECONOMISTS’ VOICE 3, Feb. 2009.

39. See Newell, *The Energy Innovation System*, *supra* note 29, at 15-16 (noting research showing that changing regulatory conditions and uncertainty can dampen private-sector investment in technological innovation).

40. See Marchant, *supra* note 37, at 848.

41. See ENVIRONMENTAL LAW INSTITUTE, BARRIERS TO ENVIRONMENTAL TECHNOLOGY INNOVATION AND USE 7 (Env’t. L. Inst., 1998). This report further explains, “Emission limits or discharge standards based on a single best technology create practical barriers to innovation by limiting permissible technologies to available ones that meet the standard. This requirement precludes the normal development and refinement processes most technologies need to achieve their best performance and, in many cases, can limit permissible technologies to a single one.” *Id.* See also Adam Jaffe, Richard G. Newell, and Robert N. Stavins, *Environmental Policy and Technological Change*, ENVTL. & RESOURCE ECON. 41, 50 (2002).

42. Wesley A. Magat, *The Effects of Environmental Regulation on Innovation*, 43 LAW & CONTEMP. PROBLEMS 4, 21 (1979).

43. See U.S. OFFICE OF TECH. ASSESSMENT (OTA), INNOVATION AND COMMERCIALIZATION OF EMERGING TECHNOLOGIES 87 (1995).

44. See David M. Driesen, *An Environmental Competition Statute*, in BEYOND ENVIRONMENTAL LAW: POLICY PROPOSALS FOR A BETTER ENVIRONMENTAL FUTURE 175-76 (Alyson C. Flournoy & David M. Driesen eds., 2010).

45. See Kalil, *supra* note 12, at 9.

46. The U.S. Climate Change Technology Program (USCCTP) defines “near-term” as less than 20 years, “mid-term” as 20-40 years, and “long-term” as more than 40 years. USCCTP, U.S. DEPT’ OF ENERGY, U.S. CLIMATE CHANGE TECHNOLOGY PROGRAM, STRATEGIC PLAN 211 (Sept. 2006), available at <http://www.climatechange.gov/stratplan/final/index.htm>.

47. *Id.*

climate-related technologies over the next decade. If the federal government committed one-third of USCCTP funding—either reallocating it from traditional R&D or augmenting it with a new revenue source—it would have sufficient resources to endow a series of substantial climate prizes. With \$10 billion over 10 years, the USCCTP, or another agency such as ARPA-E, could endow prizes across the range of technologies the USCCTP has identified as priorities for climate change policy. This amount is significantly less than the estimated potential social welfare losses of climate change, and yet would substantially increase the incentives for needed technological innovation.

Due to the potential for prize awards to spur greater levels of private research, as what occurred with the Ansari X-Prize, reallocation of USCCTP funding in this way would produce a substantial increase in overall investment into climate-friendly technologies.<sup>48</sup> Equally important, the announcement of prizes of this magnitude would draw additional attention to the need for climate-related research and increase the prestige of developing climate-related technologies. A high-profile government investment in prizes would underscore the importance of climate-friendly technological innovation.<sup>49</sup>

Developing specific prize criteria is particularly important.<sup>50</sup> The USCCTP's matrix of technological goals and projected time frames for development could serve as the basis for prize specifications, but would need to be refined if used for prizes instead of traditional R&D. Either the USCCTP or some other entity, such as the National Academy of Sciences or National Academy of Engineering, could assemble an expert panel of researchers, scientists and engineers to identify which technological goals are most suited to the use of prizes. Such a panel would also have to devote considerable time to developing prize specifications with sufficient detail to ensure that winning innovations would be worth the public investment, but with enough flexibility so as not to preclude new ways of solving existing problems.<sup>51</sup> It is also important that prize criteria are clear and objectively measurable.<sup>52</sup> The panel would also have to determine the size of prize awards, and whether there would be multiple or shared awards in any given area. In some cases, structuring prizes to divide

awards proportionately may increase entry rates and generate additional innovation.<sup>53</sup>

The recent NAS report on the prospective use of innovation inducement prizes by the National Science Foundation reviewed many of the prospective implementation questions for government administered prize program.<sup>54</sup> Among other things, the NAS stressed the need to design prizes around objectively measurable outcomes and endorsed “first past the post” prizes with set time limits.<sup>55</sup> The NAS also recommended that the federal government should not seek to own, control or influence the disposition of intellectual property resulting from a prize competition, unless the winner does not seek to commercialize resulting innovations within a reasonable time period.<sup>56</sup> The NAS suggested the possibility that prize awards include a stipulation requiring good faith efforts to commercialize resulting innovations or even forced licensing, but urged against requiring that such intellectual property be made available at no cost or on concessional terms.<sup>57</sup>

It would also be important to examine whether additional incentives would need to be created to encourage diffusion of the relevant technology. One possibility would be for prizes to include advance market commitments, through which a government commits in advance to purchase of a given quantity of an innovation that meets predetermined characteristics.<sup>58</sup> So, for instance, the federal government could commit to purchase a given number of automobiles that meet or exceed a given fuel efficiency or emissions-per-mile standard, creating additional incentives to translate new inventions in to commercially viable products. The potential for government procurement appears to enhance the incentives for defense-related technologies.

As the Office of Management and Budget noted in 2010, federal agencies, including the Department of Energy, already have some ability to fund technology inducement prizes out of existing appropriations. It would be a mistake to leave prizes to the administrative process, however. The same political pressures that can distort traditional R&D funding are likely to discourage the diversion of funds from R&D grant programs to prizes. Without a direct statutory mandate, agencies are more likely to talk about prize competitions than they are to implement them.<sup>59</sup>

Congress should mandate that specific agencies develop prizes and specify the minimum degree of funding such prizes should receive out of agency appropriations. Congress should also identify, in broad terms, the purposes for which prizes should be used, as well as to require the appointment of outside expert panels to assist in the prize

48. It is also possible that the creation of prizes would not require an equal offset of existing USCCTP funding, as prize awards would not be paid out unless and until the necessary innovations were developed and proven.

49. See MCKINSEY, *supra* note 16, at 21 (discussing potential for prizes to change public perception); *id.* at 22 (discussing ability of prizes to focus a community's efforts on a specific problem).

50. X-Prize Foundation Chairman and CEO Peter Diamandis testified before Congress that “writing the rules is more than 80 percent of the battle.” *NASA Contests and Prizes: How Can They Help Advance Space Exploration?: Hearing Before the Subcomm. on Space and Aeronautics of the H. Comm. on Sci.*, 108th Cong. 29 (2004) (statement of Dr. Peter H. Diamandis, Chairman & CEO, X-Prize Foundation).

51. See MCKINSEY, *supra* note 16, at 39-45 (discussing the goal setting process for prize competitions).

52. See MCKINSEY, *supra* note 16, at 54 (noting “objectivity and simplicity are the biggest challenges” in drafting prize criteria).

53. See Timothy N. Cason, William A. Masters, and Roman M. Sheremeta, *Entry Into Winner-Take-All and Proportional Prize Contests: An Experimental Study*, 94 J. PUB. ECON. 604 (2010).

54. See NAT'L ACAD. OF SCI., *supra* note 11, at 18-39.

55. *Id.* at 21.

56. *Id.* at 33.

57. *Id.*

58. See Kalil, *supra* note 12, at 5.

59. Although the NAE recommended consideration of prizes in 1999, the NSF did not even consider using prizes until required to by federal statute many years later. See NAT'L ACAD. OF SCI., *supra* note 11.

development process. Directed statutory authorization of this sort could ensure that agencies pursue the potential of prizes to assist with the climate change challenge. It would also further underscore that climate-friendly technological innovation is a national priority.

## Conclusion

Prizes are no panacea.<sup>60</sup> Indeed, barring some serendipitous discovery, there is no panacea for the climate policy challenge. Yet, technology inducement prizes offer a relatively low cost way to encourage greater innovation than traditional grant-based R&D funding. Prizes alone will not solve the problem. Indeed, in order to encourage greater levels of technological innovation it would also be desirable to reduce existing regulatory barriers to the development and deployment of alternative technologies as well as to place a price on carbon, ideally with a simple and

straight-forward carbon tax. Combined with prizes, such measures could create a more favorable environment for climate-friendly innovation. But without prizes, or some other enhanced incentive for technological innovation, the necessary technological breakthroughs are much less likely to materialize.

Prizes have a peculiar virtue of imposing costs only to the extent they produce results, so there is room to be ambitious. Assuming the worst climate policy scenarios only strengthens the case for large climate policy prizes. Rather than funding 10 who will try, the government needs to incentivize hundreds and reward the one who succeeds. As the patent system demonstrates, the hope of a large financial windfall is a powerful inducement for innovation. There has been lots of talk about prizes in recent years, but not much action. Now, it is time to up the ante for climate innovation with federally funded climate prizes.

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60. See David C. Mowery, Richard R. Nelson, & Ben R. Martin, *Technology Policy and Global Warming: Why New Policy Models Are Needed (or Why Putting New Wine in Old Bottles Won't Work)*, 39 RES. POL'Y 1011, 1021 (2010) (noting potential drawbacks of inducement prizes in the energy context).

## R E S P O N S E

# Prizes Versus Patents: A Comment on Jonathan Adler's *Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization*

by Timothy J. Brennan

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As an economist, I would have thought that my profession would have settled the questions regarding the merits of prizes. After all, if there's one thing that defines modern economics, it's that incentives matter, and a prize is as obvious an incentive as one could imagine.

It turns out that in many ways economists have dropped this ball. The good news is that we have a plethora of models of incentives to induce innovation. The bad news is that these models typically don't allow one to understand which incentive to choose. The economics of innovation typically treats winning a patent as the equivalent of winning a prize, where the reward for getting a patent is the profit the winning innovator<sup>1</sup> can extract from the exclusive right to produce a particular item or utilize a particular process.<sup>2</sup> What little there is on this question primarily involves the theoretical benefits and practical problems with having the government buying out patent holders and providing the relevant products and processes at marginal cost rather than at the high price protected by the patent monopoly.<sup>3</sup> Much of this is motivated by concerns not from climate but in wanting to make patented pharmaceuticals available in very poor countries where the residents are utterly unable to pay the monopoly price.<sup>4</sup>

This is why Professor Adler's insights on prizes are valuable—they contribute to filling a gap that one might not expect needed to be filled.<sup>5</sup> The compelling question is why we might need to supplement or replace the patent system with a set of specific prizes.<sup>6</sup> Adler claims that the current system is inadequate, but before moving to prizes, we need to understand why. Economic “patent buyout” analyses mentioned above do not really provide an answer. First and foremost, publicly-funded prizes—think of U.S. Department of Energy contests for solar powered vehicles—typically do not require that winners or contestants cede any patent rights. With privately-funded prizes—think of the Netflix prize for improving its film recommendation algorithm—any patent rights might be transferred or licensed to Netflix, but there is no obligation to give the public a free license to use the prize-winning results.

Even if prizes were redesigned to look more like patent buyouts, they would not avoid a number of implementation problems. First, and to an economist foremost, the funds used to cover the cost of payments to buy out patents (or to fund prizes) requires taxes that generally necessitate setting prices above marginal cost, as that's where the revenue comes from. At least qualitatively, one has to question whether it makes sense to distort prices in other markets to fund buyouts just to get prices closer to marginal cost for selected products and processes.<sup>7</sup> In addition, patent

1. I'll ignore the first-to-file versus first-to-innovate distinction, in part because the United States' outlier role in adopting the former is due to shrink if not disappear following recent legislation amending patent law.
2. SUZANNE SCOTCHMER, INNOVATION AND INCENTIVES (2004); Michael Baye and Heidrun Hoppe, *The Strategic Equivalence of Rent-Seeking, Innovation, and Patent-Race Games*, 44 GAMES & ECON. BEHAV. 217 (2003).
3. Brian Wright, *The Economics of Invention Incentives: Patents, Prizes and Research Contracts*, 73 AM. ECON. REV. 69 (1983); Steven Shavell & Tanguy van Ypersele, *Rewards vs. Intellectual Property Rights*, 44 J.L. & ECON. 525 (2001); Michael Abramowicz, *Perfecting Patent Prizes*, 56 VAND. L. REV. 114 (2003).
4. Michael Kremer, *Patent Buyouts: A Mechanism for Encouraging Innovation*, 113 Q. J. ECON. 1137 (1998); Marlynn Wei, *Should Prizes Replace Patents: A Critique of the Medical Innovation Prize Act of 2005*, 13 B.U. J. SCI. & TECH. L. 25 (2007); Aidan Hollis, *The Health Impact Fund: A Useful Supplement to the Patent System?*, 1 PUB. HEALTH ETHICS 124 (2008).

5. Jonathan H. Adler, *Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization*, 42 ELR 10713 (Aug. 2012).
6. Much of the discussion here comes from Timothy J. Brennan, Molly K. Macauley and Kate Whitefoot, *Prizes, Patents and Technology Procurement: A Proposed Analytical Framework*, RESOURCES FOR THE FUTURE 11-21 (Discussion Paper, May 2011), available at <http://www.rff.org/RFF/Documents/RFF-DP-11-21.pdf>.
7. A current policy discussion is over the virtues of using carbon taxes to contribute to the public treasury in general. The primary virtue is that if carbon used in fossil fuels is underpriced because environmental harms, particularly from climate change, are not incorporated in the price, then a carbon tax comes closer to getting prices right in the economy rather than force a gap between prices and marginal cost. Whether revenues raised from a carbon

buyouts run the risk of the government being stuck with “lemon” patents, since sellers who believe they have valuable patents may be less likely to accept a buyout. Last and not least, a widespread system for having the government pay for patents introduces a distinction between what the agencies in charge of such a program want to fund and what would have the greatest economic value, at least as indicated by success in the marketplace.

Of course, marketplace success will fail to indicate the value of a particular innovation if its benefits accrue to the public at large rather than just to its buyers and sellers. Mitigating climate change would be just such a public benefit. In theory, we might best address it by having prices incorporate climate-related costs through carbon tax or cap and trade programs and then letting innovators proceed from the right starting point. But as long as getting prices right is politically infeasible, special programs to induce climate innovation have a strong case.

Professor Adler’s discussion of the merits of prizes over research grants speaks to this point, but I am not as sure as he is regarding the advantages of the former over the latter. In his view, a first limitation of grants is that they are centralized and limit “the range of promising ventures that receive funding.” However, a defining feature of innovation inducement prizes is that they are centralized (by whomever decides to offer the price) and exceedingly limiting, requiring *ex ante* what Thomas Kalil has called “victory conditions” necessary to ensure that the prize award is not subject to uncertainty and *ex post* dispute.<sup>8</sup> Adler also argues that grant funding is subject to political pressure, but it is not obvious that the peer review process underlying grant funding is more subject to manipulation than agency decisions regarding prizes and their associated awards. Finally, he notes that winners of grants get their costs covered but, as explained below, a crucial advantage of prizes is that they also minimize risk to innovators, but on the reward side—you get the prize regardless of ultimate value—rather than on the cost side.

That returns us to the question of prizes versus patents. A number of arguments rely on potential institutional considerations. Among these are:

- Winning a prize may convey publicity benefits, a sense of social contribution, or simply the fun of a contest that getting a patent does not convey.
- A prize can be designed to provide rewards along the way or to second and third prize winners, offering encouragement and risk management options that a winner-takes-all patent does not allow.
- Those offering a prize can manage contestants by determining eligibility and encouraging information sharing and teaming, trading off the benefits of competition against the rewards of avoiding redun-

dant research efforts and perhaps achieving more timely success.

- Rewarding prizes, particularly with precise victory conditions, avoids potential validity and infringement litigation often found with patents.

Perhaps, the most significant institutional consideration is that not all innovations are patentable. Not only are there evolving interpretations of what it means to be “any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof.”<sup>9</sup> Prizes can be awarded for ideas or achievements that are not patentable. One could not get a patent for the idea of clocks sufficient for accurate ocean-going navigation, flying solo across the Atlantic, suborbital flight or a car getting a hundred miles per gallon, all of which have been the subject of prizes over the centuries.<sup>10</sup> One can easily imagine giving prizes for meeting an emissions mitigation goal that in and of itself is not patentable, although the devices used to meet that goal may well be.

With regard to economic fundamentals, apart from institutional considerations, two aspects differentiate prizes from patents. The first is generality versus specificity. A prize is for a particular accomplishment specified in advance, while one can get a patent for anything that meets the relevant statutory definition. A second involves risk. With patents, an innovator bears three related types of risk resulting from uncertainty regarding (i) the probability she will win the patent, (ii) how much it will cost to obtain that patent, and (iii) the profits she will reap from obtaining the patent. As Professor Adler points out, those seeking prizes bear the first two types of risk, although with contests awarding prizes for reaching various stages of the contest, some of that risk may be mitigated. However, having a prize reduces variance in the returns from winning the innovation race, and thus will generally shift risk from the innovators to its value to the funder of the prize.<sup>11</sup>

In short, an innovation inducement system would perform better with prizes rather than patents the more particular are one’s goals and the more risk-averse is the community of potential innovators. The system would work better by continuing to rely on patents to the extent that goals are not known in advance and that the innovation community is willing to take on risk. This leaves two other possibilities. If the goals are not known (normally favoring patents) but the risks in achieving the innovation are high (normally favoring prizes), grant funding may be the best option, where innovators propose projects and the funder mitigates risk through covering or sharing costs. If the goals are known (normally favoring prizes) but the

tax should be used to fund other government programs or to reduce these gap-forcing taxes is likely to be a prominent part of that policy discussion.

8. THOMAS KALIL, PRIZES FOR TECHNOLOGICAL INNOVATION 20 (2006).

9. 35 U.S.C. §101.

10. Adler, *supra* note 5; Brennan et al., *supra* note 6; KALIL, *supra* note 8.

11. Strictly speaking, risk mitigation requires that variation in returns to the innovation not be (close to) perfectly correlated with variation in its up-front costs. If those are closely correlated, a decrease in those returns will be matched by a decrease in costs, leaving net profits unchanged. In portfolio language, the returns in that case would be a hedge against costs, and making them constant through a prize would expose potential innovators to more risk.



risks are relatively low (normally favoring patents), one might adopt a more market-based approach to procuring the innovation.

Laying out a more precise theory of these tradeoffs remains to be done—with no guarantee that mathematically formal results can be translated into useful policy

guides. But there is surely value in describing gaps in the innovation portfolio, particularly with regard to climate change, that prizes can fill. In that regard, Professor Adler's contribution to the discussion is highly important as well as exceptionally insightful.

R E S P O N S E

# A Response to *Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization*

by Larry P. Cooper

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## Introduction

*Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization*,<sup>1</sup> explores the use of inducement prizes as a means to develop technology to stabilize greenhouse gas contributions to global climate change. The author, Jonathan H. Adler, presents the current state of the policy debate concerning greenhouse gases (GHG) and global climate change. The premise of the paper is that the level of technological innovation necessary to make atmospheric stabilization affordable—and therefore a politically viable proposition—is unlikely to happen without government intervention. Because GHG's are emitted into the atmospheric commons, there is no direct economic incentive to reduce such emissions and little market for GHG limiting innovations. The author states: "This is the problem technology inducement prizes could solve."<sup>2</sup>

This problem might also be solved by traditional approaches such as grants, contracts, or regulation and the author presents the case of grants versus prizes and government funded research versus regulation. The paper presents arguments as to deficiencies, merits, and drawbacks of the approaches. The author concludes that prizes are the superior approach to address GHG and presents a proposal for significant federal funding of innovation prizes to address the global climate change problem.

## I. Government Prize Authority

Recognition of the power and benefits of incentive prizes has led to several significant developments in recent years. In his September 2009 *Strategy for American Innovation*,<sup>3</sup> President Barack Obama called on all agencies to increase

their use of prizes and challenges in order to mobilize America's ingenuity to solve some of its most pressing challenges. In March 2010, the Office of Management and Budget issued a formal policy framework to guide agency leadership in using prizes to advance their core mission. In September 2010, the Administration launched Challenge.gov, a one-stop shop where entrepreneurs and citizen solvers can find public-sector prizes. Throughout, the Administration built a community of practice for agencies to share best practices and lessons learned. To date, there have been more than 150 competitions from 40 agencies generating novel solutions for childhood obesity, advanced vehicle technologies, financing for small businesses, Type 1 Diabetes, and many other national priorities.<sup>4</sup> On December 21, the U.S. Congress passed the America COMPETES Reauthorization Act of 2010, providing broad prize authority to all federal agencies. By giving agencies a simple and clear legal path, the Act makes it dramatically easier for agencies to use prizes and challenges. Prize competitions mark a dramatic departure from business as usual and are quickly becoming a standard tool in every federal agency's toolbox.

## II. Prizes for Greenhouse Gases Innovation

While the focus of the paper is on government funding for prizes, there is a considerable body of evidence that prizes can work for most organizations. I am in overall agreement with the statements concerning prizes regardless of the source of the prize funds. The author points out that unlike grants, the funder is only required to pay funds to competitors that achieve the funder's goals. Well-constructed prize competitions can also result in multiple competitors with the potential for multiple viable solutions to the problem posed. These competitors may have valuable insights not found in the traditional pool of sup-

1. Jonathan H. Adler, *Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization*, 42 ELR 10713 (Aug. 2012).

2. *Id.*

3. EXECUTIVE OFFICE OF THE PRESIDENT, NATIONAL ECONOMIC COUNCIL OFFICE OF SCIENCE AND TECHNOLOGY POLICY, A STRATEGY FOR AMERICAN INNOVATION: DRIVING TOWARDS SUSTAINABLE GROWTH AND QUALITY JOBS (Sept. 2009).

4. See Challenge.gov at <http://challenge.gov/>, for more examples.

pliers and can be parties that would never otherwise do business with the government.

One major issue in using prizes in this area is the apparent lack of economic return for most GHG technologies. As the author points out, there is no price on GHG emissions, no direct economic incentive to reduce such emissions, and consequently no meaningful market for GHG emission-reducing technologies. One of the major drawbacks of prizes is that prize systems require researchers to obtain funding for their research “up front.” This is particularly difficult when there is little prospect of future economic payoff. Later the author states, there is a need for practical innovations that are commercially viable. This would seem to be a significant disconnect that indicates prizes may not be the appropriate policy choice. Alternately, if one acknowledges that GHG emission technologies are unlikely to be driven by commercial viability, but will instead make GHG mitigation affordable and the use of policy tools such as regulation politically palatable, then prizes are indeed a viable tool.

Fortunately, there are many GHG areas that appear to hold promise of economic returns. For example, more efficient and longer-life light bulbs can provide consumers with an economic rationale for adopting new technologies. These potential benefits supported creation of the L Prize,<sup>5</sup> sponsored by the U.S. Department of Energy to spur lighting manufacturers to develop high-quality, high-efficiency solid-state lighting products to replace the common light bulb. In September 2009, the L Prize competition received its first entry, a 60-watt replacement product from Philips Lighting North America. After a rigorous evaluation process, Philips Lighting North America was officially awarded the first L Prize of \$10 million in August 2011.

Also, as shown by the 11 finalists for the Virgin Earth Prize,<sup>6</sup> many entrepreneurs are not deterred by general perceptions of lack of markets but look to create commercially viable ventures by changing the marketplace. Of particular note are those that are trying to extract carbon dioxide from the atmosphere and sell it to other industrial users. With commercial potential, funding from private sources may be much more readily available and prize purses may not need to be nearly as large as the author may believe. Indeed, where visionaries see significant realizable returns, they can invest considerably more than the value of the prize. This was true for the *Ansari X PRIZE*<sup>7</sup> where the winning team spent about twice the \$10 million purse and collectively the teams invested about \$100 million. Similarly, in the NASA-funded *Green Flight Challenge*, sponsored by

Google,<sup>8</sup> the teams collectively invested nearly four times the prize purse, and both second place teams spent more than the prize purse.

Other arguments advanced by the author in favor of prizes such as “grant making” being more subject to political pressure and creating negative incentives among researchers are less compelling. Both grant seekers and those seeking prize funding for particular causes can have incentives to exaggerate the potential of their projects. Similarly, any program, public or private, can be subject to external pressures, political or otherwise. In either case, there can be pressure to create prizes for favored industries as easily as for a grant to a “favored recipient.”

### III. The Prize Proposal

In regard to the author’s prize proposal, there is no doubt that billions for prizes would get attention. But what amount is really needed to achieve the sufficient innovation? Relatively small prizes can produce outsized results. The Virgin Earth Challenge attracted over 2,600 applications and 11 finalists have been selected for the \$25 million prize. Would offering billions for prizes lead to overinvestment and potentially wasteful spending?

The author states the “same political pressure that can distort traditional R&D funding are likely to discourage the diversion of funds from R&D grant programs to prizes.”<sup>9</sup> He argues for direct statutory mandates for development of prizes and specification of minimum degree of funding from agency appropriations. He argues that those parties who could benefit from political influence in grant awards should forgo them, instead requiring a system over which they would have diminished influence. It is unlikely that this would happen on a large scale without very strong support for prizes.

Rather than arguing for a particular amount of funding, the first steps should be identification of those areas most suited to the use of prizes, detailed work to define the prize competitions and the appropriate prize amounts, and proposals for the overall funding for the program. Congress could readily direct the undertaking of such studies as it has previously done for other national issues. The studies would lay the groundwork for debate and justification for future appropriations based on thoughtful reflection rather than the size of either the current federal R&D investment or the speculative size of social benefit from a successful innovation.

It has been my experience that prizes are not widely used because potential users are unfamiliar with them. For similar reasons, other tools such as Cooperative Research and Development Agreements are not widely used. Most

5. U.S. Dep’t of Energy, *L Prize*, <http://www.lightingprize.org/> (last visited June 16, 2012).

6. Helen Craig, *Virgin Earth Challenge Announces Leading Organisations*, <http://www.virgin.com/people-and-planet/blog/virgin-earth-challenge-announces-leading-organisations> (last visited June 16, 2012).

7. X PRIZE Foundation, *Ansari X PRIZE*, <http://space.xprize.org/ansari-x-prize> (last visited June 16, 2012).

8. Challenge.gov, *Green Flight Challenge*, <http://challenge.gov/NASA/47-green-flight-challenge> (last visited June 16, 2012).

9. Adler, *supra* note 1, at 10717.

program officers do have extensive experience with grants and contracts. There is nothing sinister in this, such as preference for political influence and rewarding favored parties, just a basic lack of understanding of the merits of prizes. When presented with the evidence, most experience an “aha” moment. Expanding the use of prizes in government is a diffusion of innovation problem. The early adopters are leading development of a community of practice and direction to agencies to identify candidate problems would likely accelerate adoption if subsequent funding were made available.

## Conclusion

While it is undoubtedly true that prizes can be a means to induce technological achievement, the author notes, “Prizes are no panacea.”<sup>10</sup> I wholeheartedly agree. Grants, contracts, and prizes can all produce technological innovation. The choice of the tool is dependent upon the circumstances. At this time, it is unknown if prizes will create a breakthrough technology but the outlook is hopeful and using all the tools at our disposal would appear to be a prudent course of action.

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10. *Id.*

## ARTICLE

# Uncertainty

by Daniel A. Farber

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### Introduction

Our society has sophisticated techniques for analyzing risks that can be modeled and quantified. But other threats—often the most serious ones—do not fit the paradigm. These threats involve what the economist Frank Knight classified as “uncertainty” (where the likelihood of the peril is nonquantifiable) as opposed to “risk” (where the likelihood is quantifiable).<sup>1</sup> Uncertainty is particularly pernicious in situations in which catastrophic outcomes are possible, but conventional decision tools are not equipped to cope with these potentially disastrous results; neither the risk analysis favored in the United States, nor the precautionary principle utilized by Europeans and others, is satisfactory in cases of uncertainty. This Article considers how we can use new advances in economics and decision theory to do better.

Economic modeling and policy analysis are often based on the assumption that extreme harms are highly unlikely, in the technical sense that the “tail” of the probability distributions is “thin”—in other words, that it approaches rapidly to zero. Thin tails allow extreme risks to be given relatively little weight. A growing body of research, however, focuses on the possibility of fat tails, which are common in systems with feedback between different components. As it turns out, determining the precise “fatness” of the tails is often difficult, which causes models involving fat tails to blur from risk into uncertainty.

This Article proposes the “ $\alpha$ -precautionary principle” for use when—because of fat tails or otherwise—decisionmakers cannot quantify risks and face Knightian uncertainty. The  $\alpha$ -precautionary principle is more nuanced than conventional versions of the precautionary principle though still remaining attentive to possible catastrophic outcomes and simple enough for easy application. For instance, the  $\alpha$ -precautionary principle suggests a highly precautionary approach to the uncertainties surrounding climate change but a less precautionary approach to the uncertainties of nanotechnology.

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1. FRANK KNIGHT, RISK, UNCERTAINTY AND PROFIT (1921). Uncertainty also played a central role in the thought of John Maynard Keynes.

The new techniques advanced in this Article occupy a middle space between conventional versions of risk assessment and the precautionary principle, using mathematical tools to help decisionmakers cope with uncertainty, but not requiring the assignment of precise probabilities when doing so would be inappropriate.<sup>2</sup>

### I. Current Approaches to Environmental Risks and Uncertainties

The regulatory system often addresses probabilistic harms. Conventional risk assessment—the dominant mode in the United States—is a powerful methodology, but over-reliance on it can lead to a failure to acknowledge any risks that do not lend themselves to the technique. Risk analysis requires that risks be quantified, but it is not always possible to obtain the necessary reliable estimates of probabilities. A focus on conventional risk analysis can therefore lead to disregard of nonquantifiable risks. This can bias decisionmaking and mislead the public about the possible consequences. Indeed, a policy of ignoring all nonquantifiable harms is literally a recipe for disaster.<sup>3</sup>

In contrast, the European Union and other nations are less wedded to quantitative risk assessment than the United States. Instead, the E.U. favors the use of the precautionary principle, which does address unqualified possible harms, but functions more as a source of sound advice than as a method of analysis.

In its most general sense, the precautionary principle advises that lack of certainty is not a justification for inaction in the face of possible risks<sup>4</sup>; more precise statements of the principle focus on situations involving nonquantifiable harms, irreversible harm, or catastrophic harm.<sup>5</sup> This principle has been explained on the basis of risk aversion

2. The fundamental research discussed in this Article is rapidly developing, and work on practical applications is at an even earlier stage. Thus, the conclusions discussed in this Article must be considered preliminary.

3. For example, apparently in the belief that a problem is not significant unless it can be precisely quantified, the Nuclear Regulatory Commission refuses to discuss the possibility of terrorist attacks on nuclear facilities in its environmental impact statements (EIS) because the risk cannot be quantified. See, e.g., Private Fuel Storage, L.L.C., 56 N.R.C. 340, 350-51 (2002). For further discussion, see Daniel A. Farber, *Uncertainty*, 99 GEO. L.J. 901, 909-14 (2011).

4. Jonathan Remy Nash, *Standing and the Precautionary Principle*, 208 COLUM. L. REV. 494, 498-99 (2008).

5. *Id.* at 502-03.

or skepticism about the environment's ability to tolerate damage.<sup>6</sup> The implication of the precautionary principle is that it is better to overregulate than underregulate new technologies—but this can actually result in more harm to public health or welfare under some circumstances.<sup>7</sup>

Despite its broad international acceptance, the precautionary principle is controversial.<sup>8</sup> There seem to be three main criticisms. The first is its vagueness, or “squish[iness].”<sup>9</sup> However, this vagueness critique may be overstated, as a number of efforts have been made to sharpen the precautionary principle in certain settings including where there is uncertainty rather than simply risk and where harm would be “catastrophic.”<sup>10</sup> A second criticism of the precautionary principle is that government intervention creates risks of its own.<sup>11</sup> A third criticism connects the precautionary principle with defects in human cognition. Cass Sunstein has argued that when the precautionary principle “seems to offer guidance, it is often because of the operation of probability neglect,”<sup>12</sup> meaning the cognitive incapacity of individuals to attend to the relevant risks.<sup>13</sup> Supporters of the precautionary principle respond that it is actually needed to counter defects in the ways people process probability information. Rather than being part of the problem of limited human rationality, the precautionary principle may be part of the treatment.<sup>14</sup>

While the debate will continue, it may be possible to find consensus on narrower ground, particularly as to a special form of precaution for the uncertainty associated with catastrophic risks. Sunstein, for instance, though a critic of the precautionary principle, nonetheless recognizes that catastrophic risks may be different.<sup>15</sup> He proposes a number of different versions of the catastrophic risk precaution-

ary principle, in increasing order of stringency. Sunstein's observations point helpfully in the right direction but identifying those techniques and clarifying their domain requires further work, and current developments in economics and decision theory allow us to put some flesh on the concept of a catastrophic precautionary principle.

## II. Understanding Catastrophic Uncertainty

In many situations, risk falls near the average, such that upside deviations are roughly as likely as downside deviations and extreme deviations are extremely unlikely. These situations are relatively tractable in policy terms, but some issues require much more attention to potential extreme outcomes. One way of understanding the problem begins with the concept of feedback effects.<sup>16</sup> Consider the familiar example of the feedback between a microphone and loudspeakers. If the system is already experiencing a bit of feedback, turning the amplification slightly downward provides only modest benefits, while turning it slightly upward can result in an unnerving shriek from the speakers. Thus, uncertainty about the exact amount of feedback is mostly significant because of the risk that feedback will be higher than expected, resulting in much more noise, rather than the possibility that the feedback will be lower and the noise will be a bit more subdued. The implication is that uncertainty is greatest where it matters most, in terms of extreme events.<sup>17</sup> This section discusses decisionmaking in situations where even rough quantification of probabilities is not feasible.

### A. Fat-Tailed Distributions and Catastrophic Outcomes

When probabilities form a bell curve (normal distribution), most events are bunched near the average and extreme outcomes fade away quickly.<sup>18</sup> The term *fat tails* is used to describe systems that have a higher likelihood than the normal curve of extreme outcomes—in a graph, the tail of the distribution does not thin out as quickly as the normal distribution.<sup>19</sup>

A common version of fat tails is found in the statistical distribution called a “power law.”<sup>20</sup> Rather than following the familiar bell-curve distribution, complex systems often

6. See DANIEL FARBER, *ECO-PRAGMATISM: MAKING SENSIBLE ENVIRONMENTAL DECISIONS IN AN UNCERTAIN WORLD* 170 (1999).

7. See Jonathan H. Adler, *More Sorry Than Safe: Assessing the Precautionary Principle and the Proposed International Biosafety Protocol*, 35 *TEX. INT'L L.J.* 173, 195-98 (2000).

8. For a recent update on the debate, see Fritz Allhoff, *Risk, Precaution, and Emerging Technologies*, *STUD. IN ETHICS L. & TECH.* (Aug. 2009). Allhoff suggests that “precaution supplements cost-benefit analysis given uncertainty.” *Id.* at 23.

9. Edward A. Parson, *The Big One: A Review of Richard Posner's Catastrophe: Risk and Response*, 45 *J. ECON. LITERATURE* 147, 152 (2007) (citing RICHARD A. POSNER, *CATASTROPHE: RISK AND RESPONSE* (2004)).

10. Jonathan Remy Nash, *Standing and the Precautionary Principle*, 208 *COLUM. L. REV.* 494, 503 (2008) (footnote omitted).

11. See Adler, *supra* note 7, at 195; Frank B. Cross, *Paradoxical Perils of the Precautionary Principle*, 53 *WASH. & LEE L. REV.* 851, 863-75 (1996) (describing risks created by alternative activities).

12. Cass R. Sunstein, *Probability Neglect: Emotions, Worst Cases, and Law*, 112 *YALE L.J.* 61, 94 (2002).

13. *Id.* at 62-63. Sunstein further elaborated his critique in Cass R. Sunstein, *Beyond the Precautionary Principle*, 151 *U. PA. L. REV.* 1003 (2003).

14. See David A. Dana, *A Behavioral Economic Defense of the Precautionary Principle*, 97 *NW. U. L. REV.* 1315, 1327-28 (2003) (arguing that the principle may “result in the generation of more information” and may “provide advocates of regulation with a discursive tool to increase the amount of information generated and the quality of that information”). Dana elaborates his position in David A. Dana, *The Contextual Rationality of the Precautionary Principle*, 35 *QUEEN'S L.J.* 67 (2009) [hereinafter Dana, *Contextual Rationality*].

15. See Cass R. Sunstein, *The Catastrophic Harm Precautionary Principle*, *ISSUES IN LEGAL SCHOLARSHIP* (2007), available at <http://www.bepress.com/ils/iss10/art3>.

16. See generally Jainguo Liu et al., *Complexity of Coupled Human and Natural Systems*, 317 *SCIENCE* 1513 (2007).

17. For those whose taste runs to equations and numerical examples, this point is mathematically expressed in Daniel A. Farber, *Uncertainty*, 99 *GEO. L.J.* at 921-22 (2011).

18. This can be seen from the graphs in Eric W. Weisstein, *WOLFRAM MATHWORLD, Normal Distribution*, <http://mathworld.wolfram.com/NormalDistribution.html> (last visited June 16, 2012).

19. See, e.g., William Safire, *Fat Tail*, *N.Y. TIMES MAG.*, Feb. 8, 2009, at 24.

20. For an introduction to power laws, see MANDRED SCHROEDER, *FRACTALS CHAOS, POWER LAWS: MINUTES FROM AN INFINITE PARADISE* 103-19 (1991).

at least approximately follow power-law distribution,<sup>21</sup> in which the probability of an event is given by its magnitude taken to a fixed negative exponent.<sup>22</sup> “[T]he distinguishing feature of a power law is not only that there are many small events but that the numerous tiny events coexist with a few very large ones.”<sup>23</sup> Such outliers are much less likely when a normal distribution is involved. Power laws conflict with our usual view of the world as consisting of small fluctuations around routine outcomes.

While the existence of fat tails clearly has relevance to policy, we do not have “a commonly accepted usable economic framework for dealing with these kinds of thick-tailed extreme disasters”—partly because these “probability distributions are inherently difficult to estimate.”<sup>24</sup> The reason that the probabilities are difficult to estimate is that data will rarely include instances from the tail (because the events are rare), making it impossible to estimate just how quickly the tail tapers off.

Martin Weitzman has shown on the basis of general considerations of statistical and economic theory that it often “is difficult to infer (or even to model accurately) the probabilities of events far outside the usual range of experience” and that this ultimately leads to a fat-tailed probability distribution of utility losses.<sup>25</sup> Weitzman also shows that even if the “true” probability distribution has a thin tail, the decisionmaker may still be faced with a fat-tailed distribution as a practical matter because it is impossible to get enough evidence to estimate the tail with precision. In effect, estimation errors fatten up the tail. If the parameters of the true distribution are not known with certainty, taking that second-level uncertainty into account leads decisionmakers to act as if they were facing a fat-tailed distribution. These fat tails “represent structural or deep uncertainty about the possibility of rare high-impact disasters that . . . ‘scare’ any [risk-averse] agent.”<sup>26</sup> Thus, an inability to precisely estimate the parameters of a thin-tailed distribution—a form of second-order uncertainty about the first-order probability distribution—may confront the decisionmaker with a fat-tailed distribution in practical terms. Yet, we lack good analytic techniques for quantifying total risk when the distribution has a fat tail.

In sum, there are three connections between fat tails and uncertainty: first, fat tails *contribute* to uncertainty in the sense that they create an epistemic problem of estimation (when we are in a scenario with a fat-tailed distribution, we have difficulty measuring the tail); second, we may encounter *second-order* uncertainty simply because we do not know whether we have a fat tail or not; and third, uncertainty is *more dangerous* if we think we are in a fat-tail scenario because of potential feedback effects. Thus, fat-tailed distributions and uncertainty seem to be connected at a deep level.

## B. Uncertainty Models and Worst-Case Scenarios

Unlike situations of pure uncertainty, however, we may have considerable information about the distribution of probabilities for fat-tailed distributions, but just not enough to pin down the fatness of the tail and establish the likelihood of catastrophic outcomes. Nonetheless, there are several approaches to analyzing such situations.

### I. Models of Uncertainty and Ambiguity Aversion

“Ambiguity” is a term that is often used to refer to situations in which the true probability distribution of outcomes is not known.<sup>27</sup> There is strong empirical evidence that people are averse to ambiguity,<sup>28</sup> and such aversion “appears in a wide variety of contexts.”<sup>29</sup>

There are a number of different approaches to modeling uncertainty about the true probability distribution.<sup>30</sup> I will focus on a particularly tractable approach called  $\alpha$ -maxmin models. In these models,  $\alpha$  represents the weighting factor between best and worst cases. As Sir Nicholas Stern explains, in these models of uncertainty, “the decisionmaker, who is trying to choose which action to take, does not know which of [several probability] distributions is more or less likely for any given action.”<sup>31</sup> In this situation, the decisionmaker would act as if she chooses the action that maximizes a weighted average of the worst expected utility and the best expected utility . . . . The weight placed on the worst outcome would be influenced by concern of the individual about the magnitude of associated threats, or pessimism, and possibly any hunch about which probability might be more or less plausible.<sup>32</sup>

21. It can be difficult to distinguish power laws from other fat-tailed distributions empirically. See Aaron Clauset, Cosma Rohilla Shalizi & M.E.J. Newman, Power-Law Distributions in Empirical Data (Feb. 2, 2009) (unpublished manuscript), available at <http://arxiv.org/pdf/0706.1062> (last visited June 16, 2012).

22. See RICHARD SOLE & BRIAN GOODWIN, SIGNS OF LIFE: HOW COMPLEXITY PERVADES BIOLOGY 52 (2000) (describing power laws).

23. ALBERT-LA ‘SZLO’ BARBARA ‘SI, LINKED: THE NEW SCIENCE OF NETWORKS 67-68 (2002).

24. Martin L. Weitzman, *A Review of The Stern Review on the Economics of Climate Change*, 45 J. ECON. LIT. 703, 723 (2007).

25. Martin L. Weitzman, *On Modeling and Interpreting the Economics of Catastrophic Climate Change*, 91 REV. ECON. & STAT. 1, 3 n.4 (2009). Indeed, even determining that data exhibits a fat-tailed distribution such as a power law rather than a thinner tailed distribution such as the lognormal distribution can be difficult. See M.E.J. Newman, *Power Laws, Pareto Distributions and Zipf’s Law*, 46 CONTEMP. PHYSICS 323, 329-30 (2005).

26. Weitzman, *Catastrophic Climate Change*, *id.* at 9. The distribution that he derives is not a power law but another fat-tailed distribution known for historical reasons as the “Student-t.” *Id.* at 8.

27. For other legal applications of ambiguity models, see Daniel A. Farber, *Uncertainty*, 99 GEO. L.J. 901, 928 n.116 (2011) (listing sources).

28. See Gideon Keren & Le’onie E.M. Gerritsen, *On the Robustness and Possible Accounts of Ambiguity Aversion*, 103 ACTA PSYCHOLOGICA 149, 149 (1999).

29. Nicholas Barberis & Richard Thaler, *A Survey of Behavioral Finance*, in HANDBOOK OF THE ECONOMICS OF FINANCE 1053, 1075 (George M. Constantinides, Milton Harris & Rene’ M. Stulz eds., 2003).

30. A good summary can be found in Alessandro Vercelli, *Hard Uncertainty and Environmental Policy*, in SUSTAINABILITY: DYNAMICS AND UNCERTAINTY 191, 196-205 (Graciela Chichilnisky et al. eds., 1998).

31. NICHOLAS STERN, *THE ECONOMICS OF CLIMATE CHANGE: THE STERN REVIEW* (2007).

32. *Id.*

One way to understand these models is that we might want to minimize our regret for making the wrong decision, where we regret not only disastrous outcomes that lead to the worst-case scenario, but also we regret having missed the opportunity to achieve the best-case scenario. Alternatively,  $\alpha$  can be a measure of the balance between our hopes (for the best case) and our fears (of the worst case).

Applying these  $\alpha$ -maxmin models as a guide to action leads to what we might call the  $\alpha$ -precautionary principle. Unlike most formulations of the precautionary principle,  $\alpha$ -precaution is not only aimed at avoiding the worst-case scenario; it also involves precautions against losing the possible benefits of the best-case scenario.<sup>33</sup> In some situations the best-case scenario is more or less neutral, so that  $\alpha$ -precaution is not much different from pure loss avoidance, unless the decisionmaker is optimistic and uses an especially low  $\alpha$ . But where the best-case scenario is potentially extremely beneficial, unless the decisionmaker's  $\alpha$  is very high,  $\alpha$ -precaution will suggest a more neutral attitude toward uncertainty in order to take advantage of potential upside gains.

For example, suppose we have two models about what will happen if a certain decision is made. We assume that each one provides us enough information to allow the use of conventional risk assessment techniques *if* we were to assume that the model is correct. For instance, one model might have an expected harm of \$1 billion and a variance of \$0.2 billion; the other an expected harm of \$10 billion and a variance of \$3 billion. If we know the degree of risk aversion of the decisionmaker, we can translate outcomes into an expected utility figure for each model. The trouble is that we do not know which model is right, or even the probability of correctness. Hence, the situation is characterized by uncertainty. To assess the consequences associated with the decision, we then use a weighted average of these two figures based on our degree of pessimism and ambiguity aversion. This averaging between models allows us to compare the proposed course of action with other options.

$\alpha$ -maxmin has some important virtues in terms of process. Rather than asking the decisionmaker to assess highly technical probability distributions and modeling, it simply presents the decisionmaker with three questions to consider: (1) What is the best-case outcome that is plausible enough to be worth considering? (2) What is the worst-case scenario that is worth considering? (3) How optimistic or pessimistic should we be in balancing these possibilities? These questions are readily understandable by politicians and members of the public, presenting the key value judgments directly to the officials who should be making them, rather than concealing value judgments in technical analysis by experts.

## 2. Relating the Models

We seem to be suffering from an embarrassment of riches, in the sense of having too many different models for decisionmaking in situations in which extreme outcomes weigh heavily. At present, it is not clear that any one model will emerge as the most useful for all situations. For that reason, the ambiguity models should be seen as providing decisionmakers with a collection of tools for clarifying their analysis rather than providing a clearly defined path to the "right" decision.

Among this group of tools, what I have been calling  $\alpha$ -precaution (utilizing  $\alpha$ -maxmin) has a number of attractive features. First, it is complex enough to allow the decisionmaker to continue both the upside and downside possibilities, without requiring detailed probability information that is unlikely to be available. Second, it is transparent. Although the math behind this decision tool is formidable, actually applying the tool requires only simple arithmetic. The user must decide on what parameter value to use for  $\alpha$ , but this choice is intuitively graspable as a measure of optimism versus pessimism.<sup>34</sup> Third,  $\alpha$ -maxmin can be useful in coordinating government policy. An oversight agency such as OMB can provide benchmark values of  $\alpha$  and rules for conducting sensitivity analysis. It can review departures from the benchmarks, where such departures are important, in order to determine that an agency's degree of pessimism or optimism about a problem is consistent with administration policy.

Models of uncertainty and fat-tailed models do not map precisely into each other although they both give us ways of thinking about catastrophic outcomes. Fat-tailed models are technically risk models rather than uncertainty models because the probability distribution is (somewhat) known. The mathematics in fat-tailed models thus looks different from that used in ambiguity models. A heuristic interpretation can link the difficulties of dealing with the dangers incorporated in fat-tailed distributions with the somewhat severe nature of the ambiguity-aversion models. Rather than trying to solve the intractable problem of the potential infinities in fat-tailed distributions, we can cut off the tail at some plausible "worst case"—but then make up for our inability to directly account for the full spectrum of outcomes by giving heavy weight to the chosen bad scenario. In other words, the extremism of maxmin or weighted decisions could be seen as a way of incorporating the fact that we have shunted aside the full range of horrific outcomes. Ambiguity between a finite set of models then functions as a stand-in for the fact that there are multiple alternative models, perhaps only poorly understood, that could lead to worse outcomes.

Alternatively, we might focus on the uncertainties presented by fat-tailed distributions themselves. In a situation

33. If  $\alpha = 1$ , then  $\alpha$ -maxmin becomes ordinary maxmin, in which only the worst case matters.

34. We might be able to narrow the range for  $\alpha$  by using empirical evidence showing how individuals approach decisionmaking in situations characterized by ambiguity or through experience over time that might allow officials to develop norms about the appropriate  $\alpha$ .



in which a fat-tailed distribution is a possibility, the decisionmaker may face several unknowns: whether the distribution actually does have a fat tail, the type and parameters of the fat-tailed distribution, or whether (and where) to truncate the distribution if there is some possible upper bound on outcomes. Thus, even if a specific fat-tailed distribution (with or without truncation) actually does characterize the situation, the barriers to full knowledge of the distribution may mean that the decisionmaker's problem is more one of uncertainty than risk, making ambiguity models relevant.

### III. Applying New Decision Techniques to Regulatory Policy

Of course, the crucial question is whether these various techniques can provide genuine assistance in dealing with important policy issues. This part deploys the approaches economic theory provides in the context of two important current regulatory problems, each of which is characterized by considerable uncertainty: how much society should be willing to pay to mitigate climate change by reducing emissions of greenhouse gases, and whether society should restrict the development of nanotechnology.

#### A. Climate Change Mitigation

##### I. Scientific and Economic Confidence and Uncertainty

The primary uncertainty in climate mitigation is the “wide range of possible temperature increases . . . including a five-percent possibility that temperature increases will equal or exceed 6 C° and a two-percent probability of increases equal to or greater than 8 C° within the next 100 to 200 years.”<sup>35</sup> Such increases may not sound like much, but a 5° rise is “equivalent to the change in average temperatures from the last ice age to today.”<sup>36</sup>

The customary measure for how strongly the climate system responds to changes in the level of greenhouse gases is climate sensitivity. Climate sensitivity is measured as the equilibrium temperature increase caused by a permanent doubling of preindustrial CO<sub>2</sub> concentrations. Studies based on historical climate data find that climate sensitivity is unlikely to be below 1.5° C; the upper bound is more difficult to determine for technical reasons—it could exceed 4.5° C, although such high values are much less likely on the basis of the historical record than those in the 2.0° C to 3.5° C range.<sup>37</sup> A second line of research examines

climate sensitivity in models. In each model, the climate sensitivity depends on many processes and feedbacks, and probability distributions can be determined by examining how climate sensitivity tracks variations in various other parameters in the model. Essentially, parameters are subject to variations, and the effect on climate response is measured through many runs of the model. The most frequent sensitivity values are around 3° C, but much higher values cannot be excluded.<sup>38</sup>

Unfortunately, there is no completely satisfactory way of translating these results into a formal probability distribution.<sup>39</sup> If we assume that all current models are equally likely and that they exhaust the possibilities, we can get a probability distribution, but these are somewhat heroic assumptions.<sup>40</sup>

Even when models do agree, there are residual grounds for uncertainty. Models “might share a common error” for example.<sup>41</sup> While there is fairly good evidence that there are no major missing factors, at least in terms of explaining overall 20th-century warming trends,<sup>42</sup> we do know that other factors are relevant and imperfectly modeled for future trends and regional impacts.<sup>43</sup> Some efforts have been made to quantify uncertainty based on various other lines of evidence<sup>44</sup>; new types of computational experiments have been performed to quantify uncertainty about how models respond to external inputs such as changes in solar intensity, for example. Additionally, modelers and other scientists are prone to biases and errors, like the rest of us, despite the strenuous efforts that the scientific enterprise makes to limit the effects of these weaknesses,<sup>45</sup> and this source of error is hard to estimate.

Notwithstanding such concerns, models give us a fair amount of confidence about basic trends. We can be highly confident about the existence of human-caused climate change and the likelihood that it will have serious effects. There is strong residual uncertainty, however, about the scale of climate change impacts, both globally and regionally. This uncertainty might seem to argue against investing in climate change mitigation, but as demonstrated below, the possibility of high-impact scenarios actually provides a further reason to take precautionary steps.

##### 2. Climate Policy, Catastrophic Risks, and $\alpha$ -Maxmin

The more disturbing issues are on the scientific side though, and relate to the possibility that climate change

35. Daniel H. Cole, *The Stern Review and Its Critics: Implications for the Theory and Practice of Benefit—Cost Analysis*, 48 NAT. RESOURCES J. 53, 75 (Winter 2008).

36. STERN, *supra* note 31, at xvi.

37. See Gerald A. Meehl et al., *Global Climate Projections*, in WORKING GROUP I TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS 747, 800-01 (Susan Solomon et al. eds., 2007), available at <http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter10.pdf>.

38. *Id.* at 799.

39. *Id.*

40. *See id.*

41. Myles Allen et al., *Scientific Challenges in the Attribution of Harm to Human Influence on Climate*, 155 U. PA. L. REV. 1353, 1361 (2007).

42. *See id.* at 1375.

43. See Meehl et al., *Global Climate Projections*, *supra* note 37, at 797 (“Uncertainty in predictions of anthropogenic climate change arises at all stages of the modeling process . . .”).

44. *Id.* at 754.

45. See Myanna Lahsen, *Seductive Simulations? Uncertainty Distribution Around Climate Models*, 35 SOC. STUD. SCI. 895, 904-08 (2005).

will *not* be moderate. Based on an analysis of reported studies, Weitzman estimates that a “best guess” estimate of the extreme bad tail” places the odds at about 5% of a temperature increase over 10° C (18° F) and a 1% chance of an increase of 20° C (36° F).<sup>46</sup> It is hard to improve on his explanation of the gravity of these findings:

[s]ocieties and ecosystems in a world whose average temperature has changed in the geologically instantaneous time of two centuries or so by 10° C-20° C . . . are located in *terra incognita*, since such high temperatures have not existed for hundreds of millions of years and such a rate of global temperature change might be unprecedented even on a timescale of billions of years.<sup>47</sup>

Hence, “the planetary welfare effect of climate changes [from such increases] . . . implies a nonnegligible probability of worldwide catastrophe.”<sup>48</sup>

As Weitzman says, the normative implication is clearly a higher degree of precaution, making “insurance” against catastrophe a critical factor in climate policy.<sup>49</sup> It is difficult to extract more specific guidance from his approach,<sup>50</sup> and we might instead turn to ambiguity-based models for guidance.

Ambiguity theory suggests that we weigh the best-case scenario (unimpeded economic growth combined with modest investment in climate adaptation) and the worst-case scenario (catastrophic climate outcomes), perhaps also including as a mid-case the standard economic models of climate change (which, as it happens, are not too far away from the best case).<sup>51</sup>

The implication of this analysis would be a high degree of precautionary catastrophe insurance, as Weitzman suggests. This argument can be seen as an application of Sunstein’s “catastrophic harm precautionary principle.”<sup>52</sup> If we think in terms of  $\alpha$ -maxmin models, the worst-case

scenario is grim, perhaps on the order of the end of civilization; the best-case scenario is that harm from climate change is modest. Unless we are inclined to be optimistic and place extraordinarily weight on the best-case scenario, business as usual does not seem to be an appealing strategy—in fact, we should be willing to make major investments to reduce climate change. This conclusion is  $\alpha$  robust under a variety of assumptions, as shown below.

Specifically, if  $H_w$  is the harm in the worst-case scenario and  $H_B$  is the harm in the best-case scenario, we would attribute a cost of  $\alpha H_w + (1-\alpha)H_B$  to the strategy of doing nothing. Even if  $H_B$  is zero (no net harm from climate change), the no-action option will not be appealing. The reason is that, because  $H_w$  is so large,  $\alpha H_w$  will be a large number unless  $\alpha$  is very small indeed. For example, suppose we are equally balanced between optimism and pessimism ( $\alpha = 0.5$ ) and that we take the worst case as being a temperature change equivalent to at least a trillion dollars in value. Then we would be willing to spend \$500 billion or more to avoid this risk.

If we take into account more catastrophic outcomes, the case for doing nothing evaporates even if we are optimistic about avoiding the worst-case scenario. As we have seen, Weitzman suggests that the most extreme outcomes could result in the end of civilization. If we interpret that as a complete collapse of world GDP, we would get an estimated loss of \$10<sup>16</sup>, or \$1 quadrillion (or in more familiar terms, \$1000 trillion).<sup>53</sup> In order to reflect optimism about climate change, assume that the best-case scenario is actually a \$1 trillion benefit from warming, and take  $\alpha = 0.01$  (meaning that we put 99 times as much emphasis on the best case as on the worst case). With some simple arithmetic, we come up with a loss figure of .01(1000 trillion)-0.99(1 trillion), or approximately \$9 trillion. Therefore, even if we are highly optimistic about the best-case scenario, a serious investment in climate mitigation would still be warranted if the downside risk is as severe as Weitzman suggests.

Thus, the  $\alpha$ -precautionary principle would warrant a high degree of precaution to avoid the negative uncertainties of climate change. Based on reasoning of this type, the *Stern Review* suggests that the cost of climate change should be assessed at between 13% and 20% of current global consumption, with the weight used to average the figures being based on “crude judgments about likelihoods of different kinds of probability distributions, on judgments about the severity of losses in this context, and on the basic degree of cautiousness on the part of the policymaker.”<sup>54</sup> The World Bank estimates world GDP in 2008 at about \$60.5 trillion,<sup>55</sup> so the value of eliminating climate change would be roughly \$6-\$12 trillion. Because Stern’s is only

46. Weitzman, *supra* note 25, at 1.

47. *Id.* A leading critic of Weitzman concurs that “[m]any people would agree that a 5% chance of a 10° change, or a 1% chance of a 20° change, would be a catastrophic prospect for human societies.” William D. Nordhaus, *An Analysis of the Dismal Theorem* 10 (Cowles Found., Discussion Paper No. 1686, 2009), available at <http://ssrn.com/abstract=1330454>.

48. Weitzman, *supra* note 25, at 1.

49. *Id.* at 18. The fat-tail aspect of Weitzman’s analysis seems to be crucial. Using a thin-tail analysis while still taking into account possible extreme outcomes, Pindyck finds a case for moderate climate mitigation but nothing more. See Robert S. Pindyck, *Uncertain Outcomes and Climate Change Policy* 22 (MIT Sloan Sch., Working Paper No. 4742-09, 2009), available at <http://ssrn.com/abstract=1448683>. Pindyck provides an important caveat:

We have no historical or experimental data from which to assess the likelihood of a  $\Delta T$  [change in temperature] above 5° C, never mind its economic impact, and one could argue *à la* Weitzman (2009) that we will never have sufficient data because the distributions are fat-tailed, implying a WTP [willingness to pay] of 100% [of consumption] (or at least something much larger than 2%). *Id.*

50. It is hard to quarrel, however, with Weitzman’s statement that “[e]ven just acknowledging more openly the incredible magnitude of the deep structural uncertainties that are involved in climate-change analysis . . . might go a long way toward elevating the level of public discourse concerning what to do about global warming.” Weitzman, *supra* note 25, at 18.

51. See *supra* notes 116-33 and accompanying text.

52. See Cass R. Sunstein, *The Catastrophic Harm Precautionary Principle*, Issues Legal Scholarship, 2007, available at <http://www.bepress.com/ils/iss10/art3>.

53. Nordhaus, *supra* note 47, at 14 (stating that “the discounted value of world consumption is in the order of \$10<sup>16</sup>”).

54. STERN, *supra* note 31, at 187. As Cole, *supra* note 35, at 62, explains, these numbers are controversial, but they are at least illustrative.

55. See *Key Development Data and Statistics*, THE WORLD BANK, <http://econ.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20535285%0A0menuPK:1192694%0ApagePK:64133150%0A0piPK:64133175%0AtheSitePK:239419,00.html> (last visited Dec. 20, 2010).

one model, the actual range of estimates is wider, making the choice of the weighting factor ( $\alpha$ ) even more important. It seems clear, however, that it would be worth investing a large amount of money in climate mitigation.

It is tempting to seek a higher degree of precision in this recommendation, but in practical terms, the precision is probably irrelevant. If we take seriously that there is even a small possibility that climate change could wipe out our present society,<sup>56</sup> the indicated amount of precaution is probably higher than anything we could plausibly expect from the political system. So, the identity of the “correct” policy is this: the most stringent policy that is politically feasible<sup>57</sup> (though unfortunately that policy still probably runs a haunting risk catastrophe).

The basic lesson here is quite simple and does not depend on the details of the analysis. Climate policy cannot be based simply on the outcomes we consider most likely. The full range of possible consequences must be considered. Given the possibility of dire consequences from climate change, corrective measures should be supported even if some people believe that climate change most likely will not occur or that it will be beneficial.

## B. Nanotechnology

Nanotechnology presents different sorts of unknowns and therefore a different context for investigating regulatory uncertainty. As a technology in its early stages of development, it presents the possibility of extraordinary benefits as well as serious risks. We have little ability to attach probabilities to any of the outcomes, making this a case of true uncertainty.<sup>58</sup>

Nanotechnology is the domain of the remarkably small. One nanometer (nm) is equal to one-billionth of a meter (or about 0.00000004 inches), an incredibly tiny length. Importantly, nanoparticles can have properties quite different from larger amounts of the same substance—for example, opaque particles can become transparent to visible light but reflective of ultraviolet light at nano size.<sup>59</sup>

Anticipated applications of nanotechnology in the relatively near term include cosmetics, materials for remediating hazardous waste sites, fuel cells, video displays,

batteries, and fuel additives<sup>60</sup>; longer-term projects may involve revolutionary developments rather than incremental evolution, including new tests and treatments for cancer, greatly improved renewable energy, universal access to clean water, and higher crop yields through use of nanosensors to detect plant diseases.<sup>61</sup>

But the same properties that make nanotech appealing, such as high surface reactivity and ability to cross cell membranes, may also pose risks—risks that are still poorly understood.<sup>62</sup> A study by the Royal Society indicated that “there is a lack of information about [nanoparticles’] health, safety and environmental impacts,” requiring reliance on research results regarding other small particles from pollution and occupational research.<sup>63</sup> Given the uncertainties, the Royal Society recommended a ban on use of free nanoparticles for cleaning up toxic sites,<sup>64</sup> and it put a high priority on investigation by regulators of the safety of nanoparticles in consumer products.<sup>65</sup>

The Congressional Research Service (CRS) also recently surveyed the risks and potential benefits of nanotechnology,<sup>66</sup> viewing the long-run picture as potentially involving revolutionary developments but also recognizing risks as scientists already know that some nanomaterials (carbon nanotubes and fullerenes) can cause lung damage in mice, brain damage in fish, and DNA damage.<sup>67</sup>

Environmental advocates call for a moratorium on commercial release of food and agricultural materials containing manufactured nanomaterials until a new legal structure is in place.<sup>68</sup> Public interest groups “have invoked the Precautionary Principle in advocating a more draconian regulatory approach to address potential risks from nanomaterials.”<sup>69</sup> Others argue that the precautionary principle “freezes us in place,” because “[n]o technology at its inception can satisfy the precautionary principle, so the principle becomes a formula for doing nothing.”<sup>70</sup> Thus, further study and investment in liability insurance are arguably better approaches.<sup>71</sup> Another possibility would be to impose a substantial bond requirement for

56. A caveat is that we could downplay the potential catastrophic possibilities if, as Nordhaus argues, we could learn that catastrophe is impending fast enough to make a sufficiently quick and vigorous global response to head off the possibility. See Nordhaus, *supra* note 47, at 20. In my view, Nordhaus is excessively optimistic about this last-minute policy response, in part because of the potential for “climate surprises” involving abrupt climate change that might not leave a great deal of time for a response. See JOHN D. COX, CLIMATE CRASH: ABRUPT CLIMATE CHANGE AND WHAT IT MEANS FOR OUR FUTURE 189 (2005). Nevertheless, the potential for detecting and heading off catastrophic climate change does need to be considered as part of the analysis.

57. See, e.g., Robert W. Hahn, *Climate Policy: Separating Fact From Fantasy*, 33 HARV. ENVTL. L. REV. 557, 577 (2009).

58. For a recent discussion that emphasizes the importance of these uncertainties, see Douglas A. Kysar, *Ecologic: Nanotechnology, Environmental Assurance Bonding, and Symmetric Humility*, 28 UCLA J. ENVTL. L. & POL’Y 201 (2011).

59. THE ROYAL SOC’Y & THE ROYAL ACAD. OF ENG’G, NANOSCIENCE AND NANOTECHNOLOGIES: OPPORTUNITIES AND UNCERTAINTIES 9 (2004).

60. *Id.* at 10-12.

61. JOHN F. SARGENT JR., CONG. RESEARCH SERV., RL 34511, NANOTECHNOLOGY: A POLICY PRIMER 1, 3-4 (2009).

62. ROYAL SOCIETY, *supra* note 59, at 35.

63. *Id.* at 47. As of 2004, according to the Royal Society, “very few studies have been published on the potential adverse effects that nanoparticles or nanotubes may have on humans, and only one to our knowledge on environmental effects.” *Id.* at 75.

64. *Id.* at 47.

65. *Id.* at 74.

66. SARGENT, *supra* note 61.

67. *Id.* at 9.

68. See GEORGIA MILLER & RYE SENJEN, FRIENDS OF THE EARTH, OUT OF THE LABORATORY AND ONTO OUR PLATES 3 (2008).

69. David B. Fischer, *Nanotechnology—Scientific and Regulatory Challenges*, 19 VILL. ENVTL. L.J. 315, 330 (2008). Dana, *Contextual Rationality*, *supra* note 14, at 18-29, argues that the precautionary principle may correct market incentives to avoid investigating possible environmental and health risks.

70. Robin Fretwell Wilson, *Nanotechnology: The Challenge of Regulating Known Unknowns*, 34 J.L. MED. & ETHICS 704, 710 (2006).

71. *Id.* at 711.

substances that are allowed on the market after passing screening tests.<sup>72</sup>

Because nanotechnology has potential large upsides as well as downsides, an attitude of pure precaution seems inappropriate. Instead, we would do better to use ambiguity models that balance upside and downside outcomes, such as  $\alpha$ -maxmin.<sup>73</sup> The  $\alpha$ -precautionary principle would probably not justify efforts to forestall research and development of nanotechnology given its high upside potential. It would, however, justify a degree of caution.

An appropriate strategy could involve sustained research into health and safety issues of current uses of nanomaterials,<sup>74</sup> restrictions on uses involving potential public exposure until further risk information is available, and sensitivity to potential large downside risks in R & D for longer term, nonevolutionary nanotechnologies. Given the unknown hazards associated with nanomaterials, it is surprising that regulatory authorities have failed to treat them as new substances for regulatory purposes but have instead given them the more favorable treatment available to existing products.<sup>75</sup> That said, on balance nanomaterials do not require a more precautionary approach than new chemicals in general.

## Conclusion

It is sometimes tempting to ignore the imperfectly understood dimensions of hazards as speculative. That is clearly the wrong response. Just because you do not know exactly how big a number is, there is no reason to assume it to be zero.

As we have seen, such uncertainties can be associated with fat-tailed distributions, while in other situations, we may simply have no good idea of how to assign probabilities in the first place or of what the probability distribution might look like. Ambiguity theory helps address these situations, and the most easily applied models advise assessing decisions based on a combination of the best-case and worst-case scenarios. This leads to the  $\alpha$ -precautionary principle, which weighs the best and worst potential outcomes in assessing a course of action. Although there is no easy recipe for divining the right solution to problems the parameters of which involve so much uncertainty, but we can gain some much-needed clarity with the tools discussed in this Article.

72. This proposal is made in Albert C. Lin, *Size Matters: Regulating Nanotechnology*, 31 HARV. ENVTL. L. REV. 349, 396-404 (2007). Kysar, *supra* note 58, at 208-09, presents an alternative bonding proposal that emphasizes the role played by worst-case outcomes in establishing bond amounts.

73. See *supra* notes 41-50 and accompanying text.

74. EPA has embraced such a research program, but if past practice is a guide, it could take a decade or more before the work even begins.

75. See Diana M. Bowman & Graeme A. Hodge, *A Small Matter of Regulation: An International Review of Nanotechnology Regulation*, 8 COLUM. SCI. & TECH. L. REV. 1, 36 (2007). An EPA advisory is now considering whether to recommend that nanosilver products be treated as new pesticides requiring a new pesticide registration. See Lynn L. Bergeson, *FIFRA Scientific Advisory Panel Considers Nanosilver*, 39 ELR 11143, 11143-44 (Dec. 2009).

R E S P O N S E

# Climate Policy and Uncertainty: $\alpha$ -Precautionary Principle Versus Real Options Analysis

by Alexander A. Golub

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## Introduction

A near-term decision regarding climate policy should be made even in the context of uncertainties. The reaction of the climatic system to anthropogenic emissions is unknown. Furthermore, socioeconomic systems reaction to changes in the climatic system, reflected by adaptation cost and unrecoverable damages, is also unknown. While current emissions impose future costs on society measured by future damages, climate policy aimed to reduce emissions imposes current economic costs.

It is naïve to think that a regulator will be able to select an “ideal” policy before uncertainties are narrowed through knowledge accumulation in the fields of climate science and economics. In the future, when more complete information is available, initial policy would be inevitably corrected. When estimating the long-term cost of a climate policy a regulator should also take into account correction costs.

Significant uncertainties exist on the climate side of the analysis. Climate sensitivity is a major (but not the only) parameter that describes reactions of the climatic system to accumulation of greenhouse gases in the atmosphere. Uncertainties on the climate side are amplified by uncertainties on the socioeconomic side of the analysis. The combination of these uncertainties and incomplete information creates a difficult environment in which to select a climate policy. This decision inevitably generates risks.

The key issue is how quantitative methods of economic analysis and risk management can help to make the best possible decision given incomplete information. In other words, how can modern tools for economic analysis help policymakers process available information and make a decision that balances benefits and risks. The integrated assessment framework, described in this paper, provides a convenient analytical tool.

## Conventional Approach to Cost-Benefit Analysis

When designing a climate policy, regulators balance costs and benefits associated with a certain environmental target. In terms of integrated assessment models (IAM) regulators select an emission target, which maximizes the difference between the benefits and cost of this policy. Note that regulators always try to solve a forward-looking problem, determining a long-run environmental target. In a deterministic case the cost associated with the selected environmental target is the present value of two elements: abatement cost and damage. Damage appears as a relatively permanent productivity shock on the economy that withdraws some fraction of output from investment and consumption. This could be interpreted as an adaptation cost or a cost of global environmental degradation. In the latter interpretation it includes adaptation costs and unrecoverable losses.

In order to solve a deterministic model when both damage and cost are uncertain, the central or “most likely” estimates of these parameters are usually substituted for actual cost and damage.<sup>1</sup> Since underlying uncertain parameters were substituted with their central (best guess or most likely) values, present values of abatement costs and damage turns out as the central estimates too. This way of substituting point estimates for uncertain parameters omits important information regarding variance and shape of distributions that describe these parameters. Therefore, central or expected values are not the best way to present an uncertain parameter. In the literature, there are many examples of substitutions that involve more than one point estimate: expected value and value at risk, or expected value and value in a percentile (say 90th or 95th), or  $\alpha$ -precautionary principle.<sup>2</sup> While the methods mentioned above provide some tools for tail quantification (conditional value at risk is especially focused on tail quan-

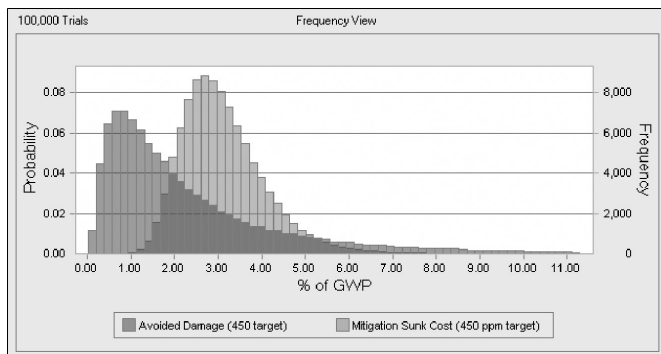
1. See, e.g., WILLIAM D. NORDHAUS, QUESTION OF BALANCE (2008).  
2. Daniel A. Farber, *Uncertainty*, 42 ELR 10725 (Aug. 2012).

tification), they do not make available an aggregated metric for valuing the underlying policy. Mean-variance analysis offers that aggregation, but this method significantly reduces information that could be retrieved from distributions. For instance, mean-variance metrics accounts for a fat tail poorly.

All available information should be taken into account and carefully processed. Modern climatic science and modern economics of climate change provide a foundation for meta-analysis and quantitative representation of different states of the world. Based on available literature, climate sensitivity and damage function could be presented as a probability distribution function.<sup>3</sup>

Figure 1 below illustrates challenges associated with cost-benefit analysis in the context of uncertainty. The figure presents results of Monte-Carlo simulations for a particular numerical example that illustrates the methodology.<sup>4</sup>

**Figure 1.<sup>5</sup> Costs and Benefits of Climate Policy**



This example highlights an important aspect of climate policy analysis: the trade off between expected values, on one hand, and tail and variance, on the other. In this particular example, because the expected cost of the policy “outweighs” expected benefits, this policy is rejected on the basis of a conventional cost-benefit analysis. However, the presence of a fat tail in the benefits distribution suggests potential high damages if the policy is rejected. With relatively low, yet significant probability, the damage (if a 450 ppm policy is rejected) may reach double-digit figures. There is a 10% probability that the irreversible damage process results in costs of more than 5.7% of the gross world product (GWP), while there is a 90% probability that the cost of an abatement policy is less than 4.4% of the GWP. Therefore, the choice is between higher costs versus higher risk. The expected value approach masks this trade off.

## $\alpha$ -Precautionary Principle

$\alpha$ -precautionary principle<sup>6</sup> offers an alternative to conventional cost-benefit analysis that focuses on a central estimate of underlying parameters.  $\alpha$ -precautionary principle “. . . differs from current conceptions of the precautionary principle by considering both the worst-case and best-case scenarios, rather than focusing merely on uncertainty about harmful outcomes.”<sup>7</sup> This approach “. . . is most crucial in situations in which uncertainty is especially grave and no quantitative assessment of probabilities is available, but it is also useful in cases in which uncertainty is limited to potential catastrophic risks rather than more moderate outcomes.”<sup>8</sup> In sum,  $\alpha$ -precautionary principle offers policymakers a method to obtain economic value of the underlying uncertain outcomes based on three different numbers: (a) best-case scenario; (b) worst-case scenario; and (c) wait coefficient “alpha”: “. . . the worst case scenario is grim, perhaps on the order of the end of civilization; the best case scenario is that harm from climate change is modest.”<sup>9</sup> Selection of alpha (about 0.01) reflects the probability of catastrophic temperature increasing up to up to 20° C.<sup>10</sup>

While this assessment may be a good approximation for potential cost of BAU (or slightly below BAU) emission scenario (e.g., scenario with relatively high probability for global temperature rise to exceed 8° C), policymakers need an analytical tool to evaluate various emission scenarios (for example, GHG concentration targets in a range between a 400 and 600 ppm stabilization target). All three numbers, mentioned above, should be calculated for each scenario. It is obvious that for a lower stabilization target, a lower alpha should be considered. Then, selection of alpha should be done in the context of all available information on the climate science side. Climate science is offering some approximation for climate sensitivity distribution.<sup>11</sup> Modern literature continues to offer distributions for climate sensitivity. Similarly, economic literature offers a range of estimates for economic damage attributable to climate change. This research made its way into a regulatory document: Interagency Report on Social Cost of Carbon (SCC). Thus, instead of focusing on just two extreme states of the world it may be better to consider all plausible states of the world and then apply more advanced methodology to quantify the tail of a damage distribution.

“One way to understand these models [ $\alpha$ -maxmin models] is that we might want to minimize our regret for making the wrong decision, where we regret not only disastrous outcomes that lead to the worst-case scenario, but also we regret having missed the opportunity to achieve the best case scenario.”<sup>12</sup> This treatment of climate policy is consistent with application of the proposed real options

3. See, e.g., Carolyn Kousky et al., *Risk Premia and the Social Cost of Carbon: A Review*, 5 *ECONOMICS* 2011-21 (2011), at <http://www.economics-ejournal.org/economics/journalarticles/2011-21>; Robert E. Kopp et al., *The Influence of the Specification of Climate Change Damages on the Social Cost of Carbon*, 6 *ECONOMICS* 2012-13 (2012), at <http://dx.doi.org/10.5018/economics-ejournal.ja.2012-13>

4. See Jon Anda et al., *Economics of Climate Change Under Uncertainty: Benefits of Flexibility*, 37 *ENERGY POL'Y* 1345 (2009).

5. *Id.*

6. Farber, *supra* note 2.

7. Daniel A. Farber, *Uncertainty*, 99 *GEO. L.J.* 901, 905 (2011).

8. *Id.*

9. Farber, *supra* note 2, at 10730.

10. *Id.*

11. *Id.* at 10729.

12. *Id.* at 10726.

analysis (ROA).<sup>13</sup> In the case of climate policy, regrets could be interpreted as unrecoverable damage or (and) sunk abatement cost. Regrets on the damage side are balanced by regrets on the abatement cost side. Higher concentration target results in lower regrets on the abatement cost side and higher on the damage side, and vice versa; lower emission target results in lower regrets on the climate side and higher on the abatement cost side. ROA offers the way to calculate a shadow price of these regrets and gives decisionmakers a tool to assess different emission reduction pathways, to act promptly in response to new information and knowledge regarding the climatic system and economy.

### Interim Policy Target and Correction Cost of Climate Policy

If a regulator could know the exact values of exogenous parameters (climate sensitivity, damage function, abatement cost function, etc.) he would be able to compute an optimal emission trajectory at the outset. Unfortunately, these parameters are unknown. Their distributions reflect the current state of knowledge regarding climate and economics. Initially, selected environmental targets will unlikely mirror an “ideal” emission trajectory and will need to be corrected as new information becomes available and when a political cycle allows for corrections of the initial policy. Climate policy is sticky and it may take several years to implement adjustments. Correction of the policy and the target will result in additional costs, not accounted for when the initial environmental target was selected based on point estimates of damage and abatement costs. Correction costs could be considered as a “penalty” for deviation from the unknown “ideal” policy target.

Since any initial decision most likely will be reconsidered, cost-benefit (or cost effectiveness) analysis should also include the correction costs attributed to fixing this initial policy. Correction costs are an important element of the cost-benefit analysis of climate policy. Regulators should select an emission target that minimizes the sum of anticipated damage, anticipated abatement costs and correction costs. Each point estimate of economic damage (and abatement cost) has a pair, which is correction cost. Thus for each level of policy target (say, reflected in ppm) we consider two numbers instead of a distribution function: the point estimate of anticipated cost (central value or best guess) and the point estimate of correction cost.

Anticipated cost and correction cost are inversely proportional. If the higher value of the anticipated avoided damage assigned to emission target is imbedded into the decision procedure, then a lower correction cost should be considered. For example, a regulator may conservatively assign a point value of 5.7% GWP that represents avoided damage (benefits of climate policy aimed to meet 450 ppm target) in the 90th percentile. With a probability of 0.9,

benefits of this policy (i.e. avoided damage) will not exceed 5.7% of GWP, actual avoided damage could be higher than 5.7% of GWP only with a probability of 0.1, and correction costs on the damage side would be relatively low. If, instead, a regulator takes the value of avoided damage in the 50th percentile, then actual damage could be higher than this point estimate with a probability of 0.5 and correction costs would be higher. At the same time, the relatively higher value of damage will result in a relatively lower (tighter) emission target and will raise anticipated abatement costs and correction costs on the abatement side.

### What Are Correction Costs?

Let both anticipated benefits and cost equal to their expected values. Then, correction cost on the benefit side equals to zero, if actual damage is less than the expected value. Regulators could slightly “untighten” emission target in order to save on abatement cost in the future. The correction cost is positive if actual damage exceeds its expected value. The expected correction cost (ECC) is:

$$ECC = \sum p_i \max(0, D_i - \bar{D})$$

where  $p_i$  is probability of an outcome  $D_i$  and  $\bar{D}$  is the expected damage. Correction cost, as defined above, equals to an option value of call on adaptation services. If the response of the climatic system to an anthropogenic impact would appear higher than expected, then an actual adaptation cost (plus irrecoverable damage)  $D$  will be consistently higher than its expected level  $\bar{D}$ . Assume that in order to hedge these costs a regulator can buy at-the-money call option on adaptation. Holding this option a regulator will call for “adaptation services,” if actual damage exceeds its expected value. Regulators may consider any other value for anticipated damage (for example, its median, or damage in 90th percentile), then the selected value for anticipated damage will be the trigger price.

The value of this option is a value of risk associated with the selected policy. Then, instead of a value of damage we consider an expected damage and price of the option on adaptation services. Selected emission targets will appear more expensive in terms of potential losses. Higher uncertainties on the climate side will drive the price of that option higher. Regulators include into calculations the price of at-the-money call option on adaptation services, or, in other words, a regulator adds the lost value of a call option on the climate asset. The same strategy could be applied to the abatement cost of the selected climate policy.

### Option Value of Climate Policy

In conventional integrated assessment analysis the regulator is the only “agent.” Therefore, a regulator bears all costs and benefits of the selected policy balancing expenses between risk prevention and mitigation, and across time periods. The regulator is simultaneously a buyer and underwriter of these options. Higher option prices are a

13. Jon Anda et al., *supra* note 4.

byproduct of economic growth. Accumulation of greenhouse gases in the atmosphere triggers negative changes in the climatic system. The monetary value of these changes constitutes an economic damage attributed to climate change. This damage represents a deferred external cost of climate policy. Thus, IAM is a dynamic optimal growth model with an additional module that represents dynamic feedback (negative, as a rule) between current economic growth and future economic growth affected by the degradation of the climatic system. Regulators maximize net discounted welfare by selecting savings rate and abatement strategy. Both savings invested into capital formation and abatement increase future production and, therefore, increase future welfare, but at the expense of current welfare reduction. Future welfare losses represent a deferred cost of current investment and environmental policy.

In IAM framework, we can interpret the correction cost as if a regulator is losing the value of call options to prevent damage of the selected policy, if this damage turns out higher than the expected cost. In time zero, the regulator has a real option on a relatively understated “climate asset.” To be precise, regulators have a continuum of real options (assuming regulators can select a GHG concentration target from a continuous set of environmental targets). As soon as this selection is made, regulators give up some flexibility and, therefore, kill the option to prevent excessive damage, if the climate asset appears more vulnerable to GHG emissions.

### Dynamic Hedging of Climate Policy

Assume that at some point in a distant future major uncertainties are resolved and an “ideal” target is finally calculated. Each correction of an interim emission target should narrow the gap between the current and the “ideal” target. For example, if an “ideal target” is 500 ppm, then the correction process, starting from an interim target of 600 ppm, may look like 600 ppm→450 ppm→550 ppm→510 ppm→490 ppm→500 ppm. The learning process would “narrow” probability distributions of uncertain parameters and, therefore, reduce the value of correction costs for a given interim target. Dynamics of the interim target may not be monotonic, but as long as a “true value” of uncertain parameters was included into an initial set of its possible realizations, the magnitude of corrections should decline with each step, and convergence will be monotonic.

Simultaneously, the cost and benefits of the policy will be recalculated. Climatic processes could be irreversible and public policy may be “sticky.” It will complicate adjustments and corrections of emission targets and result in extra cost associated with the corrections.

There are several elements of correction costs. If the climatic system turns out to be more sensitive to anthropogenic emissions and/or socioeconomic systems are more vulnerable to climate change, then adaptation cost would be higher than anticipated. The same logic works for abatement costs. The correction cost is equal to the call option value on abatement. On one hand, long-term damage attributed to climatic change is unknown; on another hand, near- and mid-term reactions of the economy for a selected climate policy (cost of carbon emission reduction) is unknown too. Regulators should select dynamically adjusted policy targets balancing between anticipated abatement costs and damage with correction costs on both sides.

### Conclusions

As long as distribution has a finite variance, a fat tail risk is quantifiable,  $\alpha$ -precautionary principle offers policymakers a method to obtain an economic value of environmental policy based on point estimates of the worst and the best outcomes, as well as an alpha-wait coefficient that could be derived from a probability distribution or set arbitrarily. In my view, climate science and economics of climate change have accumulated enough knowledge to propose plausible probability distributions for underlying uncertainty parameters or, at least, to construct a multi-step and multinomial event tree. In either case, application of real options analysis (ROA) would be possible and productive. ROA is the most reliable tool to assess multistep processes of climate policy formulation. Each decision point narrows future flexibility. Value of this flexibility equals to the lost option value.

If distribution exhibits infinite variance, then tail should be truncated at some point: “Rather than trying to solve the intractable problem of the potential infinities in fat-tailed distributions, we can cut off the tail at some plausible “worst case”—but then make up for our inability to directly account for the full spectrum of outcomes by giving heavy weight to the chosen bad scenario.” In terms of truncation of a fat tail, option methodology could be explained as a more sophisticated truncation technique. Strike price is a truncation point. If strike price (lower truncation point) is lower, then an option value (higher waited value of “worst case scenario”) is higher. Advanced option pricing formulas take into account all four characteristics of distribution: mean, variance, skewedness and kurtosis, and, therefore, will account for tail risk. As a hedging tool, options control the “invisible” costs of climate policy.



## R E S P O N S E

# Comment on *Uncertainty*

by Gordon Woo

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The precautionary principle is often cited to assure the public, in situations where decisions have to be made under great uncertainty, that safety is paramount. However, this blanket assurance comes at the cost of foregoing a potential public benefit associated with an alternative riskier decision. Those basing a decision on the precautionary principle might implicitly or subconsciously also consider such benefit loss. For reasons of transparency and auditability, there is practical merit in attempting to make this explicit and measurable. This has been done by Daniel Farber in his paper on *Uncertainty*, originally published in the *Georgetown Law Journal*.<sup>1</sup>

The concept of  $\alpha$ -precaution is aimed at avoiding the worst-case scenario, such as dominates application of the precautionary principle. It is more nuanced, and involves precaution against losing the possible benefits of the best-case scenario. The user decides on the value for the optimism-pessimism weight parameter  $\alpha$ , balancing the worst and best cases. According to Daniel Farber, the range of this weight parameter might be narrowed “by using empirical evidence showing how individuals approach decision making in situations characterized by ambiguity or through experience over time that might allow officials to develop norms about the appropriate  $\alpha$ .”<sup>2</sup> Right now, guidance on the choice of the weight parameter is rather vague, except that it is intuitively a measure of optimism versus pessimism.

The  $\alpha$ -precautionary principle is intended for use when decisionmakers cannot quantify risks. Farber considers it to be most crucial in situations in which uncertainty is especially grave, and no quantitative assessment of probabilities is available. In addition, Farber suggests it is useful in cases in which uncertainty is limited to potentially catastrophic risks rather than more moderate outcomes. The  $\alpha$ -precautionary principle occupies a middle ground between conventional quantitative risk assessment and the standard precautionary principle.

More than any other industry, the transaction of insurance involves an estimate of probability, required for setting premiums, and the formal quantitative assessment of

probability has been advanced by insurance risk modelling agencies such as RMS to include terrorism risk. As with the rating agency S&P, so with the Nuclear Regulatory Commission, ignoring the possibility of terrorist attacks because they seem to be beyond precise quantification is not a defensible public policy. Although Farber views terrorism as a risk analyst’s blind spot, modern quantitative risk analysis is actually well capable of informing policy on counter-terrorism, without recourse to the  $\alpha$ -precautionary principle.

The same broad conclusion applies to financial risks. Probabilistic risk management metrics have both the flexibility and capability of meeting the needs of regulators much better than the comparatively blunt  $\alpha$ -precautionary principle. Unfounded assumptions, omission of risk factors, and other errors have led to the underestimation of financial risks in the past. Straight application of the  $\alpha$ -precautionary principle would have drastic consequences, such as potentially closing down some major financial markets, where traded volumes are measured in many billions of dollars.

For climate change, which is the predominant international environmental policy concern, the  $\alpha$ -precautionary principle adds little to the standard precautionary principle, since such benefits as may come with climate change are dwarfed by the enormous costs for future generations. For the disposal of nuclear waste, the costs for future generations are also massive, and the precautionary principle might be invoked in view of the inherently large uncertainty over future accidental or malicious intrusion. However, nuclear energy constitutes a much needed societal benefit that has to be weighed against the major risks of waste disposal. So the  $\alpha$ -precautionary principle might justify the current policy of continuing nuclear power generation, despite the unsolved problem of nuclear waste disposal.

For advanced technology in general, the  $\alpha$ -precautionary principle is a simple variation of the standard precautionary principle that might influence public policy. In Europe, for example, the precautionary principle has been adopted to exclude genetically-modified foods from the food market. But exercise of the  $\alpha$ -precautionary principle, accounting

1. Daniel A. Farber, *Uncertainty*, 99 GEO. L.J. 901 (2011).

2. Daniel A. Farber, *Uncertainty*, 42 ELR 10725, 10728 n.34 (Aug. 2012).

for superior yield benefits in harsh growing environments, might yet reverse this policy.

In the domain of medical innovation, a form of the  $\alpha$ -precautionary principle is already operational, with the hopeful prospect of new improved treatments being balanced by dread of allowing another horrific thalidomide tragedy. Fifty years ago, as a young FDA regulator, Frances Kelsey was honored by President John F. Kennedy for her exceptional vigilance in not authorizing thalidomide for use in the United States. Since then, the appropriate  $\alpha$  for the approval of new drugs has shifted towards cautious pessimism over potential side effects, but not so far as to make new drugs development impossibly protracted and expensive. In regenerative medicine, significant advances may be forthcoming in the next few decades through the application of nanotechnology. But concern remains over the unknown side effects from nanoparticles. Because of the potential large upsides as well as downsides, Farber

argues that nanotechnology is another pertinent application of the  $\alpha$ -precautionary principle.

A more immediate and pressing issue of health public policy that might be addressed using the  $\alpha$ -precautionary principle concerns the authorization of genetic engineering experiments to produce highly lethal pandemic flu viruses, such as the avian flu H5N1. The scientific lessons learned by virologists from managing to engineer new deadly viruses should be weighed against the societal risk of their accidental or malicious release. The precautionary principle of banning such laboratory experiments in genetic engineering would be hard to enforce internationally, given the reluctance of scientists to be constrained in their choice of research, and their mobility in avoiding bureaucratic restrictions in specific countries. As an addition to the library of tools to assist public policy in ambiguous circumstances such as this, the  $\alpha$ -precautionary principle should prove its worth in courts of law and beyond.

## ARTICLE

# What Climate Change Can Do About Tort Law

by Douglas A. Kysar

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## Introduction

Climate change is coming to the common law. Plaintiffs in several cases are pressing tort claims against carefully composed groups of greenhouse gas emitting defendants, seeking monetary damages and injunctive relief to lessen the threat and financial burden of climate change's harmful impacts. Accordingly, the question of whether greenhouse gas emissions constitute an actionable tort, may soon receive judicial airing. In all likelihood, courts will agree with commentators that nuisance and other traditional tort theories are overwhelmed by the magnitude and the complexity of the climate change conundrum. Built as it is on a paradigm of harm in which *A* wrongfully, directly, and exclusively injures *B*, tort law seems fundamentally ill-equipped to address the causes and impacts of climate change: Diffuse and disparate in origin, lagged and latticed in effect, anthropogenic greenhouse gas emissions represent the paradigmatic anti-tort, a collective action problem so pervasive and so complicated as to render at once both all of us and none of us responsible. Thus, courts will have ample reason—not to mention doctrinal weaponry—to prevent climate change tort suits from reaching a jury.

But what might climate change suits do for tort law? That is, rather than serving to address the impacts of climate change, might tort law itself be impacted by climate change? This Article answers “yes.” Just as earlier periods of unprecedented injury and loss of life contributed to significant changes in American tort doctrine and practice,<sup>1</sup> an influx of climate change claims may force a reevaluation of the existing system for compensating and deterring harm. Most significantly, the bar for exoticism in tort may shift as courts are confronted by climate-related claims. Various suits that have frustrated judges because of their scale, scientific complexity, and widespread policy implications—such as claims involving toxic and environmental

harm, tobacco and handgun marketing, or slavery and Holocaust reparations—may come to seem less daunting and intractable when juxtaposed against “the mother of all collective action problems.”<sup>2</sup> Current debate over whether courts are engaging in “regulation through litigation”<sup>3</sup> may come to appear miscast in the face of suits that raise at once both an ordinary pollution nuisance and a challenge to the very foundations of modern industrial life.<sup>4</sup> At long last, courts and commentators may come to view tort claims in degrees of polycentricity, rather than in crude binary terms of conventional civil disputes, on the one hand, and political or regulatory matters, on the other.<sup>5</sup> Should these developments occur, they will be salutary, as they will help tort law to continue its role as backdrop and partner to environmental, health, and safety regulation. Gradually and unevenly, the administrative state is evolving in response to the complex, uncertain, and potentially catastrophic nature of 21st century threats to social welfare. Problems such as climate change, terrorism, infectious disease outbreaks, and financial market instability resist figuration within conventional regulatory frameworks, not least because their drivers and impacts span the globe and fall under multiple agency mandates. Even garden variety regulatory tasks such as ecosystem management and pharmaceutical regulation increasingly are being seen to require new modes of governance, ones built on an understanding of risk regulation as a continual process of experimentation, monitoring, and adjustment in light of ever-present prospects of unpleasant surprise. Under this “new governance” framework,<sup>6</sup> regulatory targets are seen

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1. See generally JOHN FABIAN WITT, *THE ACCIDENTAL REPUBLIC* (2004). See also LAWRENCE M. FRIEDMAN, *A HISTORY OF AMERICAN LAW* 516-23 (3d ed. 2005).

2. Sarah Krakoff, *Fragmentation, Morality, and the Law of Global Warming*, available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=976049](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=976049) (last visited June 23, 2012).

3. For critical overviews, see REGULATION THROUGH LITIGATION (W. Kip Viscusi ed., 2002); ANDREW P. MORRIS, BRUCE YANDLE, & ANDREW DORCHAK, *REGULATION BY LITIGATION* (2009). For the origination of the term, see Robert B. Reich, *Regulation Is Out, Litigation Is In*, USA TODAY, Feb. 11, 1999, at 15A.

4. Cf. Eric A. Posner, *Tobacco Regulation or Litigation?*, 70 U. CHI. L. REV. 1141, 1155 (2003).

5. Cf. Lon L. Fuller, *The Forms and Limits of Adjudication*, 92 HARV. L. REV. 353, 394-404 (1978).

6. The “new governance” literature is vast. For overviews, see Scott Burris, Michael Kempa, & Clifford Shearing, *Changes in Governance: A Cross-Disciplinary*

to be embedded within intricate systems that defy precise prediction and control; rapidly evolving, globally interconnected, and wickedly complex, such systems do not yield to straightforward command-and-control regulation or other familiar lawmaking forms.<sup>7</sup> Instead, governance only emerges from the decentralized, overlapping, and continually evolving interventions of public and private actors, each operating at different levels and from different spheres of authority, utilizing a range of policy tools both hard and soft, and representing diverse interests and stakeholder groups.

As regulatory law moves in response to these unprecedented challenges to the promotion of welfare (and new understandings of old challenges), tort law must move along with it in order to continue to serve as the administrative state's necessary backdrop. Given its classical liberal origins and its limited adjudicatory framework, tort law will always lag regulatory law in its embrace of a "systems view" of risk and harm. Nevertheless, the era of climate change will make certain trappings of classical liberalism—such as the presumed atomicity of private actors or the purely mechanistic depiction of causation—increasingly difficult to maintain. Just as railroad and workplace carnage forced recognition of new forms of risk in the latter half of the nineteenth century, just as automobile and product-caused accidents illuminated extended chains of responsibility in the 20th century, climate change will challenge prevailing conceptions of wrongdoing in the 21st century. Judges, having engaged up close with the extraordinary accumulation of minor, diffuse activities into a global environmental problem of potentially biblical magnitude, may find themselves willing to step farther outside of the classical liberal tort paradigm in non-climate change cases—yet another surprising and dramatic consequence of humanity's most dramatic experiment with the natural world.

## Climate Change as Tort Reform

Make no mistake: A conceivable set of arguments on behalf of climate change tort plaintiffs *does* exist. The problem, however, is that the winning scenario for most climate-related harms requires a court to stretch in plaintiffs' direction at nearly every stage of the traditional tort analysis: Duty would have to encompass "negligence in the air," rather than more particularized relations of responsibility; nuisance would have to be interpreted as an absolute protection against significant invasions, irrespective of social welfare balancing; actual cause would have to embrace a probabilistic, risk-enhancement conception of causation; exceptional measures of apportionment would have to be invoked to address a multiple defendant problem of unprecedented magnitude; proximate cause would

have to be interpreted such that the scope of foreseeable harm from emissions both tracks projections from climate models that stand at the forefront of scientific inquiry and, in many cases, applies retroactively tantamount to strict liability; and harm would have to be expanded to include much more by way of anticipatory injury.

Judges are unlikely to follow plaintiffs down this gauntlet. Nevertheless, the effort to assess the validity of climate-related tort claims may have significant secondary effects for the common law, encouraging judges to view less extreme fact settings as more amenable to tort resolution.

**Duty/Proximate Cause.** Duty must be attentive to changing circumstances while remaining stable enough to honor private expectations. At times, this balancing act reaches a crisis point. Judges came under strain during the late 19th century, as shocking rates of injury and death among industrial workers became difficult to square with prevailing tort doctrines and free labor ideology. Part of tort law's adaptive disadvantage was its inability to assimilate new social scientific ways of apprehending the industrial landscape. While classical tort doctrines seemed capable of rationalizing away any individual case of workplace suffering, aggregated accident data presented a policy problem of unprecedented magnitude. "[I]n the face of such statistical regularities, classical tort law's attempt to assign fault and responsibility through individualized inquiry into each work-accident case seemed beside the point."<sup>8</sup> In contrast, judges showed nimbleness in responding to the changing American consumer marketplace, perhaps in part because of lessons from the industrial accident crisis. This products liability revolution had the effect of protecting the common law from the kind of wholesale displacement that occurred in the case of worker injury.

Like industrialization and mass marketing, climate change ill fits the existing tort paradigm. Consider the familiar framing of environmental harm as a collective action problem. For the better part of two thousand years,<sup>9</sup> this lens has influenced and at times dominated Western understanding of why certain resources—such as the finite capacity of the earth to absorb greenhouse gases without serious repercussion—are prone to tragic overuse. Unless individual self-interest can be constrained, the logic of the commons dilemma is inexorable: "Burn 'em if you got 'em, since the other guy is surely going to burn his." Keith Hylton attempts to distinguish between public goods—for which the government must compensate individuals when they are required to contribute—and public harms—for which the government may impose nuisance liability against individual contributors.<sup>10</sup> The problem is determining which is which. Are the *Connecticut* defendants creating a public harm when they emit greenhouse gases that contribute to climate change or are they merely failing to

*ciplinary Review of Current Scholarship*, 41 AKRON L. REV. 1 (2008); Orly Lobel, *The Renew Deal: The Fall of Regulation and the Rise of Governance in Contemporary Legal Thought*, 89 MINN. L. REV. 342 (2004).

7. See Michael C. Dorf & Charles F. Sabel, *A Constitution of Democratic Experimentation*, 98 COLUM. L. REV. 267, 270 (1998).

8. JOHN FABIAN WITT, *THE ACCIDENTAL REPUBLIC* 144 (2004).

9. See ELINOR OSTROM, *GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION* 2-3 (James E. Alt & Douglass C. North eds., 1990).

10. Keith N. Hylton, *When Should We Prefer Tort Law to Environmental Regulation?*, 41 WASHBURN L.J. 515, 533-34 (2002).

preserve the public good of atmospheric stability? What are the relevant public goods in *Kivalina*—the electricity grid and highway transportation system, in which case plaintiffs seem to bear a disproportionate burden for the goods' provision, or the atmosphere's limited absorptive capacity, in which case defendants seem unfairly saddled by nuisance liability? Expectations about resource ownership and socially appropriate behavior must drive the public good/public harm dichotomy in order for it to do meaningful conceptual work, yet the task of law frequently is to subject those very expectations to fresh inquiry.

Consider *Barasich v. Columbia Gulf Transmission Co.*,<sup>11</sup> in which a putative class of Louisiana landowners sued oil and gas companies for exploration, pipeline, and shipping activities that left residents more vulnerable to property damage during Hurricanes Katrina and Rita. Their allegation was directly linked to defendants' activity in reducing and impairing protective marshland. In dismissing the claims, the court emphasized such obligations traditionally only apply between "neighbors," construed in narrow terms.<sup>12</sup>

We are all "neighbors" in an environmental sense. Hence, law's intimate embrace of territoriality—and tort law's dependence on proximity—both are tested by climate change awareness. Duty and proximate causation remain substantially animated by a classical liberal worldview in which individuals are free to pursue activities unless they impose harms upon identified victims that bear some relational nexus to the actor. Certain categories of harm such as emotional distress or pure economic loss are problematic on this account because they reveal systems capable of spreading wide harmful impacts of our behavior. Tort law manages these threats by recognizing only limited categories of emotional distress and economic loss recovery, and by preserving the classical liberal fiction that we are atomistic, save for our occasional physical collisions. Climate change deals a final blow to this fiction by making the causation of physical harm independent of any familiar understanding of proximity. By comparison, the duty alleged in *Barasich* seems noncontroversial.

Law in the 21st century will be preoccupied with the problem of instilling responsibility within complex networks. Much of tort law works out the idea that responsibility needs to be confined, rather than located. Individuals are thought to have limited capacity to care for others, not least because of imperfect abilities to predict and prevent harmful consequences of action. The various uses of foreseeability in tort law respond to this condition, providing cues to help them prioritize limited investments in harm prevention.<sup>13</sup> Whatever its appropriateness in earlier times, this interpersonal vision seems out of focus in the climate change context where a plaintiff may be a many thousand-year-old Inuit tribe and where a defendant may

be a multinational corporation.<sup>14</sup> Duty and foreseeability should not be uncritically carried over from a nineteenth century template. Responsibility may need to be created, not limited.

One attractive option will be to focus on the instrumental efficacy of large institutional actors, such as corporations, or groups of actors, such as industries. Notwithstanding isolated flirtation by judges with a concept of industry-wide "enterprise liability,"<sup>15</sup> agency in tort law remains individualistic. Climate change litigation may cause courts to renew their romance with supra-individual conceptions of agency and responsibility, as the mismatch between the atomistic account and our governance needs will become apparent. Even in *Barasich*, the court bridled against "allegations that all of the defendants' activities caused all of the plaintiffs' damages."<sup>16</sup> Rejecting any notion of "group liability" that would allow plaintiffs to recover "without demonstrating any individual connection between any single member of the industry and the plaintiffs' harm,"<sup>17</sup> the court ruled that traditional (and insurmountable) causal requirements apply. A classical liberal individualism was at work in which "groups" do not easily register as duty-bearing entities with causal capacity. After marinating in climate change litigation for a while, however, judges might view a case like *Barasich* differently. They might see for instance, that the *Barasich* defendants had behaved as a group in several ways, including collectively lobbying to secure rights to conduct the exploration and pipeline activities that allegedly caused plaintiffs' harm.<sup>18</sup>

Courts in the twenty-first century may also become increasingly sophisticated in their treatment of epistemic responsibility. Commentators frequently assume that causal pathways in the climate change context are too complex and speculative to ground a duty of tort responsibility under conventional approaches.<sup>19</sup> This may or may not be true, but it is mistaken to assume that foreseeability exists independent of defendants. To ask what is foreseeable in order to ground responsibility is to ignore the responsibility of those who influence what is foreseeable. In fact, as the *Kivalina* plaintiffs note in their complaint, major oil companies began funding research into climate change as far back as 1970,<sup>20</sup> around the time that the CEQ warned that "carbon dioxide in the atmosphere could have dramatic and long-term effects on world climate."<sup>21</sup> At a certain level

11. 467 F. Supp. 2d 676 (E.D. La. 2006).

12. *Id.* at 690.

13. See Mark Geistfeld, *The Analytics of Duty: Medical Monitoring and Related Forms of Economic Loss*, 88 VA. L. REV. 1921, 1927 (2002)

14. *D* in this example is ExxonMobil Corp, lead defendant in *Kivalina*. See Rhett A. Butler, *Corporations Agree to Cut Carbon Emissions*, <http://news.mongabay.com/2007/0220-roundtable.html> (last visited June 23, 2012).

15. See *Hall v. E.I. Du Pont de Nemours & Co.*, 345 F. Supp. 353 (E.D.N.Y. 1972).

16. 467 F. Supp. 2d 676, 694 (E.D. La. 2006).

17. *Id.*

18. See, e.g., Leslie Wayne, *Companies Used to Getting Their Way*, N.Y. TIMES, Dec. 4, 1998.

19. See, e.g., Eric A. Posner & Cass R. Sunstein, *Climate Change Justice*, 96 GEO. L.J. 1565, 1592 (2008).

20. Complaint, *Native Village of Kivalina v. ExxonMobil Corp.*, No. CV-08-01138 SBA (N.D. Cal. Feb. 26, 2008), ¶ 162.

21. *Id.* ¶ 141. See Council on Env'tl. Quality, *CEQ Proactive Disclosure Reading Room*, <http://www.whitehouse.gov/administration/eop/ceq/foia/reading-room> (last visited June 23, 2012).

of generality, foreseeability has been satisfied for decades. Tort law will have to reckon with this dynamic, as it will become impossible to maintain that a robust independent body of knowledge exists to bear on foreseeability questions. Increasingly, scientists are confident that we have entered a new geological epoch, the *Anthropocene*, in light of the sheer scale and intensity of human interventions into earth system processes. To name one among many unprecedented features of this age, atmospheric CO<sub>2</sub> levels are now higher than at any point in 650,000 years.<sup>22</sup> Thus, it is reasonably foreseeable that we will face unforeseeable environmental challenges. Likewise, for the same reason that they hold promise, new technologies such as genetic and nanoscale engineering pose dimly understood and potentially considerable threats. Behaving reasonably under such circumstances cannot simply mean conforming to an existing understanding of risk and benefit. Instead, it must mean relating to uncertainty in a particular way, with a particular attitude. Scenario planning and other proactive, open-ended risk projection techniques might be required to behave reasonably toward novel technologies and activities.<sup>23</sup> Rather than risk deterring knowledge about risky products and activities through fixed assumptions about foreseeability, tort law might actively marshal the considerable epistemic capacity of private enterprise by imposing more dynamic duties of humility, caution, and investigation. In the extreme, judges might reconsider their abandonment of the “constructive knowledge” approach to foreseeable risk.

**Breach.** Such an orientation has implications for the assessment of liability. One effect might be to reveal deeper wisdom behind Judge Learned Hand’s admonition in *The T.J. Hooper* that “a whole calling may have unduly lagged in the adoption of new and available devices.”<sup>24</sup> This statement is often understood as an acknowledgment that markets sometimes fail and that independent judicial assessment of reasonableness is therefore merited, rather than deference to prevailing market conditions through a customary care standard. As the climate change problem reveals, independent judicial assessment of market outcomes may be merited by pervasive structural features of the economy that no longer are sustainable. Judges will not become macroeconomists or energy systems analysts, but they may experience a macro-scale shift in their attitude toward conventional economic activities. Judicial interest in strict liability may revive as the accumulated negative externalities of greenhouse gas emissions come to loom larger than the felt positive externalities of economic activity.

Attitudes of that sort have long driven tort doctrine, typically in favor of negligence rather than strict liability.<sup>25</sup> Even during tort law’s classical phases, judges struggled to explain why faultless victims of nonnegligent harms should bear a loss, rather than the actor who caused the harm.<sup>26</sup> Appeals to defendants’ liberty interests and freedom of action always rang hollow, given the impairment of those same interests among injured plaintiffs.<sup>27</sup> Pressed for an account, judges and commentators turned to a nebulous concept of social good said to flow from industrious activity. Often, such appeals took the form of claims about the “barbarism” that would follow if individuals were not free to pursue activities without fear of strict liability.<sup>28</sup> The core rationale for preferring negligence over strict liability remained one of a basic, almost aesthetic preference for society’s doers.

Classical tort law’s preference for the doer was formalized by law and economics, as the choice between strict liability and negligence came to be a matter of summing negative and positive externalities generated by a defendant’s activity. According to canonical accounts,<sup>29</sup> the costs and benefits of accidents are a function of two key variables: care levels and activity levels. The former has to do with the level of precaution an actor utilizes while engaging in an activity, while the latter has to do with the frequency and scale of the activity. With respect to any accident, then, judges may ask both whether the actor adopted all cost-justified investments in precaution and whether the activity in its overall costs and benefits was justified at all. The latter activity level analysis is said to be difficult, if not impossible for courts to conduct. Thus, the determinative factor in choosing between strict liability and negligence is said to hinge on these uncounted impacts of activity. Where judges suspect that an activity poses significant residual costs even after all reasonable precautions have been undertaken, strict liability is justified. Implicitly, the canonical law and economics wisdom assumes that activities tend to offer positive benefits for society, above those already captured by the price mechanism.<sup>30</sup> Absent such an assumption, it would remain unexplained why negligence is the default rule that must be overcome through a showing of significant unregulated costs from activity. Courts just as easily could apply strict liability as the default rule unless an activity is shown to offer significant uncaptured benefits.<sup>31</sup> Thus, the classical liberal preference for the doer remains at work, justified on the ground that activity levels

22. See NATIONAL RESEARCH COUNCIL, CLIMATE STABILIZATION TARGETS: EMISSIONS, CONCENTRATIONS, AND IMPACTS OVER DECADES TO MILLENNIA (2010), available at [http://www.nap.edu/catalog.php?record\\_id=12877](http://www.nap.edu/catalog.php?record_id=12877); Johan Rockström, *A Safe Operating Space for Humanity*, 461 NATURE 472 (2009); J.B. Ruhl, *Climate Change Adaptation and the Structural Transformation of Environmental Law*, 40 ENVTL. L. 343 (2010).

23. Witt has written that these 21st century risks exceed the grasp of the tort system. JOHN FABIAN WITT, THE ACCIDENTAL REPUBLIC 209 (2004).

24. 60 F.2d 740 (2d Cir. 1932) (holding that evidence of industry custom is relevant, but not decisive, for purposes of assessing reasonableness).

25. See Jon D. Hanson & Douglas A. Kysar, *Abnormally Dangerous: Inequality Dissonance and the Making of Tort Law*, 45 VAL. U. L. REV. (forthcoming 2011).

26. WITT, *supra* note 23, at 28.

27. Cf. Peter M. Gerhart, *The Death of Strict Liability*, 56 BUFF. L. REV. 245 (2008).

28. *Brown v. Collins*, 53 N.H. 442 (1873). See also *Losee v. Buchanan*, 51 N.Y. 476 (1873).

29. See Steven Shavell, *Strict Liability Versus Negligence*, 9 J. LEGAL STUD. 1 (1985).

30. See Keith N. Hylton, *The Economic Theory of Nuisance Law and Implications for Environmental Regulation*, 58 CASE W. RES. L. REV. 673 (2008).

31. See Guido Calabresi, *Toward a Test for Strict Liability in Torts*, 81 YALE L.J. 1055, 1063 n.29 (1972).

are generally not thought to need disciplining, since positive externalities of activity tend to dominate negative ones.

Because of climate change, the presumption that external costs and benefits of activity are positive on net is becoming no longer tenable with respect to major segments of the economy. [. . .] Thus, the assumption that “the public generally profits from individual activity,”<sup>32</sup> may be subjected to scrutiny in coming years, as the accumulated debts from such activity become increasingly difficult to ignore. The theoretical apparatus devised to explain the dominance of negligence liability will instead provide strict liability’s justification.

**Causation.** Following *Daubert v. Merrell Dow Pharmaceuticals, Inc.*,<sup>33</sup> most courts have adopted a more proactive stance toward the admission and supervision of scientific evidence. The espoused goal of the Court’s opinion was to move away from a simple scientific acceptance test to a more judicially-engaged inspection of the techniques and methodological rigor behind proffered scientific evidence. Commentators regard *Daubert* as having created a heightened bar for plaintiffs, as judges utilize their gatekeeper role to hold plaintiffs’ experts to a high standard. Climate change litigation may reverse this dynamic. If judges are faced with climate change scientists and their skeptical counterparts in a series of intensive *Daubert* hearings, they will find the former group more worthy of admission to testify on every relevant criteria identified in *Daubert* and subsequent case law.<sup>34</sup> Judicial concern about “junk science”—usually focused on experts hired by plaintiffs’ lawyers in advance of litigation—instead may shift to scientists and spokespeople hired by greenhouse gas emitters.<sup>35</sup> The result may be a cultural shift among judges toward scientific evidence and a willingness to modernize causation doctrine.

**Harm.** Implicit conceptual dichotomies often lurk beneath the surface of tort doctrine: physical is contrasted with emotional, individual with communal, manmade with natural, immediate with distant, present with future, and so on. One side of these pairings is privileged over another, often on the theory that tort cannot provide redress for all wrongs and thus must establish some system of triage. Surfacing tort law’s deep structures and subjecting them to critique has been a major and fruitful focus of feminist tort scholarship for some time now. Intriguingly, climate change litigation may aid this cause by making more visible tort law’s disfavored interests. Certain forms of injury that have been rationalized away as incidental or marginal may come to appear more significant when presented in this dramatic new light.

Consider the distinction between individual and communal interests, which relates to similar dichotomies

between personal and relational or property and cultural interests. In the wake of *Exxon Valdez*, Alaska Natives sought recovery for an irreparable impairment to their way of life. Addressing this claim, the Ninth Circuit noted that the Alaska Native class had settled economic claims stemming directly from loss of fishing resources. The panel then pondered what could be meant by “cultural damage” apart from those losses. To the extent that culture was acknowledged by the panel, it was understood to be the basic right of every individual to pursue a life of his choosing. From that perspective, the Alaska Natives failed to satisfy the “special injury” requirement of a public nuisance.<sup>36</sup>

A sleight of hand was at work here. It may be that all Alaskans can pursue the various disaggregated activities that were impaired by the *Exxon Valdez* disaster and that collectively *appear* to compose the Native Alaskans’ distinctive culture. But only Native Alaskans can claim historical continuity with this culture. For thousands of years, only Native Alaskans have been returning bones of consumed salmon to the waters from which they are caught, with gratitude and hope for next year’s harvest. To imagine that liberalism’s self-made man might fashion himself into the equivalent of a Native Alaskan is to deprive the group injury of distinctiveness through what amounts to a threat of cultural entry. And because liberalism promises to every individual maximal freedom to pursue his own life course, this hypothetical threat of entry is always available to defeat a claim of cultural distinctiveness. As the number of lost cultures, languages, and territorial homelands mounts,<sup>37</sup> the reality of group-based cultural interests may become more tangible to courts because their disappearance makes their uniqueness plain. [. . .]

A similar dynamic already seems to be playing out in the common law with respect to ecological resources. Although American property and tort law traditionally expressed a bias against intact wilderness and in favor of human development of land,<sup>38</sup> courts are beginning to adopt a sensibility toward land use that is more ecologically informed, breaking down the dichotomy between development (seen as productive) and wilderness (seen as wasteful or dangerous). Climate change suits will further this exercise as the attempt to understand harm forces judges to think ecologically. Ecosystem services that were previously overlooked or undervalued become more legible and material. Distances that seemed remote become more intimate, as the natural pathways that connect them are brought into view. Accordingly, it becomes less comfortable to maintain the traditional assumptions that “natural” and “distant”

32. OLIVER W. HOLMES JR., *THE COMMON LAW* 95 (Dover Publications 1991) (1881).

33. 509 U.S. 579 (1993).

34. See, e.g., *Green Mountain Chrysler Plymouth Dodge Jeep v. Crombie*, 508 F. Supp. 2d 295, 310-33 (D. Vt. 2007).

35. See Sophia I. Gatowski et al., *Asking the Gatekeepers: A National Survey of Judges on Judging Expert Evidence in a Post-Daubert World*, 25 L. & HUM. BEHAV. 433, 443 (2001).

36. In re the Exxon Valdez: Alaska Natives Class v. Exxon Corp., 104 F.3d 1196 (9th Cir. 1997). See Denise E. Antolini, *Modernizing Public Nuisance: Solving the Paradox of the Special Injury Rule*, 28 *ECOLOGICAL L.Q.* 755 (2001) (arguing that the modern requirement that plaintiffs demonstrate harm different in kind, rather than merely degree, from the public rests on a misconstrual of public nuisance’s historical origins).

37. See Rebecca Tsosie, *Indigenous People and Environmental Justice: The Impact of Climate Change*, 78 *U. COLO. L. REV.* 1625, 1633-47 (2007).

38. See John G. Sprankling, *The Antiwilderness Bias in American Property Law*, 63 *U. CHI. L. REV.* 519 (1996).

interests are less important than those that are “manmade” and “immediate.”

Less comfortable too will be the assumption that risk of future harm is not an injury. Short-sighted and optimistic habits of thought frequently lead us to downplay the significance of uncertain future harms in pursuit of current gains.<sup>39</sup> Climate change litigation focuses courts’ attention on the extraordinary inertia and risk potential of the climate system. Familiar linear understandings of time become confused in the climate change context, where emissions are long-lived and system patterns are often irreversible. The reality of path dependence in energy infrastructure investment and the possibility of climate change catastrophe demands more by way of prevention and insurance than it does optimal cost-benefit balancing.<sup>40</sup> Once judges have understood these aspects of the climate change problem, they may view risk recovery as a useful epistemological device for bringing the future into present focus and attention. Again, climate change plaintiffs will face a variety of remaining doctrinal obstacles, but for other victims of future harm, courts may begin fashioning mechanisms to overcome temporal neglect. By comparison to the

climate change conundrum, the latency problem posed in more garden variety environmental and toxic tort suits seems quite manageable.

## Conclusion

Ideas about tort law must continually interact with the realities of human suffering and with institutions that address such suffering.<sup>41</sup> Such a complex and contingent matrix does not lend itself readily to prediction, but if scientists are even remotely correct in their assessment of harms to be expected from greenhouse gas emissions, climate change will enter prominently into tort law’s evolutionary dynamics. Judges likely will not award damages or issue injunctions for climate-related harms but may find themselves affected in other ways by the process of rejecting such claims. The tort system may shift to keep in alignment with an administrative state that is increasingly preoccupied by grander, and more complicated challenges than the previous century posed. Even as climate change tort suits fail on the merits, they may yet change the air.

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39. See Jeffrey J. Rachlinski, *The Psychology of Global Climate Change*, 2000 U. ILL. L. REV. 299.

40. See Steven J. Davis et al., *Future CO<sub>2</sub> Emissions and Climate Change From Existing Energy Infrastructure*, 329 SCIENCE 1330 (2010); Martin Weitzman, *On Modeling and Interpreting the Economics of Catastrophic Climate Change*, 91 REV. ECON. & STAT. 1 (2009); Martin Weitzman, *A Review of the Stern Review on the Economics of Climate Change*, 45 J. ECON. LIT. 703 (2007).

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41. See John Fabian Witt, *Contingency, Immanence, and Inevitability in the Law of Accidents*, 1 J. TORT L. 1, 19 (2007).



R E S P O N S E

# Comment on Doug Kysar's What Climate Change Can Do About Tort Law

by James Anderson

James Anderson is a behavioral and social scientist at the RAND Corporation. This Response reflects the views and opinions of only myself and does not necessarily reflect the position of RAND or any unit within RAND. This Response has not been peer-reviewed.

Professor Doug Kysar's thought-provoking article<sup>1</sup> cogently outlines an array of doctrinal and conceptual hurdles that climate-change plaintiffs face and notes the way in which tort's focus on short-term solutions—its marginalist bias as Professor Kysar puts it—impairs its ability to address a variety of important issues. He then suggests that while climate change litigation may not succeed at its own goal, it may have the salutary effect of changing tort law for the better. As he puts it: "Various suits that have frustrated judges because of their scale, scientific complexity, and widespread policy implications—such as claims involving toxic and environmental harm, tobacco and handgun marketing, or slavery and Holocaust reparations—may come to seem less daunting and intractable when juxtaposed against the 'mother of all collective action problems.'"<sup>2</sup>

In this Response, I sketch what I see as two problems with this argument. The first concerns Kysar's implicit model of legal change, which I think is overly sanguine about the ability of tort law to evolve in response to either climate change or climate change litigation. The second concerns the issue of the institutional competence of the courts to administer the kind of tort law regime that Kysar proposes.

## I. Will Climate Change Litigation Actually Change Tort Law?

Setting aside for the moment whether it is desirable, I'm not as optimistic about the possibility of climate change litigation actually changing tort doctrine in the ways that Kysar proposes. This might be an unfair criticism because I'm not sure whether Kysar really believes that climate change litigation will change tort law or simply uses it as a

provocative device to unify an engaging law review article. But to the extent that Kysar is making a descriptive claim that engaging with climate change tort claims will actually change tort law, I must respectfully disagree. It is implausible to believe that climate-change litigation will, in fact, lead to these changes occurring in tort law.

To make the argument that tort law will evolve in response to climate change litigation, Kysar uses the analogy to the way that limitations on products liability like the requirement of privity dissolved in the early 20th century. He also cites the rise of accidents in the late 19th century and John Fabian Witt's work in chronicling the way that this subsequently shaped and changed tort law.<sup>3</sup> As I understand it, the argument is that widespread climate change litigation will similarly dissolve the currently existing limitations that prevent plaintiffs from succeeding in a variety of doctrine-stretching tort contexts and continue the transformation of American law from a "an individualized ex post reparative modality to a systemic ex ante planning one."<sup>4</sup> The change in tort doctrine he proposes seem substantial. For examples of suits that a reinvented notion of tort might address, he uses Holocaust and slavery reparations, toxic and environmental harm, and tobacco and handgun marketing.<sup>5</sup>

But there are critical differences between the distance that tort law had to evolve in the 19th and early 20th century to consider industrial accident and products liability claims and the distance that tort law would have to evolve in the ways that he suggests. In the products liability context, the basic tort paradigm of A injures B was largely intact. The traditional requirement of privity had to be overcome for modern products liability law to emerge, but

1. Douglas A. Kysar, *What Climate Change Can Do About Tort Law*, 42 ELR 10739 (Aug. 2012).  
2. *Id.* at 10739.

3. *Id.* (citing JOHN FABIAN WITT, *THE ACCIDENTAL REPUBLIC* (2004)).

4. *Id.* at 10744 (citing BRUCE A. ACKERMAN, *RECONSTRUCTING AMERICAN LAW*, at 74 (1984)).

5. *Id.* at 10739.

this was a tiny step compared to the doctrinal changes that he seems to suggest might be occasioned.

And, in the industrial accident context, the most salient outcome was the development of the legislatively-enacted workers' compensation system. In the industrial accident context, Kysar notes "tort law's adaptive disadvantage was its inability to assimilate new social scientific ways of apprehending the industrial landscape."<sup>6</sup> Climate change presents many of the same problems and it is not clear that tort has lost any of its comparative disadvantages over a legislative response.

The relative short doctrinal distance that needed to be traveled also provided a process by which that distance could be covered—it encouraged litigation. I don't know exactly what led Mr. MacPherson of *MacPherson v. Buick*<sup>7</sup> to bring suit in the face of clear adverse precedent on the question of privity, but he must have had some hope of convincing the courts of success. This is partly a function of the relatively small leap that he was requesting.

In contrast, as Kysar carefully chronicles in the first half of his Article, the doctrinal changes that climate-change litigation requires are much more substantial. A key theme in the logic of the doctrinal obstacles that Kysar describes is one of justiciability—that the scope of harms and causation are just too vast to address by use of the judicial system. Whether or not this is fact true, I think Kysar would agree that the first wave of litigation seems to be foundering on rulings of nonjusticiability of various kinds.

Rulings that a particular category of claims can simply not be addressed in the courts do not encourage follow-up litigation. In this respect, they are very different than a claim on the merits or even a narrower procedural ruling. If, as seems likely, the first wave of litigation is ruled nonjusticiable, it is not clear that there will even be a second wave of litigation. Who will fund it and what reasonable hope might they have of receiving a positive outcome?

Here, I must offer an analog from personal experience. I represented prisoners sentenced to death for 10 years in Pennsylvania. For many years, we attempted to litigate a claim of racial discrimination in capital sentencing in Philadelphia. Our chief doctrinal obstacle was *McCleskey v. Kemp*,<sup>8</sup> which held that race-of-victim racial discrimination in capital sentencing in the state of Georgia did not violate the Eighth or Fourteenth Amendments.

On paper, our claims were very different than those of Warren McCleskey. We plead and offered to prove not only a statistical pattern of race of defendant discrimination in capital sentencing but also a specific mechanism—racial discrimination in jury selection—that tied it to intentional action by a specific state actor—the District Attorney of Philadelphia. We even submitted a jury selection training videotape used by the district attorney's office that explicitly espoused race-based jury selection techniques. We

raised this claim in at least twenty capital cases in Philadelphia in both state and federal court in post-conviction.

We could not get an evidentiary hearing in any court. *McCleskey* was interpreted by the state and federal courts to mean that claims of racial discrimination in capital sentencing that were based on statistical evidence were nonjusticiable. The claims were too vast and implicated too many causal actors. Because it was essentially a holding that claims of this sort were not justiciable, *McCleskey* almost completely halted the development of this area of the law.

The analog to climate change litigation is imperfect, but obvious. A broad finding of nonjusticiability could seriously curtail litigation in this area, preventing the traditional common-law approach and the kind of tort reform that Kysar predicts. Many judges may be tempted to over-extend even a narrowly drafted nonjusticiability precedent if it means they can avoid the headaches (and risk of reversal) that are associated with adapting tort doctrine to novel contexts. Given such a hostile environment, it may be the rare plaintiff who incurs the costs and time to bring a case. Similarly, it seems likely that it will be the still rarer judge who reshapes conventional tort doctrine in the way that Kysar suggests.

While I'm not optimistic about the existence of climate change cases reshaping tort law, there may be a narrower category of climate-change claims that do find traction. These are likely to focus less on the ultimate causation of climate change and more on adaptation to climate change. Suppose, for example, the sea level rises and a seaport negligently fails to make adaptations to accommodate the rising sea level and a nearby property is flooded. This category of litigation may not require any adaptation to existing tort doctrine. Here, the tortious action may be the failure to take reasonable precautionary measures in the face of climate change rather than being implicated in causing the climate change itself.

However, even this category of litigation risks being lumped in together with more ambitious climate change litigation and found nonjusticiable. And it is hard to see how such litigation, relying on traditional tort principles, would lead to the kind of change in tort that Kysar predicts.

In order to thrive, the common-law process, like natural life, requires certain ecologies. As Kysar himself shows in the first half of his article, the tort law would require wholesale terraforming for most climate change claims to survive. Accordingly, the chances for such claims to reshape tort seem small.

## II. Should Tort Law Be Changed?

In some ways, this is unfortunate. Tort law is surely a conceptual mess. Kysar makes powerful criticisms noting the way in which efforts to extend tort law beyond the A injures B paradigm are met with resistance, even in instances in which a strong economic argument can be made that doing so would improve incentives.

6. *Id.* at 10739 (citing Witt, *supra* note 3).

7. 111 N.E. 1050 (N.Y. 1916).

8. 481 U.S. 279 (1987).

I have discussed elsewhere the way in which the conventional economic analysis of tort law does not specify the set of inputs to which its cost-benefit analysis should be applied.<sup>9</sup> Any accident can be prevented by a nearly infinite number of precautionary measures. For example, an accident involving an auto and a pedestrian can be prevented not just by safer driving, but by safer walking, road/sidewalk design, car design, walking or driving in different places, auto design, etc. These can be roughly mapped onto the familiar short-run to long-run continuum. The economic analysis of tort law (and the practice of tort law) generally focuses on just a relatively short-run subset of the overall potential ways to reduce accident risks—the inputs to the accident production function.

Kysar makes this point far more intuitively with his metaphor of a mountain. As he put it, tort law is good at identifying solutions that may help us ascend a particular mountain, but does not ordinarily address the issue of whether we are on the right mountain in the first place. In economic terms, tort law searches for the partial equilibrium solution as opposed to the general equilibrium solution. This myopia has real costs. As Kysar eloquently puts it:

This marginalist orientation has two important limitations in the context of contemporary environmental, health, and safety threats. First, the partial equilibrium framing tends as a practical matter to miss important welfare consequences that would be more apparent from a vantage point that assumes complex interrelations among systems. . . . Second, the partial equilibrium framing is only able to offer marginal efficiency improvements to a given status quo, rather than an entirely different imagined baseline from which to seek such marginal improvements.<sup>10</sup>

Kysar suggests that by grappling with the problem of climate change, tort may learn to take a less myopic view in its analysis—to consider a wider set of inputs in its cost benefit analysis and to take a longer-run perspective. Tort may not be able to single-handedly address climate change, but perhaps in the process of addressing these claims, it might provide useful incentives in a wider variety of contexts.

This is an intriguing argument. And at least from a certain flavor of theoretical law and economic perspective it is attractive to use tort liability to improve incentives and eliminate externalities. In a wide variety of contexts, from childhood obesity<sup>11</sup> to coal mining,<sup>12</sup> a case can be made

that the tort system could improve social welfare by “internalizing the externality”—ensuring that the market price of a product reflects the full social costs of it.

Moreover, the market-oriented nature of liability is arguably more efficient than command and control regulation. Even if the judge/jury gets the cost-benefit analysis wrong and imposes liability inefficiently, if the activity is sufficiently socially beneficial, the actor should be able to price the liability costs into the product, at least in theory. In contrast, if an activity is banned by a regulator, the actor can't price this into the product.

But here I want to raise an issue that Kysar doesn't really address—institutional competence. Are the common-law courts really the right institution to be deciding what mountain we should be ascending? Might there be good institutional justifications for not expanding the conventional A injures B paradigm? This is obviously a huge topic but today I shall briefly discuss two concerns of this kind—informational competence and democratic legitimacy.

First, how good are courts and juries likely to be at getting it right—at conducting the appropriate longer-run cost benefit analyses to determine if we're on the right mountain, and if, not, provide incentives to get us there? Are courts and juries able to adequately consider the longer-run costs and benefits of certain actions or inactions? Mark Grady has argued that the plaintiff has a strong incentive to specifically identify the untaken precautions that led to the alleged tort and that this specification of an untaken precaution will focus the court and jury's inquiry.<sup>13</sup> But even with the help of the parties to hone, the court and jury's understanding of the alleged tort, incorporating a truly long-run perspective into tort law would seem difficult. Too many assumptions about the state of the world are required. On the other hand, defenders of the expansion of tort in this way can argue that possibly false assumptions are better than simply ignoring a category of costs altogether.

Local political concerns may also warp the fact-finding process and affect informational competence. To take climate change as an example, a jury from a locality in which many jobs are derived from carbon-based energy may have a different perspective and bring in a different set of assumptions than a jury from another a low-lying coastal area. While every jury brings certain assumptions to bear, the longer the time frame the jury is asked to consider, the more speculative the assumptions usually (but not necessarily) become.

Democratic legitimacy is another important set of concerns that Kysar does not address. Are the courts the right institution to address longer-run societal problems in the way that Kysar suggests? Critics of extending liability are likely to argue that the more democratic branches are the

9. See James M. Anderson, *The Missing Theory of Variable Selection in the Economic Analysis of Tort Law*, 2007 UTAH L. REV. 255 (2007).

10. Douglas A. Kysar, *What Climate Change Can Do About Tort Law*, 41 ENVTL. L. 1 (2010).

11. Cf. Michael J. O'Grady & James C. Capretta, *Assessing the Economics of Obesity and Obesity Interventions*, CAMPAIGN TO END OBESITY (Mar. 2012) (arguing that short-term analysis of costs of childhood obesity ignore long-term chronic conditions that result from it; calling for shift in CBO scoring).

12. Cf. Paul R. Epstein et al., *Full Cost Accounting for the Life Cycle of Coal*, 1219 ANN. N.Y. ACAD. SCI. 73 (2011) (noting that externalities from coal that are not reflected in its market cost are substantial and, based on the

author's calculations, should double or triple the price of electricity generated from coal).

13. Mark Grady, *Untaken Precautions*, 18 J. LEG. STUD. 139, 140 (1989) (describing the way that a plaintiff's claim of an untaken precaution structures the inquiry of judge and jury).

appropriate places to address the issue of whether we're climbing the right mountain.

One counterargument is a rough appropriation of footnote four from *United States v. Carolene Products*,<sup>14</sup> which suggests that courts should be less willing to defer to ordinary political processes when there is some reason to think that the process will not function—if, for example, legislation is directed at an insular minority. Perhaps, one could make an analogous case for judicial intervention in certain kinds of cases when the stakes are so vast and the injury imposed over such a diffuse group, many of whom have not even been born. In such circumstances of political failure, perhaps, the courts should be less reluctant to intervene to identify the right mountain.

While the informational competence and democratic legitimacy issues appear to become more acute as tort is expanded to take a more long-range perspective, there may be important exceptions. More research should be done on understanding circumstances in which tort might address longer runs costs and benefits in a way that satisfies the informational competence and democratic legitimacy concerns.

### III. Conclusion

To summarize, I'm very sympathetic with Kysar's frustration with the intellectual inconsistencies and limitations of existing tort law doctrine. It seems regrettable that tort law is quite so myopic with its theoretical potential of pro-

viding an efficient market-based system of incentives in a much broader set of contexts. Similarly, I'm intrigued by the idea that by grappling with climate change, tort law might evolve to become more polycentric and consider which mountain we might want to climb and not just how to inch slightly higher on the mountain that we're on.

But I'm quite skeptical that the process of addressing climate change claims will change judges or tort law in the way he suggests. It seems more likely to me that findings of nonjusticiability may make litigation of broad climate change issues uncommon.

Similarly, it seems to me that the kind of changes in tort law that would be necessary to have it do the things he suggests would raise serious issues of institutional competence. At least on first blush, the longer the perspective, the more inputs the courts and jury must consider and the more acute these problems appear. More research to better understand if there are exceptions—situations in which tort could better take a long-term perspective—would be useful.

In closing, it seems clear that existing tort law doctrine does not perfectly map on to the limits of the institutional competence of the courts. There is surely room for improvement. To the extent that Kysar's article and climate change litigation cause us to rethink the way in which tort considers costs and benefits, I applaud the effort. But the steps that tort takes (and the kinds of climate change litigation that are likely to succeed) are likely to be modest. This is, probably, as it should be.

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14. 304 U.S. 144, 152 n.4 (1936).

R E S P O N S E

# A Response to *What Climate Change Can Do About Tort Law*

by David T. Buente Jr., Quin M. Sorenson, and Clayton G. Northouse

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In *What Climate Change Can Do About Tort Law*,<sup>1</sup> Professor Douglas A. Kysar acknowledges forthrightly that the several recently filed “climate change suits,” in which plaintiffs seek to impose liability upon individual sources of greenhouse gas emissions for past harms and future risks associated with climate change, stand little chance of success. Climate change, he writes, is “a collective action problem so pervasive and so complicated as to render at once both all of us and none of us responsible,” and for that reason tort law—focused as it is on a proximate link between cause and effect—“seems fundamentally ill-equipped to address [these issues].”<sup>2</sup> On this point we agree.

Professor Kysar goes on to argue that, if the existing tort system is incapable of addressing climate change, climate change should then serve as a catalyst to force a radical alteration of that system. Basic principles that have traditionally defined and limited tort liability—including duty, breach, causation, and injury—should be reconceived to change the tort system from a means of “compensating and deterring harm” into a broad “backdrop and partner to environmental, health, and safety regulation.”<sup>3</sup> Phrased differently, Professor Kysar would transform the existing common-law tort system into an administrative regime, supporting and supplementing—and perhaps sometimes supplanting—existing statutory and regulatory structures, but still administered by the courts through *ad hoc* adjudication.

While Professor Kysar’s proposal is certainly bold, it rests on fundamental misconceptions regarding the basis and purpose of American tort law. The tort system was never envisioned as the cure for all of society’s ills, and it was certainly never intended to serve as a shadow version of the modern administrative state. Quite the contrary, tort law has always been understood and designed to address those disputes that are quintessentially private and local in

nature, of the type that are most amenable to case-by-case adjudication rather than statutory or regulatory response. While the recent climate change lawsuits may indeed spark a reevaluation of tort law, the result is likely to be not the wholesale transmogrification suggested by Professor Kysar, but instead a reaffirmation of the traditional elements and boundaries of common-law tort, preserving broader “collective action” issues such as climate change for regulatory and legislative solution.

## I. The Nature of Tort

A “tort” has historically been defined, and still is, as a “wrong” committed against another that causes a legally cognizable injury, for which the law allows a remedy in order to address the “desire of retaliation against the offending thing itself.”<sup>4</sup> Liability is imposed on the actor because, and only because, he or she should have foreseen the possibility of harm and yet engaged in (or authorized) the conduct that resulted in the injury.<sup>5</sup> This link—between the actor and the injury to the victim—renders the actor culpable and responsible for the harm, and justifies the imposition of liability.<sup>6</sup> Through all of the historical developments in tort law noted by Professor Kysar, from the concepts of “joint and several liability” and “respondeat superior” to most recently “strict liability,” this critical link between the tortfeasor and the harm has been maintained.

That link is, however, precisely what Professor Kysar’s new system would sever. The concept of “duty” would be expanded, under his approach, to require individuals to avoid contributing to risks of harm that are unforeseeable. An individual could be deemed the “cause” of a harm if his or her conduct is of a type that could contribute to that harm, even if there is no evidence that he or she did in fact contribute to the particular harm and, indeed, even if it is beyond doubt that he or she did not. “Harm” too would

1. Douglas A. Kysar, *What Climate Change Can Do About Tort Law*, 42 ELR 10739 (Aug. 2012).

2. *Id.* at 10739.

3. *Id.*

4. OLIVER WENDELL HOLMES, *THE COMMON LAW* 33 (1881).

5. *E.g.*, *Palsgraf v. Long Island R.R. Co.*, 248 N.Y. 339, 344 (1928).

6. John H. Wigmore, *Tripartite Division of Torts*, 8 HARV. L. REV. 200, 202 (1894).

be expanded to include perceived harms to overall societal interests and public welfare.<sup>7</sup> Tort liability might be imposed, under Professor Kysar's approach, on any individual who has engaged in any conduct that might be deemed contrary to the public interest or otherwise as contributing to future risks.

This approach is not a "recalibration"<sup>8</sup> of the traditional tort system, but a repudiation of it. The link between culpable actor and actual injury that has always both justified and limited the scope of tort liability—the "relational nexus" between "identified victims [and] the actor"<sup>9</sup>—would be effectively eliminated. Liability could instead be premised solely on an assessment of the conduct itself, in light of relevant societal interests: if that conduct (for example, emission of greenhouse gases) is deemed by judges to be contrary to the public welfare or to contribute to unacceptable risks (for example, impacts associated with climate change), an actor that engages in that form of conduct may be held liable for any and all ill-effects attributed thereto. The range of issues that could be addressed in such a system are virtually limitless, according to Professor Kysar: "climate change, terrorism, infectious disease outbreaks, and financial market instability," among others.<sup>10</sup>

The problem is that this is not a "tort" system at all. It is, in reality, a transfer of unbounded legislative and regulatory power to the judiciary. Whereas the traditional tort system allowed liability to be imposed on a defendant only upon a finding that his or her own conduct caused actual and reasonably foreseeable harm to the plaintiff, Professor Kysar would grant virtually unlimited discretion to judges and juries to decide whether and how to allocate the costs of addressing essentially any issue of national or global concern. Courts in these circumstances would be acting not as adjudicatory bodies but as legislatures or agencies, crafting and implementing responses to issues of national (and international) concern.

## II. Limitations on the Tort System

Tort law cannot serve the role that Professor Kysar envisions. Ignoring for the moment the traditional limitations on tort liability discussed above, Professor Kysar's approach faces at least two other fundamental problems.

*First*, separation of powers principles preclude the transfer of legislative authority that it would require. Professor Kysar's system would not only empower but require judges and juries to weigh a nearly infinite range of societal interests and determine, based on their own policy views, whether the conduct at issue is acceptable in light of associated risks and, if not, how the risks at issue should be addressed. Even if judges and juries had the capacity to assess and balance all of these varied interests in the context of a single case—

a proposition which is itself very doubtful<sup>11</sup>—that authority is inherently legislative in nature, and cannot properly be vested in the courts under our Constitution.<sup>12</sup>

The same concerns that bar adjudication of these claims in the federal courts preclude their recognition as a matter of state law in state courts. State courts will generally refuse to recognize a new common-law cause of action, or expand an existing one, when doing so would unduly interfere with the legislative function or in the absence of objective and manageable standards for adjudicating the claim.<sup>13</sup> This description clearly applies to claims addressing collective action issues such as climate change, which are global in nature and cannot reasonably be addressed by a single judge or jury in a single jurisdiction. Indeed, vesting authority in one state to craft a binding "solution" to a matter of national and international concern, like climate change, would violate the cardinal rule (recognized under both state common law and federal constitutional law) that the law of one state normally cannot dictate conduct or bind actors in other states.<sup>14</sup>

*Second*, Professor Kysar's system would unmoor the tort system from principles of fairness, allowing liability to be imposed arbitrarily on the few for harms attributed to the actions of the collective. Climate change offers a prime example. No one person or entity can properly be held responsible for "the extraordinary accumulation of minor, diffuse activities into a global environmental problem," as Professor Kysar acknowledges.<sup>15</sup> Nevertheless, the parties that have been named in climate change litigation to date consist of a few dozen U.S. energy corporations, oil and gas utilities, and five automobile manufacturing companies.<sup>16</sup> There are literally billions of other former and current sources of greenhouse gas emissions—collectively responsible for a far greater share of emissions<sup>17</sup>—and yet those parties may escape suit entirely, whether due to the choice of plaintiffs' counsel or because of some other arbitrary reason.<sup>18</sup>

To hold a small group of parties liable for a collective problem merely because they are the most attractive (and readily available) targets for litigation is fundamentally

7. Kysar, *supra* note 1, at 10744.

8. *Id.* at 10739.

9. *Id.* at 10741.

10. *Id.* at 10739.

11. See, e.g., *American Electric Power Co. v. Connecticut*, 131 S. Ct. 2527, 2540 (2011) [hereinafter *AEP*] ("Federal judges lack the scientific, economic, and technological resources [to] cop[e] with issues of this order.").

12. E.g., *Vieth v. Jubelirer*, 541 U.S. 267, 277 (2004) (plurality).

13. E.g., *Hunter v. City of Eugene*, 787 P.2d 881 (Or. 1990); Nat. Stern, *The Political Question Doctrine in State Courts*, 35 S.C. L. REV. 405, 415-18 (1984). See generally Roscoe Pound, *Common Law and Legislation*, 21 HARV. L. REV. 383 (1908).

14. E.g., *State Farm Mutual Automobile Ins. Co. v. Campbell*, 538 U.S. 408, 421 (2003); *World-Wide Volkswagen Corp. v. Woodson*, 444 U.S. 286, 292 (1980); see also John S. Baker Jr., *Respecting a State's Tort Law, While Confining Its Reach to That State*, 31 SETON HALL L. REV. 712 (2001).

15. Kysar, *supra* note 1, at #.

16. E.g., *AEP*, 131 S. Ct. 2527.

17. E.g., Eric A. Posner & Cass R. Sunstein, *Climate Change Justice*, 96 GEO. L.J. 1565, 1575 (2008).

18. The bulk of greenhouse gas emissions come from foreign sources. E.g., John Vidal & David Adam, *China Overtakes US as World's Biggest CO<sub>2</sub> Emitter*, *GUARDIAN* (June 19, 2007). There are also billions more historical greenhouse gas emitters that are no longer in existence.

unfair. Yet, that is precisely what Professor Kysar's approach would encourage.

### III. What Law Can Do About Climate Change

Climate change and other so-called "collective action" problems simply cannot be addressed through the common-law tort system. That system was developed to address essentially private disputes, involving lines of fault and causation running directly between discrete parties. It was never intended, and cannot reasonably be applied, to allow a judge or jury to assess and allocate liability for any and all societal concerns.

This is not to say, though, that the law is incapable of addressing these issues. On the contrary, Congress and executive agencies have already taken steps to regulate

greenhouse gas emissions.<sup>19</sup> There may even be a place for tort-like remedies in these solutions. For instance, under the National Childhood Vaccine Injury Act,<sup>20</sup> a person who suffers side-effects from a vaccine may collect damages without a showing of defect and, in some instances, without even showing causation.

The point is that, while the law certainly can "do" something about climate change, the courts through tort law are not the appropriate venue to craft the solution. Only a legislature has the authority and the capacity to consider and develop responses to such concerns, and only after a regulatory architecture has been established can judges and juries properly (and constitutionally) play a role. Whatever the merit of Professor Kysar's proposal, it is fundamentally a legislative one, and should be addressed to Congress, not the courts.

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19. *E.g.*, *AEP*, 131 S. Ct. at 2534-35.

20. 42 U.S.C. §300aa-1.

R E S P O N S E

# A Comment on *What Climate Change Can Do About Tort Law*

Ellen M. Peter

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Professor Douglas Kysar's March 2011 law review article predicted plaintiffs' difficulties for success in climate change public nuisance tort lawsuits since on every element—duty, proximate cause, breach, and injury—courts would have to stretch or overcome precedent in order to award relief.<sup>1</sup> Undaunted by this sack of doctrinal lemons, Professor Kysar seeks to make lemonade and suggests climate-related tort litigation “may have significant secondary effects for the common law” (condensed p. 5), to wit, that the felt necessity of providing remedies could cause the courts to reassess and surmount these hurdles in the tort law.

Shortly after his article was published, a unanimous United States Supreme Court barred the door to federal common-law public nuisance claims related to climate change holding that “the Clean Air Act and the EPA [Environmental Protection Agency] actions it authorizes displace any federal common law right to seek abatement from fossil-fuel fired power plants.” *American Electric Power Co. v. Connecticut*, 131 S. Ct. 2527, 2537 (2011) (*AEP*). Assuming Congress does not amend the Clean Air Act to exclude greenhouse gases, as threatened by some, *AEP* forecloses future federal common-law public nuisance claims.<sup>2</sup> Professor Kysar's lemonade projection, that favorable secondary effects in tort law could still occur, is not

foreclosed by *AEP*; state law public nuisance claims were remanded by the *AEP* Court.

In addition to speculation as to tort law's evolution, Professor Kysar's article also posed questions about the relationship between the administrative, or regulatory, framework and tort law as its backdrop. Almost a decade ago, several states filed federal common-law public nuisance actions when federal regulatory action on greenhouse gases was refused under then-President Bush's Administration and state regulatory action was under attack by industry. Although under the present Administration, federal regulatory efforts are underway, delay and deny remain the watchwords; arguments similar to those raised by nuisance lawsuits' defendants are being used in an attempt to defeat current federal regulatory efforts.

Meanwhile, the risk of injuries and the magnitude of harm are increasing. Low-lying island states are threatened with extinction and United States residents are faced with increasing extreme weather events resulting in damage to life and property. Reducing greenhouse gas emissions now is a far better solution than defending against international or state law tort claims in the future or paying for costly adaptive projects to address climate change-induced harms. A series of actions (voluntarily embraced by business or mandated by federal and state governments) could reduce the greenhouse gas emissions and, in turn, stave off claims brought by increasingly injured plaintiffs. California's multi-prong regulatory program to address climate change can serve as a model for those willing to pursue regulatory action.

## I. Historical Context: Public Nuisance Actions as the Regulatory Backstop

Some commentators have derided the use of public nuisance actions to redress climate change impacts. However, the historical context discussed below provides the justification for such actions. Moreover, if current litigation defeats emissions regulations in the industrial sector, renewed public nuisance suits may again act as the regulatory backstop.

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1. Douglas A. Kysar, *What Climate Change Can Do About Tort Law*, 41 ENVTL. L. 1, 44 (2011), 42 ELR 10739 (2012).

2. The opinion was predicated on a Clean Air Act statutory framework that authorizes, albeit not requires, regulatory action to reduce greenhouse gas emissions. *American Electric Power Co. v. Connecticut*, 131 S. Ct. 2527, 2538 (2011) [hereinafter *AEP*]. One salutary effect of *AEP* could be to slow efforts to pursue Clean Air Act amendments to preclude EPA's controls of greenhouse gases. See H.R. 2584, 112th Cong. §431 (2011) (failed attempt to impose ban on the promulgation of federal greenhouse gas regulations and to bar any tort claim for greenhouse gas emissions for one year). In a similar vein, the leading Republican presidential candidate is proposing that the Clean Air Act be amended to exclude carbon dioxide as a pollutant. See Romney for President, Inc., *Believe in America: Mitt Romney's Plan for Jobs and Economic Growth*, <http://www.mittromney.com/sites/default/files/shared/BelieveInAmerica-PlanForJobsAndEconomicGrowth-Full.pdf> (last visited June 23, 2012). This amendment would be tantamount to reinstating the *AEP* plaintiffs' claims.



One of the country's first greenhouse gas regulations was emission standards for model-year 2009-2016 new passenger vehicles. This 2004 regulatory action by the California Air Resource Board (CARB) provoked an onslaught of litigation from automakers in California and in three of the states that had adopted California's vehicle standards under §177 of the Clean Air Act.<sup>3</sup> In the face of this auto industry attack and accompanying federal resistance to these regulations, California's Attorney General filed an affirmative case<sup>4</sup> seeking, under a public nuisance theory, monetary damages from the six automakers with the highest new vehicle sales in California.

Some of the automakers' challenges to the regulation mirrored some of their defenses to the public nuisance lawsuit; namely that climate change was not caused by anthropogenic impacts (causation element) and that their contributions to the atmospheric concentration were insignificant due to emissions from others around the globe (proximate cause element).<sup>5</sup> However, the automakers' multi-state litigation challenge to California's greenhouse gas vehicle emissions regulations proved completely unsuccessful.<sup>6</sup> In fact, as Professor Kysar noted, the *Green Mountain* court specifically rejected a challenge to Vermont's expert testimony as to the causes and impacts of global warming.<sup>7</sup> The public nuisance alternative, which had been dismissed primarily on political question grounds, had proved unnecessary. Subsequently, and more critically, a dramatic change occurred in the automakers' approach. Instead of litigation, the vehicle greenhouse gas regulatory program is now moving ahead collaboratively with a joint automaker/California/federal effort underway for model-years 2017-2025 standards.

In contrast, there is no rapprochement concerning the effort to reduce greenhouse gas emissions from power plants and refineries. Under the Clean Air Act, states do not have independent authority to regulate emissions from industrial sources as California can do for vehicles. When the states' petitions to EPA to regulate greenhouse gases were denied under the previous Administration, federal public

nuisance claims were pursued in *AEP* to abate emissions.<sup>8</sup> The power plants' motion to dismiss asserted defenses outlined by Professor Kysar: the allegations revealed no current injury, no imminent future harm, the power plants' conduct did not cause the claimed injuries, their global carbon dioxide contribution is trivial compared to others, and any injury cannot be redressed (2004 WL 5614399, pp. 28-37). The district court's conclusion, that a regulatory solution under the Clean Air Act was the proper forum to set emissions limits and consider costs and societal trade offs, was upheld in the Supreme Court.<sup>9</sup>

One could support this industry claim for deference to the regulatory approach except, when federal regulations were promulgated, a full-bore attack was launched, including from defendants in the *AEP* public nuisance case.<sup>10</sup> Delay and deny continue as the watchwords for the advocates of business-as-usual in the industrial sector.

Public nuisance cases are clumsy tools to effect change; as the *AEP* court noted, judges do not have the scientific, economic, or technical resources to evaluate options and case-by-case injunctions may lead to disparate judicial decisions.<sup>11</sup> However, the continued opposition to regulatory controls of greenhouse gas pollution, using the same type of arguments asserted as tort defenses, "not me," "my share does not matter," and the bedrock defense "climate change—no such thing," undercuts the persuasiveness of those arguing that public nuisance lawsuits raise nonjusticiable political questions. If EPA's regulatory controls are stymied or if the Clean Air Act regulatory authority is revoked, public nuisance actions, admittedly staggering post-*AEP*, could be resuscitated.

## II. Risk and Harm: Imminent Injuries and Sporadic Private-Sector Responses

Environmental harms, predicted decades ago, are no longer theoretical but are imminent for a growing population. The first victims face inexorable sea-level rise, and small low-lying island states head toward inundation. Recently, Anote Tong, president of Kiribati, said he was in negotiations with Fiji's government to buy up to 5,000 acres to relocate his countrymen—perhaps the first climate-induced migration in modern times.<sup>12</sup> In the United States, sea-level rise poses threats of flooding in coastal communities. Storm surges from extreme weather events are a grow-

3. See *Central Valley Chrysler, Inc. et al. v. Goldstene*, 2004 WL 5001055 (E.D. Cal. 2004) [hereinafter *Central Valley*]; *Green Mountain Chrysler Plymouth Dodge Jeep v. Crombie*, 508 F. Supp. 2d 295, 310-33 (D. Vt. 2007) [hereinafter *Green Mountain*]; *Lincoln-Dodge Inc. et al. v. Sullivan*, Nos. 06-69T, 06-70T (D.R.I. 2007); *Zangara Dodge Inc. et al. v. Curry*, No. 1:07-cv-01305ACT-LFG (D.N.M. 2007).

4. Second Amended Complaint in *California v. General Motors Corp. et al.*, 2006 WL 3069165 (N.D. Cal. Oct. 24, 2006).

5. See Complaint at ¶ 24, *Green Mountain*; First Amended Complaint at ¶ 5, *Central Valley*; Motion to Dismiss by General Motors, *California v. General Motors*, 2006 WL 2726871 (N.D. Cal. Oct. 24, 2006).

6. *Central Valley Chrysler, Inc. et al. v. Goldstene*, 529 F. Supp. 2d 1151 (E.D. Cal. 2007); *Green Mountain Chrysler et al. v. Crombie*, 508 F. Supp. 2d 295 (D. Vt. 2007); *Lincoln-Dodge Inc. et al. v. Sullivan*, 588 F. Supp. 2d 224 (D.R.I. 2008).

7. Kysar, *supra* note 1 n.34 (citing *Green Mountain*, 508 F. Supp. 2d at 320, 325, 333).

8. *Connecticut et al. v. American Electric Power et al.*, 2004 WL 5614399 (S.D.N.Y. July 21, 2004).

9. *AEP*, 131 S. Ct. at 2539-40.

10. *Coalition for Responsible Regulation et al. v. EPA*, Nos. 09-1322, 10-1073, 10-1092, 10-1167 (D.C. Cir.).

11. *AEP*, 131 S. Ct. at 2539-40.

12. Paul Chapman, *Entire Nation of Kiribati to Be Relocated Over Rising Sea Level Threat*, THE TELEGRAPH, Mar. 7, 2012, available at <http://www.telegraph.co.uk/news/worldnews/australiaandthepacific/kiribati/9127576/Entire-nation-of-Kiribati-to-be-relocated-over-rising-sea-level-threat.html>.

ing concern, and detailed modeling, by zip code, for the contiguous United States is now available.<sup>13</sup>

Extreme weather events worldwide were the focus of a 594-page study released March 28, 2012, by the United Nations Intergovernmental Panel on Climate Change; it assesses past and future changes in the frequency, intensity, and duration of climate extremes and discusses management of weather-related risks.<sup>14</sup>

In response, the insurance industry, particularly the reinsurance sector, is advocating both adaptive changes to minimize immediate risk and emissions reductions to forestall the increased atmospheric concentrations with their resultant pervasive future injuries.<sup>15</sup> For the most part, both suggestions are falling on relatively deaf ears. According to a recent survey, corporate sustainability efforts are increasing both to reduce emissions and save money in the process; a key driver is the expectations of customers, employees, and shareholders.<sup>16</sup> The sporadic private-sector actions are encouraging, but a nationwide comprehensive groundswell from the private sector to reduce emissions is not evident.

### III. California's Model: Economywide Plan and Multi-Prong Actions to Reduce Greenhouse Gases

For those willing, California's statutory framework for greenhouse gas reductions provides an economywide approach with multi-prong solutions, and relies on an absolute greenhouse gas emissions limit—California's

emissions in 2020 must return to the 1990 level.<sup>17</sup> In many ways, the centerpiece of California's Global Warming Solutions Act of 2006 (also known as AB 32) is its requirement for the creation of a Scoping Plan<sup>18</sup> to establish the framework of measures, policies, and approaches for every sector of the economy to achieve the emission reductions sufficient to meet the 2020 target and to set California on course for much deeper, sustained reductions well into the future. The initial Scoping Plan was developed in 2008, reduction measures are now in place, and planning for the required, five-year Scoping Plan update is starting.<sup>19</sup>

California's experience highlights two salient points. First, a U.S.-wide scoping plan for emission reductions would complement the existing EPA regulatory program and the private-sector sustainability efforts. Second, a nationwide absolute emissions limit should be set. This concept is simple, but, in California, the implementation and political consequences are profound. Instead of each economic sector focusing solely on short-term strategies to make their own burden less onerous, with an economywide approach, each sector carefully monitors the obligations and actions of others. With an absolute limit, if one sector is successful in its short-term strategy to delay implementation of emission reductions, then the burden automatically shifts to others. In California, this absolute limit is an effective undercurrent in the ongoing regulatory efforts and is to be commended as an element of a national climate program.

### Conclusion

As climate change-induced injuries mount in the United States and around the globe, the clamor for relief from specific injuries, such as flooding, will increase. Instead of a stalwart defense against these claims, the better course is a systematic reduction of greenhouse gas emissions on a national, economywide basis. California's experience with a Scoping Plan, a range of direct and market-based measures, and an overall reduction cap is a tested model to emulate. The goal is to reduce emissions and to minimize risk and harm; otherwise, as Professor Kysar notes, tort suits will remain the backstop.

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13. Justin Gillis, *Rising Sea Levels Seen as Threat to Coastal U.S.*, N.Y. TIMES, Mar. 13, 2012, available at [http://www.nytimes.com/2012/03/14/science/earth/study-rising-sea-levels-a-risk-to-coastal-states.html?\\_r=1&bl](http://www.nytimes.com/2012/03/14/science/earth/study-rising-sea-levels-a-risk-to-coastal-states.html?_r=1&bl) (reporting on two studies: Benjamin H. Strauss et al., *Tidally Adjusted Estimates of Topographic Vulnerability to Sea Level Rise and Flooding for the Contiguous United States*, 7 ENVTL. RES. LETTER 014033 (2012), available at [http://iopscience.iop.org/1748-9326/7/1/014033/pdf/1748-9326\\_7\\_1\\_014033.pdf](http://iopscience.iop.org/1748-9326/7/1/014033/pdf/1748-9326_7_1_014033.pdf); and Claudia Tebaldi et al., *Modeling Sea Level Rise Impacts on Storm Surges Along US Coasts*, 7 ENVTL. RES. LETTER 014032 (2012), available at [http://iopscience.iop.org/1748-9326/7/1/014032/pdf/1748-9326\\_7\\_1\\_014032.pdf](http://iopscience.iop.org/1748-9326/7/1/014032/pdf/1748-9326_7_1_014032.pdf)).
  14. See Intergovernmental Panel on Climate Change, *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: Special Report of the Intergovernmental Panel on Climate Change* (Christopher B. Field et al. eds., Cambridge Univ. Press 2012), available at [http://www.ipcc-wg2.gov/SREX/images/uploads/SREX-All\\_FINAL.pdf](http://www.ipcc-wg2.gov/SREX/images/uploads/SREX-All_FINAL.pdf).
  15. See The Geneva Reports—Risk and Insurance Research No. 5, *Extreme Events and Insurance: 2011 Annus Horribilis* (Christophe Courbage & Walter R. Stahel eds., 2012), available at [http://www.genevaassociation.org/PDF/Geneva\\_Reports/GA-2012-Geneva\\_report%5B5%5D.pdf](http://www.genevaassociation.org/PDF/Geneva_Reports/GA-2012-Geneva_report%5B5%5D.pdf).  
See also The Geneva Reports—Risk and Insurance Research No. 2, *Insurance Industry and Climate Change—Contribution to the Global Debate* (2009), available at [http://www.genevaassociation.org/PDF/Geneva\\_Reports/Geneva\\_report%5B2%5D.pdf](http://www.genevaassociation.org/PDF/Geneva_Reports/Geneva_report%5B2%5D.pdf).
  16. See Ernst & Young and GreenBiz Group, *Six Growing Trends in Corporate Sustainability: An Ernst & Young Survey in Cooperation With GreenBiz Group* (2012), available at [http://www.greenbiz.com/sites/default/files/1112-1315117\\_CCaSS\\_SixTrends\\_FQ0029\\_lo%20res%20revised%203.7.2012.pdf](http://www.greenbiz.com/sites/default/files/1112-1315117_CCaSS_SixTrends_FQ0029_lo%20res%20revised%203.7.2012.pdf).

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17. California's Global Warming Solutions Act of 2006, CAL. HEALTH & SAFETY CODE §§38500-38598 (2006); CAL. HEALTH & SAFETY CODE §§38550, 38562(a) (2006).
  18. CAL. HEALTH & SAFETY CODE §38561(a) (2006).
  19. CARB's climate webpage provides links to the Scoping Plan and the spectrum of regulatory measures and other programs. See California Air Resources Board, *Climate Change*, <http://www.arb.ca.gov/cc/cc.htm> (last visited June 23, 2012).

## ARTICLE

# Residential Renewable Energy: By Whom?

by Joel B. Eisen

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President Barack Obama's 2011 State of the Union speech termed development of clean energy sources our "Sputnik Moment," and called for 80% of the nation's electricity to be generated from renewables, clean coal, and nuclear power by 2035.<sup>1</sup> The message is clear: we need research, development and deployment of a new generation of energy technologies.

The president's focus on the technology of renewable energy, however, is an indicator that a deceptively difficult question remains less well addressed: how can we overcome the built-in barriers of the current electricity infrastructure and create the distribution system that will bring renewable energy to American homes? The technology already exists to put solar photovoltaic (PV) panels on millions of homes,<sup>2</sup> but we have paid inadequate attention to getting them there. This lack of focus on distribution will limit residential solar deployment indefinitely, unless it is addressed soon.

While a number of solutions to this problem have been proposed or are in various stages of implementation, given the pressing need to address climate change, more rapid action is needed. In addition to pursuing other options for generating electricity using renewables and ramping up energy efficiency and conservation efforts, we must achieve routinization<sup>3</sup> in residential solar. Residential solar can

only become a widespread consumer product when the purchase and installation process transforms from a model that resembles custom construction to one that is virtually transparent to the consumer. Overcoming the entrenched position of (and subsidies for) electric utilities requires government support of firms that will take on the responsibility of offering residential homeowners solar panel systems. I call such firms "solar utilities"<sup>4</sup> and explain in this Article why they (or some other new form of market entrant such as smart grid companies) must supplant the nascent industry of residential solar companies.

## I. The Problem: The Hypothetical Scenario of "Cars and 'PMVs'"

Imagine a different context: household transportation. Suppose you are the head of a suburban household with two cars, and have decided to replace one. Being receptive to environmentally friendly vehicles if they don't cost "too much," you settled on a hybrid gas-electric family sedan after some research, and established that its price should be approximately \$30,000.<sup>5</sup> You determined that until the end of 2010 there was a federal tax credit available for purchase of hybrid vehicles,<sup>6</sup> which brought the cost down roughly to parity with conventional gasoline-powered vehicles. Then, you identified four dealers in your area that sold this brand of vehicle, contacted them for test drives, and entered into negotiations to purchase a car in the next 30 days from vehicles in stock.

Now, let's change this transaction. Instead of car dealers, you must buy automobiles from custom coach builders

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1. President Barack Obama, Remarks by the President in State of Union Address (Jan. 25, 2011).
2. Joel B. Eisen, *Can Urban Solar Become a "Disruptive" Technology: The Case for Solar Utilities*, 24 NOTRE DAME J.L. ETHICS & PUB. POL'Y 53, 53-56 (2010) [hereinafter Eisen, *Solar Utilities*] (citing ARJUN MAKHJANI, CARBON-FREE AND NUCLEAR-FREE: A ROADMAP FOR U.S. ENERGY POLICY 37-40 (2007)). See also Accenture, *Carbon Capital: Financing the Low Carbon Economy* at 13 (2011) (noting that, "Solar PV cost per MW-capacity has decreased by more than 30 per cent between 2000 and 2010"), available at [https://microsite.accenture.com/sustainability/research\\_and\\_insights/Documents/Accenture\\_Barclays\\_Carbon\\_Capital.pdf](https://microsite.accenture.com/sustainability/research_and_insights/Documents/Accenture_Barclays_Carbon_Capital.pdf).
3. See B.C. Farhar & T.C. Coburn, *A New Market Paradigm for Zero-Energy Homes: The Comparative San Diego Case Study*, NAT'L RENEWABLE ENERGY

LAB. at 17 (2006) (noting with respect to the solar PV panel systems offered in new homes in a subdivision studied in San Diego that, "[t]he significance of such an offering by a large-production builder is that it potentially makes the offer of these types of homes routine rather than unique specialty commodities offered only by custom builders").

4. See generally Eisen, *Solar Utilities*, *supra* note 2.
5. *Ford Fusion Hybrid: What the Auto Press Says*, U.S. News Rankings & Reviews: Best Cars, (2011), available at [http://usnews.rankingsandreviews.com/cars-trucks/Ford\\_Fusion-Hybrid/2011/](http://usnews.rankingsandreviews.com/cars-trucks/Ford_Fusion-Hybrid/2011/) (average mid-sized hybrid costs \$28,670).
6. IRS.gov, *Qualified Hybrid Vehicles*, <http://www.irs.gov/businesses/corporations/article/0,,id=203122,00.html> [www.irs.gov/businesses/corporations/article/0,,id=203122,00.html](http://www.irs.gov/businesses/corporations/article/0,,id=203122,00.html) (last visited June 23, 2012).

who assemble low volumes of cars to individual specifications and needs. The price of any car is a means of discussion between you and the custom manufacturer. Until he knows what engine and transmission you want (because you need some understanding of these automotive subsystems to buy a car), he cannot quote you a price. You find car builders through word of mouth, and there is no reliable means of establishing whether any of them will still be around when your car needs maintenance or repair.

But the car is not the only way to get around suburbia. 99% of households already have comparable forms of transportation called personal mobility vehicles, or “PMVs.” PMVs, unlike cars, are sold widely at dealers throughout the nation, and there is an extensive support infrastructure that supports them. Information about where to buy new PMVs and resell used ones is easy to find, with fluid markets everywhere.

In this scenario, “cars” are the emerging technology, not the one that has existed for decades. This flips our normal understanding of the transportation landscape. We use this inversion to highlight the entrenched advantages that an incumbent technology (“OldTech”) has over one that would displace it (“NewTech”). Contemplate a world in which the “PMV” industry had all the advantages the car industry does now. As there is no PMV industry, when we speak of cars as NewTech, OldTech’s advantages will be precisely those of the American auto industry.

Extend that analogy to a completely different field: residential solar. Electric utilities are OldTech and solar panels are NewTech, because electric utilities have comparable regulatory and economic advantages to those of the real world American automobile industry. When solar panels are “cars,” then, electric utilities would be PMV sellers.

### A. *The Entrenched Advantages of “PMVs”*

Few, if any, would switch from a PMV to a car. Only those most determined to have a car would put up with a custom builder’s lengthy purchase process or spend the money on an untested car company when they could snap up a PMV down the street.

At some point, a compelling incentive might prompt many PMV owners to switch. Consider some other ideas: a tax credit of 30% on new car purchases, a break on gasoline prices for those purchasing cars, or a financial arrangement making the car free upfront in return for increasing your taxes to pay for it over the long term.

Most consumers would probably not take advantage of these. Buying a car is an arduous, time-consuming endeavor, and there are serious transaction costs associated with it that do not exist in the PMV distribution channel. There is no “nudge”<sup>7</sup> for this purchase.

7. Stefanie Simon, *The Secret to Turning Consumers Green*, WALL ST. J., Oct. 18, 2010, at R1. The term “nudge” and the examples used in the text come from the important book on behavioral economics, RICHARD R. THALER & CASS R. SUNSTEIN, *NUDGE: IMPROVING DECISIONS ABOUT HEALTH, WEALTH, AND HAPPINESS* (2009).

Until it is as easy to buy a car as it is a PMV, economic incentives to do so will have limited effect. PMV companies retain their dominant market position with enormous economic advantages over car companies. PMVs fulfill a basic human need (transportation) in such a systematic way that we take their distribution infrastructure for granted. Firms selling PMVs enjoy production economies of scale, a ubiquitous market presence and the enormous reservoir of goodwill derived from the system set up to generate and disseminate information about the PMV market.

The PMV infrastructure also has huge subsidies, some hidden from public view. State legislatures and Congress view the PMV industry as essential to local economies, and prop it up with research and development funding,<sup>8</sup> tax credits and deductions. The PMV industry is not forced to fully internalize environmental costs into its products.

This system of economic subsidization is so extensive, yet so unaccounted for in the price of a PMV, that it creates a barrier to car purchases. Though relatively insignificant, car subsidies have high public visibility. This allows politicians to claim that car incentives are giveaways that “hurt” the PMV industry.

The existing legal system that regulates at many points along the PMV production and distribution timeline provides no incentives to “car” companies, having been developed and refined for decades without them in mind. This system is an ill fit for “cars.”

There is also little consistency among state regulatory systems. PMV companies have decades of experience in adjusting their business models to the different legal environments in various states, with state officials who want to make sure that PMV companies will not move to other states. A car company would see this as one of many ways in which the regulated community of PMV manufacturers has captured the regulatory system.

No car firm entering into the market could readily overcome these headwinds.

### B. *“Solar Panels” Are “Cars”*

The barriers to more widespread distribution of residential solar are the expense of the panels, the transaction costs associated with their installation,<sup>9</sup> and the difficulties of connecting to the existing electric utility grid.<sup>10</sup> Our system of energy law promotes entrenched technologies, not emerging ones.<sup>11</sup> Regulated natural monopoly

8. See, e.g., Deloitte Development LLC, *Research and Development Tax Incentives for the Automotive Industry*, [http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/Tax/us\\_tax\\_rd\\_automotive\\_083110\\_16092010.pdf](http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/Tax/us_tax_rd_automotive_083110_16092010.pdf) (last visited June 23, 2012).

9. The series of articles by Scientific American writer George Musser is a vivid illustration of the difficulties involved in a residential solar installation. George Musser, *Solar Power Purchase Agreements, aka Let Someone Else Deal With the Paperwork for You*, <http://www.scientificamerican.com/blog/post.cfm?id=power-purchase-agreements-aka-let-s-2009-08-03> (last visited June 23, 2012).

10. Farhar and Coburn, *supra* note 4, at 52.

11. See Lincoln L. Davies, *Stegner Symposium Essay: Energy Policy Today and Tomorrow—Toward Sustainability?*, 29 J. LAND, RESOURCES & ENVTL. L. 71, 76-81 (2009) (presenting data on low levels of spending on renewables, and

rates guarantee utilities' profitability. Utilities' fossil fuel suppliers enjoy far more pervasive subsidies than renewable energy industries.<sup>12</sup>

It makes as much sense to ask this system to ramp up residential solar as it would to ask PMV dealers to sell cars. No amount of persuasion or mandate (short of actually requiring them to sell NewTech solar panels) will prompt utilities to embrace distributed solar.

There is a predictable and enormous base of subsidies to fossil fuel industries, but it is difficult in the current political climate to demand that these subsidies be redirected.<sup>13</sup>

Advocating for tax credits and financial incentives for solar also presumes that the "car" distribution infrastructure either exists or could be developed. A homeowner receives a 30% tax credit for putting a qualifying solar system into place,<sup>14</sup> but that credit is only claimed after she has installed and paid for the system.<sup>15</sup> Once the average homeowner recognizes that a solar installation is a customized proposition requiring considerable labor and oversight on her part,<sup>16</sup> the tax credit begins to lose some of its luster.

## II. Toward More Widespread Solar Distribution: The Problem of "Diffusion" of Solar Technology

The literature on innovation suggests a dynamic process of technological diffusion. There is a well-known "S-curve" along which new technology is adopted, with a lag between invention and mass commercialization.<sup>17</sup>

This S-curve plots the number of people who adopt a new product over time, but the "product" itself often changes. Still, consumers may be willing to purchase a product, even when they know that constant improvements to a core

technology<sup>18</sup> will make the next product generation technically superior.

Even as people are buying a new product, there can be a lag in popular perception of it. Criticism of new technology is typically based on metrics used to evaluate existing products, not the new one, and analyses are presented as if the new product were required to do exactly what the existing one did.

Offering incentives to adopt a product works best when it prompts early adopters to switch to a new product that is not directly comparable to the existing one. If a technology can displace the other with "disruptive" characteristics (e.g., the cell phone is different from the landline because it makes and receives calls, but is portable<sup>19</sup>) then it is more likely that some consumers would discover its attractive features.

The fundamental inquiry then becomes how to move beyond early adopters to widespread diffusion of a disruptive technology. Professor Everett Rogers' pioneering work on this subject refers to five factors that move an innovation toward the higher end of the S-curve:

- The innovation has to be available through regular organizational channels;
- The adopters have to understand enough about the innovation to make a decision;
- The adoption decision has to have salience—it has to be important enough to be at or near the top of an individual's or a household's action list;
- The adopters need a support system, preferably the organization from which the innovation was purchased, and access to friends or others who understand the innovation; and
- The adopters need the financial wherewithal to purchase the innovation, or financing arrangements to make purchase possible.<sup>20</sup>

### A. "Regular Organizational Channels," "Salience" of a Solar Installation, and Financial Considerations

Current initiatives to homeowners to install residential solar systems have limited appeal. They only address Rogers' fifth criterion, and even then, they do so imperfectly. "Regular organizational channels" refers to an entire distribution web, not just access to retail outlets. Ask any homeowner to name a reliable solar installer in their metropolitan area. Chances are he or she cannot do so.

Rogers' second criterion is whether prospective buyers understand the technology well enough to consider pur-

noting that "our nation's lackluster commitment to renewables and energy conservation" fits within the "dominant energy policy paradigm" set forth in Joseph P. Tomain, *The Dominant Model of United States Energy Policy*, 61 U. COLO. L. REV. 355 (1990).

12. A recent report from the Environmental Law Institute estimates total subsidies to fossil fuel industries at \$72 billion between 2002-2008, far more than those available to the renewables industries (and six times the amount of subsidies if renewables used as fuel are not counted). Env'tl. L. Inst., *Estimating U.S. Government Subsidies to Energy Sources: 2002-2008*, [http://www.eli.org/Program\\_Areas/innovation\\_governance\\_energy.cfm](http://www.eli.org/Program_Areas/innovation_governance_energy.cfm) (last visited June 23, 2012).

13. See, e.g., James Barrett, *What Obama Should Know About Ending Oil Subsidies*, <http://www.grist.org/article/2011-02-07-what-obama-should-know-about-ending-oil-subsidies> (last visited June 23, 2012).

14. The tax credits available for placing renewable energy property into place are discussed in Eisen, *Solar Utilities*, *supra* note 2, at 77-78.

15. See IRS, *Form 5695 Residential Energy Credits*, <http://www.irs.gov/pub/irs-pdf/f5695.pdf> (last visited June 23, 2012).

16. Musser, *supra* note 10.

17. Bronwyn H. Hall & Beethika Khan, *Adoption of New Technology*, <http://elsa.berkeley.edu/~bhkhall/papers/HallKhan03%20diffusion.pdf> (last visited June 23, 2012); see also Farhar & Coburn, *supra* note 4, at 12 (noting that, "adoption of an innovation usually follows a normal bell curve. If the cumulative number of adopters is plotted, the result is an S-shaped curve"); Accenture, *supra* note 3, at 24-28 (modeling adoption of low-carbon technologies using the S-curve method).

18. Technological improvements are typically incremental once a major innovation has been made. See Suzanne Scotchmer, *Standing on the Shoulders of Giants: Cumulative Research and the Patent Law*, 5 J. ECON. PERSP. 29, 29 (1991) (noting that "almost all technical progress builds on a foundation provided by earlier innovators").

19. Professor Rogers terms this "relative advantage." Farhar & Coburn, *supra* note 3, at 23.

20. Farhar & Coburn, *supra* note 3, at 19.

chasing it. Residential solar is a complex technology,<sup>21</sup> and the lack of standardized solar systems makes it difficult for prospective owners to evaluate it. The requirement to fit the technology to the characteristics of individual sites puts the homeowner in the position of technology consultant for each residential solar project.

The third criterion, “salience,” relates to the product’s importance to the prospective purchaser.<sup>22</sup> Solar is on the opposite end of the salience spectrum from the car/PMV situation. For now, there is little evidence of a widespread commitment to this expensive purchase.

The fourth criterion, availability of a network to support the purchase, is virtually absent everywhere. If a critical mass of one neighborhood had solar panels, homeowners could develop a base of knowledge about them and share observations. This is not likely to be the case with solar, where each installation project is a one-of-a-kind,<sup>23</sup> and few areas see widespread, clustered adoption of the technology.

Even if all criteria were satisfied, no current financial incentive or set of incentives brings the cost of even a modest sized solar system below the level where consumers are willing to adopt it in large numbers. No combination of federal, state, local, and utility incentives currently being offered on a widespread basis will bring the cost of a typical system below the level consumers are willing to pay.

### B. *Likelihood of Diffusion: An Empirical Test*

An empirical test was conducted to obtain real world data on Rogers’ criteria for diffusion as applied to residential solar. Price quotes from solar installers were solicited in six metropolitan areas across the nation. The results are daunting. No installer in any area quoted a system price below \$9,900 after applicable state and federal tax credits and incentives, and quotes were often far higher than that.

Most quotes did not mention the available state and federal tax incentives, leaving the hypothetical homeowners to research them on their own. Nor did installers mention that leases might be available. Price quotes often included qualifiers such as “a hard bid cannot be determined until the customer provides a full year of utility bills, and someone looks at the roof and determines if the electrical service needs any upgrading.”<sup>24</sup> Installers typically also requested a year’s worth of electric bills.<sup>25</sup>

Most homeowners would not proceed further with the installation process after receiving these quotes, which would make solar systems more expensive in many cases than the average new automobile.<sup>26</sup> When

they find out about the legal and practical hurdles to installation, the number of interested homeowners would dwindle still further.

## III. Four Models for Promoting More Residential Solar Installations

There are pockets of encouraging activity where leasing programs and utility incentives have spurred growth, but the total volume of installations is still discouragingly small. How can we encourage more uptake of residential PV systems?

### A. *The “Pure Entrepreneurial” Model*

If strong latent residential demand for solar exists, presumably firms will spring up to satisfy it and grow to larger scale as they work out the various legal, technical, and financial issues. A variant on this “pure entrepreneurial” model might be a state incentive program that offers funding for installations and drives consumers to existing companies. This idea has great superficial appeal. If there is energy gold to be had on residential roofs, then companies would rush to get at it. Those with the vision to do so would capture the economies of scale of multiple installations.

This entrepreneurial model assumes a visionary will emerge who can take the core technology and recognize the value added in it. With solar, we figure someone, somewhere will figure out how to scale it up to amazing heights. This is the promise of every new breakthrough technology: firms will grow more rapidly than their history can be written.

Yet, it has been a long time since anyone created a major energy industry virtually from scratch in this country. And waiting for residential solar to scale up in a free-market fashion also ignores the extensive subsidization of the current “PMV” (utility) system and downplays or ignores the realities of innovation diffusion. In effect, we assume the “custom coach builder” problem is either irrelevant or will be overcome once enough people purchase or lease solar systems.

### B. *“Exchange” or “Neighborhood” Purchasing*

Assume a different solution to this problem: the power of group purchasing, akin to what retailers like Costco do. The organization One Block Off the Grid (1BOG)<sup>27</sup> offers volume pricing and selects installers for individual homeowners who sign up with 1BOG to form neighborhood groups.

This model assumes transaction costs pose the most significant hurdles to individual homeowners seeking to install residential solar. However, the group purchasing model substitutes another form of transaction costs for those faced by the individual. Someone has to make the deci-

21. Eisen, *Solar Utilities*, *supra* note 2, at 73-74.

22. Farhar & Coburn, *supra* note 3, at 23.

23. Musser, *supra* note 10.

24. This and other information are detailed in memoranda by two student researchers working at the direction of the author: Madelaine Kramer, New Mexico & California: Customer Experiment (Nov. 21, 2010) (unpublished manuscript, on file with the author); and Garland Carr, Consumer Study (Nov. 21, 2010) (unpublished manuscript, on file with the author).

25. *Id.*

26. Fed. Trade Comm’n, *Facts for Consumers*, <http://www.ftc.gov/bcp/edu/pubs/consume/autos/aut11.shtm> (last visited June 23, 2012) (quoting the

average cost of a new car at \$28,400).

27. One Block Off the Grid, <http://1bog.org/> (last visited June 23, 2012).

sions about what goes into each solar system. Unless the group purchaser has been granted full authority to do this, there promises to be a give-and-take discussion between each buyer and the group purchaser, so this model simply shifts legwork to the group organizer. This requires an incentive for the organizer, which in the case of IBOG takes the form of referral fees from solar installers.<sup>28</sup> It does not appear that IBOG handles the legal issues associated with homeowner associations or local permitting, so that burden remains with the homeowner. Also, the assumption that volume pricing can bring prices below the threshold of homeowners' willingness to pay for solar may not be realistic.

### C. Waiting for the "Angel Investor"

In 2010, Google announced a major new initiative it called the "Google Power Line," an offshore transmission line backbone to connect with current and planned wind energy projects along the Atlantic coast.<sup>29</sup> The scale of this initiative is breathtaking, and it could revolutionize the process of connecting offshore wind projects with the onshore electricity grid.<sup>30</sup>

Similarly, wouldn't some firm find it irresistible to enter into the residential solar market and scale up installations dramatically? Considering that Google is willing to get into the extremely complex transmission business, it might be possible for a large venturer to enter this space as well. The problem is that it requires an angel investor unconcerned with the current diseconomies of scale. Consider what that firm would be required to do. First, get financing from someone convinced that residential solar can overcome the ubiquity of traditionally generated electricity. At approximately \$10,000 per installation, it would take many millions of dollars in financial power to make a difference. The firm would also have to be willing to address the legal and logistical hurdles associated with solar installations.<sup>31</sup> As no firm has yet done this, it seems unlikely that one ever will, under current market conditions.

### D. A New Idea: The "Solar Utility"

Letting current entrants into the residential solar business go it alone also ignores a critical feature of growth in technology: the governmental support (in the form of funding and key regulatory decisions) necessary for dramatic transformation in an industry where barriers exist to rapid growth.

The cell phone industry is an excellent example of governmental support for a technology that disrupted an existing market. In the 1970s, no one had cell phones. The transformation we have witnessed since then could not have been accomplished by a smattering of cell phone companies nationwide putting up a few tens of millions of dollars each to convince people to buy portable phones. A cell phone requires an extensive infrastructure to work.

The extensive subsidies granted to fossil fuel industries put it in essentially the same position as the landline telephone industry in the 1970s,<sup>32</sup> and it may take the same sort of commitment to support the solar industry as was made to cell phone pioneers.

Let's perform a bit of economic jiu jitsu with the existing "PMV" (utility) distribution infrastructure, much as we have done with the cable and phone lines. Why not force utilities to sell solar panels? There would be backlash about ending the capitalist system as we know it by telling firms what they can and cannot sell. It might take an enormous financial incentive to assuage complaints that utilities were being deprived of their legitimate opportunity to earn a profit. But perhaps the best objection is that this asks the system to retool for a different purpose that it would not accommodate easily.

There would be many impediments; for example, custom assembly of solar panels would require a new installation and distribution system for each utility. At the retail level, a sales channel that for years had promoted traditional fossil-fueled generation and its advantages would be required to change. Of course, there are other obvious problems with asking a firm to cross-sell an unfamiliar product instead of devoting its efforts to the currently profitable product.

Given utilities' historical lack of involvement in these endeavors, it makes more sense to establish a completely separate distribution channel for solar panels. Yet attempting to build a solar company from scratch and operate on a regional or even national scale in competition with incumbent utilities would be tough. It would take an extraordinarily committed entrant into the market with the technical skills to perform installations, the regulatory know-how to evaluate the existing utility landscape in every state, and the financial wherewithal to convince funders to support the company. Not to mention the small matter of accumulating goodwill comparable to that which utilities have built up over many decades.

I propose a different business model centered on the concept of a "solar utility"<sup>33</sup>: a company devoted to national (or at least regional), large-scale entry into residential solar market, which would be responsible for the entire process of solar marketing and distribution in a wide geographic area. As with the cable and phone companies, it is necessary for the federal government to promote companies that would offer homeowners solar panel systems at little

28. One Block Off the Grid, *Frequently Asked Questions*, <http://about.1bog.org/faq/> (last visited June 23, 2012).

29. See Joel B. Eisen, Presentation at William and Mary Environmental Law & Policy Review Symposium: On Looking Beyond the Deepwater Horizon: The Future of Offshore Drilling (Jan. 29, 2011) (copy on file with author) [hereinafter Eisen, Don't Drill, Windmill!]; Tom Doggett, *U.S. Offshore Agency Excited Over Google Power Line*, REUTERS (Oct. 14, 2010), available at <http://www.reuters.com/article/idUSTRE69D65O20101014>.

30. Eisen, Don't Drill, Windmill!, *supra* note 29.

31. See, e.g., Musser, *supra* note 9.

32. Milton Mueller, *Universal Service and the New Telecommunications Act: Mythology Made Law*, 40 COMMUNICATIONS OF THE ACM 39, 39 (1997).

33. Eisen, *Solar Utilities*, *supra* note 2, at 15.

or no cost. Counterintuitive as it may seem to create regulated utilities in a field that already has them, the barriers to entry in residential solar make for the type of anti-competitive environment that has historically prompted governmental intervention to entice prospective venturers to move forward. This system could be structured in numerous ways, and research into many legal and financial issues is underway. As one example of a financial model, a solar utility could provide PV panels to a homeowner at no cost and recoup its investment through a combination of charging for electricity (as in the PPA context), tax incentives, and sale of RECs.

It is also possible that the “solar utility” could be a completely different entity altogether: a “smart grid”<sup>34</sup> company that views the solar panel installation as part of a portfolio of products and services. Want a plug-in hybrid<sup>35</sup> station connected to your solar panel? Or, perhaps, home energy management software and hardware to lessen your electric bill still further than is possible through the installation of solar panels? This would require a historic transition from utilities’ traditional role as infrastructure providers to a consumer orientation that the industry is not prepared for, nor has it shown any inclination to undertake. In the efforts to develop a smart grid, it is widely acknowledged that incumbent utilities are slow to recognize the potential of new technologies and applications.<sup>36</sup>

Relying on utilities to change on their own is akin to waiting for the PMV industry to transform itself. That is

unlikely to happen, and it is better to pursue an alternative course of action.

#### IV. Conclusion

The car/PMV scenario is a thought experiment, but one designed to illustrate the difficulties of promoting residential solar with the system of incentives currently designed for that purpose. If we depart from thinking about offering subsidies to level the playing field, and instead focus on developing institutions that bypass the existing distribution channel, we may make more significant progress than we have in the past four decades. All of this is possible when we begin to think of business models that depart from offering subsidies to compete with the status quo. An incumbent utility could “morph into a complete smart grid service provider, supplying digital meters and home energy displays, leasing solar panels, and owning electric vehicle charging stations.”<sup>37</sup> But it is more likely that distributed solar will have to be offered by new entrants, given the historical focus in the electric utility industry on providing power to safely meet demand. Supplying consumers with an array of products and services is a task that utilities seem concerned about being able to tackle, not one with which they have expertise.<sup>38</sup> The challenge is developing the alternative infrastructure for delivering residential solar and supporting it, which, given the pervasive subsidization of the status quo, will take active governmental involvement.

34. See generally U.S. Dep’t of Energy, *The Smart Grid: An Introduction*, <http://energy.gov/oe/downloads/smart-grid-introduction-0> (last visited June 23, 2012).

35. See generally U.S. Dep’t of Energy, *Alternative Fuels & Advanced Vehicles: Plug-in Hybrid Electric Vehicle Basics*, [http://www.afdc.energy.gov/afdc/vehicles/electric\\_basics\\_phev.html](http://www.afdc.energy.gov/afdc/vehicles/electric_basics_phev.html) (last visited June 23, 2012) (defining and discussing a plug-in hybrid).

36. See Matthew Lynley, *Why Won’t Utility Companies Innovate? Smart Grid Leaders Explain*, GREENBEAT (Nov. 4, 2010), <http://venturebeat.com/2010/11/04/why-wont-utility-companies-innovate-smart-grid-leaders-explain/>.

37. Peter Behr, *Who Will Become the Masters of the “Smart Grid?”*, N.Y. TIMES (Sept. 23, 2010), available at <http://www.nytimes.com/cwire/2010/09/23/23climatewire-who-will-become-the-masters-of-the-smart-grid-4691.html>.

38. Lynley, *supra* note 36 (noting that, “[u]tilities are concerned about being supplanted by smart grid companies, but aren’t sure what to do about it”). See also Gabriel Ma, *Edison Electric Institute Annual Meeting Notes*, Halcrow Power Blog (June 30, 2010), <http://blogs.halcrow.com/power/?p=3>.



# RECENT DEVELOPMENTS

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## In the Congress

“In the Congress” entries cover activities reported in the *Congressional Record* from June 1, 2012, through June 30, 2012. Entries are arranged by bill number, with Senate bills listed first. “In the Congress” covers all environment-related bills that are introduced, reported out of committee, passed by either house, or signed by the President. “In the Congress” also covers all environmental treaties ratified by the Senate. This material is updated monthly. For archived materials, visit <http://www.elr.info/legislative>.

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### Public Laws

**S. 292 (land use)**, which resolves the claims of the Bering Straits Native Corporation and the state of Alaska to land adjacent to Salmon Lake and conveys certain other public land to the Bering Straits Native Corporation in partial satisfaction of the land entitlement of the Corporation under the Alaska Native Claims Settlement Act, was signed into law by President Obama on June 15, 2012. Pub. L. No. 112-133, 158 Cong. Rec. D601 (daily ed. June 19, 2012).

**S. 363 (land use)**, which authorizes the Secretary of Commerce to convey NOAA property to the city of Pascagoula, Mississippi, was signed into law by President Obama on June 15, 2012. Pub. L. No. 112-134, 158 Cong. Rec. D601 (daily ed. June 19, 2012).

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### Chamber Action

**S. 292 (land use)**, which would resolve the claims of the Bering Straits Native Corporation and the state of Alaska to land adjacent to Salmon Lake and convey certain other public land to the Bering Straits Native Corporation in partial satisfaction of the land entitlement of the Corporation under the Alaska Native Claims Settlement Act, was passed by the House. 158 Cong. Rec. H3575 (daily ed. June 6, 2012).

**S. 363 (land use)**, which would authorize the Secretary of Commerce to

convey certain NOAA property to Pascagoula, Mississippi, was passed by the House. 158 Cong. Rec. H3575 (daily ed. June 6, 2012).

**S. 684 (land use)**, which would convey certain parcels of land to the town of Alta, Utah, was passed by the House. 158 Cong. Rec. H3714 (daily ed. June 18, 2012).

**S. 739 (energy)**, which would authorize the Architect of the Capitol to establish battery recharging stations for privately owned vehicles in parking areas under the jurisdiction of the Senate, was passed by the Senate. 158 Cong. Rec. S3657 (daily ed. May 25, 2012).

**S. 2061 (land use)**, which would provide for an exchange of land between the Department of Homeland Security and the South Carolina State Ports Authority, was passed by the Senate. 158 Cong. Rec. S3735 (daily ed. June 5, 2012).

**H.R. 241 (land use)**, which would authorize the conveyance of certain National Forest System lands in the Los Padres National Forest in California, was passed by the House. 158 Cong. Rec. H3438 (daily ed. June 5, 2012).

**H.R. 1740 (water)**, which would amend the Wild and Scenic Rivers Act to designate a segment of Illabot Creek in Skagit County, Washington, as a component of the National Wild and Scenic Rivers System, was passed by the House. 158 Cong. Rec. H3441 (daily ed. June 5, 2012).

**H.R. 2060 (water)**, which would amend the Wild and Scenic Rivers Act

to adjust the Crooked River boundary and provide water certainty for Prineville, Oregon, was passed by the House. 158 Cong. Rec. H3432-34 (daily ed. June 5, 2012).

**H.R. 2336 (water)**, which would amend the Wild and Scenic Rivers Act to designate segments of the York River and associated tributaries for study for potential inclusion in the National Wild and Scenic Rivers System, was passed by the House. 158 Cong. Rec. H3442 (daily ed. June 5, 2012).

**H.R. 2512 (land use)**, which would convey certain federal land in Clark County, Nevada, for the environmental remediation and reclamation of the Three Kids Mine Project Site, was passed by the House. 158 Cong. Rec. H3434 (daily ed. June 5, 2012).

**H.R. 2578 (water)**, which would amend the Wild and Scenic Rivers Act related to a segment of the Lower Merced River in California, was passed by the House. 158 Cong. Rec. H3744 (daily ed. June 19, 2012).

**H.R. 2621 (land use)**, which would establish the Chimney Rock National Monument in the state of Colorado, was passed by the House. 158 Cong. Rec. H2781-82 (daily ed. May 16, 2012).

**H.R. 2745 (wildlife)**, which would amend the Mesquite Lands Act of 1986 to facilitate implementation of a multi-species habitat conservation plan for the Virgin River in Clark County, Nevada, was passed by the House. 158 Cong. Rec. H2745 (daily ed. May 16, 2012).

**H.R. 3263 (water)**, which would authorize the Secretary of the Interior to allow the storage and conveyance of non-project water at the Norman Project in Oklahoma, was passed by the House. 158 Cong. Rec. H3437 (daily ed. June 5, 2012).

**H.R. 4222 (land use)**, which would convey certain land inholdings owned by the United States to the Tucson Unified School District and to the Pascua Yaqui Tribe of Arizona, was passed by the House. 158 Cong. Rec. H3443 (daily ed. June 5, 2012).

**H.R. 4480 (energy)**, which would develop a plan to increase oil and gas exploration, development, and production under oil and gas leases of federal lands under the jurisdiction of the Secretary of Agriculture, the Secretary of Energy, the Secretary of the Interior, and the Secretary of Defense in response to a drawdown of the Strategic Petroleum Reserve, was passed by the House. 158 Cong. Rec. H3918 (daily ed. June 21, 2012).

**H.R. 4849 (land use)**, which would direct the Secretary of the Interior to issue commercial use authorizations to commercial stock operators for operations in designated wilderness within the Sequoia and Kings Canyon National Parks, was passed by the Senate. 158 Cong. Rec. S3292 (daily ed. May 17, 2012).

**H.R. 4850 (energy)**, which would allow for innovations and alternative technologies that meet or exceed desired energy-efficiency goals, was passed by the House. 158 Cong. Rec. H3984 (daily ed. June 26, 2012).

**H.R. 5325 (governance)**, which would make appropriations for energy and water development and related agencies for the fiscal year ending September 30, 2013, was passed by the House. 158 Cong. Rec. H3489, H3513 (daily ed. June 6, 2012).

**H.R. 5625 (energy)**, which would reinstate and transfer certain hydropower licenses and extend the deadline for commencement of construction of certain hydroelectric projects, was passed by the House. 158 Cong. Rec. H3985 (daily ed. June 26, 2012).

## Committee Reports

**S. 1023 (natural resources)** was reported by the Committee on Foreign Relations. S. Rep. No. 112-165, 158 Cong. Rec. S3172 (daily ed. May 15, 2012). The bill would authorize the President to provide assistance to the government of Haiti to end the deforestation in Haiti within five years and restore the extent of tropical forest cover in existence in Haiti in 1990 within 30 years.

**S. 2061 (land use)** was reported by the Committee on Homeland Security and Governmental Affairs. S. Rep. No. 112-171, 158 Cong. Rec. S3630 (daily ed. May 25, 2012). The bill would provide for an exchange of land between the Department of Homeland Security and the South Carolina State Ports Authority.

**H.R. 460 (land use)** was reported by the Committee on Natural Resources. H. Rep. No. 112-503, 158 Cong. Rec. H3265 (daily ed. May 30, 2012). The bill would authorize the Secretary of the Interior to facilitate the development of hydroelectric power on the Diamond Fork System of the Central Utah Project.

**H.R. 1237 (land use)** was reported by the Committee on Natural Resources. H. Rep. No. 112-500, 158 Cong. Rec. H3265 (daily ed. May 30, 2012). The bill would provide for a land exchange with the Trinity Public Utilities District of Trinity County, California, involving the transfer of land to BLM and the Six Rivers National Forest in exchange for National Forest System land in the Shasta-Trinity National Forest.

**H.R. 2352 (land use)** was reported by the Committee on Natural Resources. H. Rep. No. 112-532, 158 Cong. Rec. H3706 (daily ed. June 15, 2012). The bill would authorize the Secretary of the Interior to adjust the boundary of the Stephen Mather Wilderness and the North Cascades National Park in order to allow the rebuilding of a road outside of the floodplain while ensuring that there is no net loss of acreage to the Park or the Wilderness.

**H.R. 2512 (land use)** was reported by the Committee on Natural Resources. H. Rep. No. 112-512, 158 Cong. Rec. H3366 (daily ed. June 1, 2012). The bill would convey certain federal land in Clark County, Nevada, for the environmental remediation and reclamation of the Three Kids Mine Project Site.

**H.R. 2621 (land use)** was reported by the Committee on Natural Resources. H. Rep. No. 112-473, 158 Cong. Rec. H2644 (daily ed. May 10, 2012). The bill would establish the Chimney Rock National Monument in the state of Colorado.

**H.R. 2745 (wildlife)** was reported by the Committee on Natural Resources. H. Rep. No. 112-474, 158 Cong. Rec. H2644 (daily ed. May 10, 2012). The bill would amend the Mesquite Lands Act of 1986 to facilitate implementation of a multispecies habitat conservation plan for the Virgin River in Clark County, Nevada.

**H.R. 3065 (wildlife)** was reported by the Committee on Natural Resources. H. Rep. No. 112-529, 158 Cong. Rec. H3706 (daily ed. June 15, 2012). The bill would amend the Pittman-Robertson Wildlife Restoration Act to facilitate the establishment of additional or expanded public target ranges in certain states.

**H.R. 3100 (land use)** was reported by the Committee on Natural Resources. H. Rep. No. 112-538, 158 Cong. Rec. H3732 (daily ed. June 18, 2012). The bill would authorize the Secretary of the Interior to expand the boundary of the San Antonio Missions National Historical Park and to conduct a study of potential land acquisitions.

**H.R. 3685 (natural resources)** was reported by the Committee on Natural Resources. H. Rep. No. 112-524, 158 Cong. Rec. H3706 (daily ed. June 15, 2012). The bill would amend the Heger-Feinstein Quincy Library Group Forest Recovery Act to extend and expand the scope of the pilot forest management project required by that Act.

**H.R. 3874 (land use)** was reported by the Committee on Natural Resources. H. Rep. No. 112-475, 158 Cong. Rec. H2644 (daily ed. May 10,

2012). The bill would provide for the conveyance of eight cemeteries that are located on National Forest System land in the Black Hills National Forest, South Dakota.

**H.R. 4039 (land use)** was reported by the Committee on Natural Resources. H. Rep. No. 112-525, 158 Cong. Rec. H3706 (daily ed. June 15, 2012). The bill would convey certain federal land to the city of Yerington, Nevada.

**H.R. 4222 (land use)** was reported by the Committee on Natural Resources. H. Rep. No. 112-510, 158 Cong. Rec. H3362 (daily ed. May 31, 2012). The bill would convey certain land inholdings to the Tucson Unified School District and to the Pascua Yaqui Tribe of Arizona.

**H.R. 4234 (land use)** was reported by the Committee on Natural Resources. H. Rep. No. 112-533, 158 Cong. Rec. H3706 (daily ed. June 15, 2012). The bill would amend the Federal Land Policy and Management Act of 1976 to improve the management of grazing leases and permits.

**H.R. 4381 (energy)** was reported by the Committee on Natural Resources. H. Rep. No. 112-530, 158 Cong. Rec. H3706 (daily ed. June 15, 2012). The bill would direct the Secretary of the Interior to establish goals for an all-of-the-above energy production plan strategy on a four-year basis on all onshore federal lands managed by the DOI and the Forest Service.

**H.R. 4383 (land use)** was reported by the Committee on Natural Resources. H. Rep. No. 112-528, 158 Cong. Rec. H3706 (daily ed. June 15, 2012). The bill would streamline the application for permits to drill process and increase funds for energy project permit processing.

**H.R. 4471 (governance)** was reported by the Committee on Energy and Commerce. H. Rep. No. 112-519, 158 Cong. Rec. H3577 (daily ed. June 6, 2012). The bill would require analyses of the cumulative impacts of certain EPA rules and actions that impact gasoline, diesel fuel, and natural gas prices; jobs; and the economy.

**H.R. 4480 (energy)** was reported by the Committee on Energy and Commerce. H. Rep. No. 112-520, 158 Cong. Rec. H3698 (daily ed. June 8, 2012). The bill would develop a plan to increase oil and gas exploration, development, and production under oil and gas leases of federal lands under the jurisdiction of the Secretary of Agriculture, the Secretary of Energy, the Secretary of the Interior, and the Secretary of Defense in response to a drawdown of the Strategic Petroleum Reserve.

**H.R. 5325 (governance)** was reported by the Committee on Appropriations. S. Rep. No. 112-462, 158 Cong. Rec. H2316 (daily ed. May 7, 2012). The bill would make appropriations for energy and water development and related agencies for the fiscal year ending September 30, 2013.

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## Bills Introduced

**S. 2515 (Collins, R-Me.) (air)** would promote the use of clean cookstoves and fuels. 158 Cong. Rec. S2922 (daily ed. May 7, 2012). The bill was referred to the Committee on Foreign Relations.

**S. 3053 (Inhofe, R-Okla.) (governance)** would require Regional Administrators of EPA to be appointed by and with the advice and consent of the Senate. 158 Cong. Rec. S3042 (daily ed. May 9, 2012). The bill was referred to the Committee on Environment and Public Works.

**S. 3080 (Sanders, I-Vt.) (energy)** would eliminate certain subsidies for fossil-fuel production. 158 Cong. Rec. S3084 (daily ed. May 10, 2012). The bill was referred to the Committee on Finance.

**S. 3183 (Schumer, D-N.Y.) (energy)** would amend the Internal Revenue Code of 1986 to require the use of domestic property to be eligible for certain tax incentives for solar energy. 158 Cong. Rec. S3174 (daily ed. May 15, 2012). The bill was referred to the Committee on Finance.

**S. 3262 (Begich, D-Alaska) (wildlife)** would amend the Whaling Convention Act to require the Secretary of Commerce to authorize aboriginal

subsistence whaling and set aboriginal subsistence catch limits for bowhead whales in the event the Commission fails to adopt such limits. 158 Cong. Rec. S3728-29 (daily ed. June 5, 2012). The bill was referred to the Committee on Commerce, Science, and Transportation.

**S. 3264 (Vitter, R-La.) (water)** would amend the Federal Water Pollution Control Act to reauthorize the Lake Pontchartrain Basin Restoration Program. 158 Cong. Rec. S3729 (daily ed. June 5, 2012). The bill was referred to the Committee on Environment and Public Works.

**S. 3265 (Murkowski, R-Alaska) (land use)** would amend the Federal Power Act to remove FERC's authority to collect land use fees for land that has been sold, exchanged, or otherwise transferred from federal ownership but that is subject to a power site reservation. 158 Cong. Rec. S3729 (daily ed. June 5, 2012). The bill was referred to the Committee on Energy and Natural Resources.

**S. 3275 (Coons, D-Del.) (energy)** would amend the Internal Revenue Code of 1986 to extend the publicly traded partnership ownership structure to energy power-generation projects and transportation fuels. 158 Cong. Rec. S3838 (daily ed. June 7, 2012). The bill was referred to the Committee on Finance.

**S. 3284 (Graham, R-S.C.) (water)** would amend the OCSLA to include areas off the coast of South Carolina in the outer continental shelf leasing program for fiscal years 2012 through 2017. 158 Cong. Rec. S3900 (daily ed. June 11, 2012). The bill was referred to the Committee on Energy and Natural Resources.

**S. 3288 (Thune, R-S.D.) (land use)** would convey certain cemeteries that are located on National Forest System land in Black Hills National Forest, South Dakota. 158 Cong. Rec. S4151 (daily ed. June 13, 2012). The bill was referred to the Committee on Energy and Natural Resources.

**S. 3298 (Cantwell, D-Wash.) (water)** would amend the Oil Pollution Act of

1990 to establish the Federal Oil Spill Research Committee, and amend the Federal Water Pollution Control Act to include in a response plan certain planned and demonstrated investments in research relating to discharges of oil and to modify the dates by which a response plan must be updated. 158 Cong. Rec. S4203 (daily ed. June 14, 2012). The bill was referred to the Committee on Commerce, Science, and Transportation.

**S. 3305 (Hatch, R-Utah) (land use)** would clarify authority granted under the Act entitled "An Act to define the exterior boundary of the Uintah and Ouray Indian Reservation in the State of Utah." 158 Cong. Rec. S4238 (daily ed. June 18, 2012). The bill was referred to the Committee on Energy and Natural Resources.

**S. 3319 (Klobuchar, D-Minn.) (land use)** would amend the National Trails System Act to revise the route of the North Country National Scenic Trail in northeastern Minnesota to include existing hiking trails along the north shore of Lake Superior, in the Superior National Forest, and in the Chippewa National Forest. 158 Cong. Rec. S4368 (daily ed. June 20, 2012). The bill was referred to the Committee on Energy and Natural Resources.

**S. 3329 (Murray, D-Wash.) (land use)** would designate and expand wilderness areas in Olympic National Forest in the state of Washington and designate certain rivers in Olympic National Forest and Olympic National Park as wild and scenic rivers. 158 Cong. Rec. S4417 (daily ed. June 21, 2012). The bill was referred to the Committee on Energy and Natural Resources.

**S. 3334 (Cornyn, R-Tex.) (land use)** would limit the power of eminent domain. 158 Cong. Rec. S4417 (daily ed. June 21, 2012). The bill was referred to the Committee on the Judiciary.

**S. 3343 (Klobuchar, D-Minn.) (air)** would amend the Consumer Product Safety Act to require residential carbon monoxide detectors to meet the applicable ANSI/UL standard by treating that standard as a consumer product safety rule, and encourage states to require the

installation of such detectors in homes. 158 Cong. Rec. S4674 (daily ed. June 27, 2012). The bill was referred to the Committee on Commerce, Science, and Transportation.

**S. 3346 (Reid, D-Nev.) (land use)** would convey certain land in the state of Nevada. 158 Cong. Rec. S4674 (daily ed. June 27, 2012). The bill was referred to the Committee on Energy and Natural Resources.

**S. 3352 (Bingaman, D-N.M.) (energy)** would amend the Internal Revenue Code of 1986 to improve and extend certain energy-related tax provisions. 158 Cong. Rec. S4724 (daily ed. June 28, 2012). The bill was referred to the Committee on Finance.

**H.R. 5381 (Flake, R-Ariz.) (air)** would amend the CAA with respect to exceptional event demonstrations. 158 Cong. Rec. H2317 (daily ed. May 7, 2012). The bill was referred to the Committee on Energy and Commerce.

**H.R. 5544 (Cravaack, R-Minn.) (land use)** would authorize and expedite a land exchange involving certain National Forest System land in the state of Minnesota that has limited recreational and conservation resources and certain lands with important recreational, scenic, and conservation resources. 158 Cong. Rec. H2241 (daily ed. May 8, 2012). The bill was referred to the Committee on Natural Resources.

**H.R. 5545 (Thompson, D-Cal.) (land use)** would designate the Berryessa Snow Mountain National Conservation Area in the state of California. 158 Cong. Rec. H2241 (daily ed. May 8, 2012). The bill was referred to the Committee on Natural Resources.

**H.R. 5625 (Murphy, D-Conn.) (energy)** would reinstate and transfer certain hydroelectric licenses and extend the commencement deadline for the construction of certain hydroelectric projects. 158 Cong. Rec. H2243 (daily ed. May 8, 2012). The bill was referred to the Committee on Energy and Commerce.

**H.R. 5626 (Murphy, D-Conn.) (land use)** would authorize the Secretary of the Interior to make grants to facilitate

certain acquisitions of property for conservation purposes. 158 Cong. Rec. H2243 (daily ed. May 8, 2012). The bill was referred to the Committee on Natural Resources.

**H.R. 5710 (Westmoreland, R-Ga.) (energy)** would amend the Energy Policy Act of 2005 to establish minimum efficiency standards for self-contained commercial refrigerators and freezers and would direct DOE to establish standards for other related products. 158 Cong. Rec. H2644 (daily ed. May 10, 2012). The bill was referred to the Committee on Energy and Commerce.

**H.R. 5739 (Scott, R-S.C.) (land use)** would provide for an exchange of land between the Department of Homeland Security and the South Carolina State Ports Authority. 158 Cong. Rec. H2662 (daily ed. May 11, 2012). The bill was referred to the Committee on the Judiciary.

**H.R. 5744 (Gosar, R-Ariz.) (natural resources)** would require the Secretary of Agriculture and the Secretary of the Interior to expedite forest management projects relating to hazardous fuels reduction, forest health, and economic development to address the threat of wildfire on National Forest System lands. 158 Cong. Rec. H2712-13 (daily ed. May 15, 2012). The bill was referred to the Committees on Natural Resources Agriculture.

**H.R. 5745 (Ellison, D-Minn.) (energy)** would eliminate certain subsidies for fossil-fuel production. 158 Cong. Rec. H2713 (daily ed. May 15, 2012). The bill was referred to the Committees on Ways and Means, Transportation and Infrastructure, Natural Resources, Energy and Commerce, Agriculture, Appropriations, Financial Services, Foreign Affairs, and Science, Space, and Technology.

**H.R. 5791 (Flake, R-Ariz.) (land use)** would provide for reasonable and necessary access to wilderness areas for the restoration of water sources, supplies, or infrastructure during a state of emergency declared by the governor of a state. 158 Cong. Rec. H2812 (daily ed. May 16, 2012). The bill was referred to the Committee on Natural Resources.

**H.R. 5826 (Johnson, D-Tex.) (water)** would implement a National Water Research and Development Initiative to ensure clean and reliable water for future generations. 158 Cong. Rec. H3161 (daily ed. May 18, 2012). The bill was referred to the Committee on Science, Space, and Technology.

**H.R. 5827 (Johnson, D-Tex.) (water)** would ensure consideration of water intensity in DOE's energy research, development, and demonstration programs to help guarantee efficient, reliable, and sustainable delivery of energy and clean water resources. 158 Cong. Rec. H3161 (daily ed. May 18, 2012). The bill was referred to the Committee on Science, Space, and Technology.

**H.R. 5863 (Burgess, R-Tex.) (energy)** would clarify §1702 of the Energy Policy Act of 2005 to include penalties for violations of Title XVII of that Act. 158 Cong. Rec. H3266 (daily ed. May 30, 2012). The bill was referred to the Committees on Energy and Commerce and Science, Space, and Technology.

**H.R. 5864 (Slaughter, D-N.Y.) (wildlife)** would improve the regulatory process to prevent the introduction and establishment of non-native wildlife and wild animal pathogens and parasites that are likely to cause harm. 158 Cong. Rec. H3266 (daily ed. May 30, 2012). The bill was referred to the Committees on Natural Resources, the Judiciary, Ways and Means, and the Budget.

**H.R. 5885 (Bishop, D-N.Y.) (wildlife)** would amend the Magnuson-Stevens Fishery Conservation and Management Act to add New York to the New England Fishery Management Council. 158 Cong. Rec. H3404 (daily ed. June 1, 2012). The bill was referred to the Committee on Natural Resources.

**H.R. 5892 (McMorris Rodgers, R-Wash.) (energy)** would seek to improve hydropower. 158 Cong. Rec. H3480 (daily ed. June 5, 2012). The bill was referred to the Committee on Energy and Commerce.

**H.R. 5898 (Young, R-Alaska) (wildlife)** would amend the Whaling Convention Act to require the Secretary of Commerce to authorize aboriginal

subsistence whaling and set aboriginal subsistence catch limits for bowhead whales in the event the Commission fails to adopt such limits. 158 Cong. Rec. H3480 (daily ed. June 5, 2012). The bill was referred to the Committee on Foreign Affairs.

**H.R. 5907 (Costa, D-Cal.) (land use)** would modify the boundary of Yosemite National Park. 158 Cong. Rec. H3660 (daily ed. June 7, 2012). The bill was referred to the Committee on Natural Resources.

**H.R. 5911 (Sullivan, R-Okla.) (toxic substances)** would amend TSCA relating to lead-based paint renovation and remodeling activities. 158 Cong. Rec. H3660 (daily ed. June 7, 2012). The bill was referred to the Committee on Energy and Commerce.

**H.R. 5923 (Hastings, R-Fla.) (wildlife)** would direct the Secretary of the Interior to establish a grant program to eradicate non-native constrictor snakes from ecosystems in which they exist in sustainable populations. 158 Cong. Rec. H3660 (daily ed. June 7, 2012). The bill was referred to the Committee on Natural Resources.

**H.R. 5927 (Tonko, D-N.Y.) (water)** would authorize the Secretary of the Interior to carry out projects and conduct research on water resources in the Hudson-Mohawk River Basin and establish a Hudson-Mohawk River Basin Commission. 158 Cong. Rec. H3660 (daily ed. June 7, 2012). The bill was referred to the Committee on Natural Resources and the Committee on Transportation and Infrastructure.

**H.R. 5931 (Crawford, R-Ark.) (wildlife)** would ensure the continuation of successful fisheries mitigation programs. 158 Cong. Rec. H3698 (daily ed. June 8, 2012). The bill was referred to the Committees on Transportation and Infrastructure and Natural Resources.

**H.R. 5935 (Fortenberry, R-Neb.) (energy)** would prohibit the Secretary of Energy from enforcing regulations pertaining to certain battery chargers. 158 Cong. Rec. H3698 (daily ed. June 8, 2012). The bill was referred to the Committee on Energy and Commerce.

**H.R. 5955 (Kaptur, D-Ohio) (energy)** would amend the Farm Security and Rural Investment Act of 2002 to improve energy programs. 158 Cong. Rec. H3732-33 (daily ed. June 18, 2012). The bill was referred to the Committees on Agriculture, Oversight and Government Reform, and Science, Space, and Technology.

**H.R. 5959 (Kucinich, D-Ohio) (natural resources)** would place a moratorium on permitting for mountaintop removal coal mining until health studies are conducted by the Department of Health and Human Services. 158 Cong. Rec. H3806 (daily ed. June 19, 2012). The bill was referred to the Committees on Natural Resources, Transportation and Infrastructure, and Energy and Commerce.

**H.R. 5960 (Markey, D-Mass.) (wildlife)** would amend the Healthy Forests Restoration Act of 2003 to improve the response to insect infestations and related diseases and change the funding source for the Healthy Forests Reserve Program, codify the stewardship end-result contracting and good neighbor authorities, and amend the emergency watershed protection program to improve post-fire rehabilitation. 158 Cong. Rec. H3806 (daily ed. June 19, 2012). The bill was referred to the Committees on Agriculture and Natural Resources.

**H.R. 5962 (Capps, D-Cal.) (toxic substances)** would amend the Organic Foods Production Act of 1990 to require recordkeeping and authorize investigations and enforcement actions for violations of such Act. 158 Cong. Rec. H3806 (daily ed. June 19, 2012). The bill was referred to the Committee on Agriculture.

**H.R. 5980 (Peterson, D-Minn.) (land use)** would amend the National Trails System Act to revise the route of the North Country National Scenic Trail in northeastern Minnesota to include existing hiking trails along Lake Superior's north shore and in Superior National Forest and Chipewewa National Forest. 158 Cong. Rec. H3914 (daily ed. June 20, 2012). The bill was referred to the Committee on Natural Resources.

**H.R. 5991 (Heck, R-Nev.) (energy)** would promote the development of renewable energy on public lands. 158 Cong. Rec. H3974 (daily ed. June 21, 2012). The bill was referred to the Committees on Natural Resources, Armed Services, and Agriculture.

**H.R. 5995 (Dicks, D-Wash.) (land use)** would designate and expand wilderness areas in Olympic National Forest in the state of Washington and designate certain rivers in Olympic National Forest and Olympic National Park as wild and scenic rivers. 158 Cong. Rec. H3974 (daily ed. June 21, 2012). The bill was referred to the Committee on Natural Resources.

**H.R. 6007 (Hall, R-Tex.) (natural resources)** would exempt certain water transfers by the North Texas Municipal Water District and the Greater Texoma Utility Authority from the Lacey Act Amendments of 1981. 158 Cong. Rec. H3974 (daily ed. June 21, 2012). The bill was referred to the Committee on Natural Resources.

**H.R. 6009 (Labrador, R-Idaho) (land use)** would establish a program to generate dependable economic activity for counties and local governments containing National Forest System land through a management-focused approach. 158 Cong. Rec. H3975 (daily ed. June 21, 2012). The bill was referred

to the Committees on Agriculture and Natural Resources.

**H.R. 6024 (Markey, D-Mass.) (energy)** would authorize development of hydropower and efficiencies at existing Bureau of Reclamation facilities. 158 Cong. Rec. H4064 (daily ed. June 26, 2012). The bill was referred to the Committee on Natural Resources.

**H.R. 6026 (Richmond, D-La.) (water)** would modify the Mississippi River Ship Channel to Baton Rouge navigation project. 158 Cong. Rec. H4064 (daily ed. June 26, 2012). The bill was referred to the Committee on Transportation and Infrastructure.

**H.R. 6030 (Levin, D-Mich.) (energy)** would provide a temporary tax credit for increased payroll and eliminate certain tax benefits for major integrated oil companies. 158 Cong. Rec. H4156 (daily ed. June 27, 2012). The bill was referred to the Committee on Ways and Means.

**H.R. 6031 (Blumenauer, D-Or.) (energy)** would amend the Internal Revenue Code of 1986 to extend the production and investment tax credits for wind facilities and modify the foreign tax credit rules applicable to major integrated oil companies that are dual-capacity taxpayers. 158 Cong. Rec. H4156 (daily ed. June 27, 2012). The bill was referred to the Committee on Ways and Means.

**H.R. 6032 (Blackburn, R-Tenn.) (land use)** would modify the boundary of the Shiloh National Military Park, located in Tennessee and Mississippi, and establish Parker's Crossroads Battlefield as an affiliated area of the National Park System. 158 Cong. Rec. H4156 (daily ed. June 27, 2012). The bill was referred to the Committee on Natural Resources.

**H.R. 6039 (Larsen, D-Wash.) (land use)** would preserve the Green Mountain Lookout in the Glacier Peak Wilderness of the Mount Baker-Snoqualmie National Forest. 158 Cong. Rec. H4156 (daily ed. June 27, 2012). The bill was referred to the Committee on Natural Resources.

**H.R. 6047 (Flake, R-Ariz.) (air)** would amend the renewable fuel program under CAA §211(o) to require the cellulosic biofuel requirement to be based on actual production. 158 Cong. Rec. H4603 (daily ed. June 28, 2012). The bill was referred to the Committee on Energy and Commerce.

**H.R. 6056 (Stivers, R-Ohio) (energy)** would amend the Internal Revenue Code of 1986 to extend the energy-efficient appliance credit. 158 Cong. Rec. H4603 (daily ed. June 28, 2012). The bill was referred to the Committee on Ways and Means.

## In the Courts

These entries summarize recent cases under the following categories: Air, Climate Change, Energy, Land Use, Natural Resources, Toxic Substances, Waste, and Water. The entries are arranged alphabetically by case name within each category. This material is updated monthly. For archived materials, visit <http://www.elr.info/judicial>.

### AIR

*BCCA Appeal Group v. United States Environmental Protection Agency*, 42 ELR 20131 (5th Cir. June 15, 2012). The Fifth Circuit upheld EPA's decision to disapprove certain revisions to Texas' SIP.

*Mack Trucks, Inc. v. Environmental Protection Agency*, 42 ELR 20133 (D.C. Cir. June 12, 2012). The D.C. Circuit

vacated an interim final rule issued by EPA that would allow manufacturers of heavy-duty diesel engines to pay nonconformance penalties in exchange for the right to sell engines that fail to satisfy nitrogen oxide requirements.

*Sierra Club v. Korleski*, 42 ELR 20113 (6th Cir. May 25, 2012). The Sixth Circuit held that the CAA's citizen suit provision does not allow an environmental group to file suit to compel the

state of Ohio to administer a particular federal CAA regulation it has chosen no longer to administer.

### CLIMATE CHANGE

*Alec L. v. Jackson*, 42 ELR 20115 (D.D.C. May 31, 2012). A district court dismissed a lawsuit filed by nongovernmental organizations and a group of minors claiming that six federal agencies violated their fiduciary duties

to preserve and protect the atmosphere as a commonly shared public trust resource under the public trust doctrine.

*Association of Irrigated Residents v. California Air Resources Board*, 42 ELR 20127 (Cal. App. 1st Dist. June 19, 2012). A California appellate court held that the California Air Resources Board's (CARB's) climate change scoping plan, designed to reduce greenhouse gas emissions to 1990 levels by 2020, complies with the state's Global Warming Solutions Act of 2006.

*Thrun v. Cuomo*, 42 ELR 20132 (N.Y. Sup. Ct. June 13, 2012). A New York court dismissed individuals' lawsuit challenging the legality of New York's participation in the Regional Greenhouse Gas Initiative, a regional cap-and-trade plan for carbon dioxide emissions.

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## ENERGY

*Gulf Restoration Network, Inc. v. Salazar*, 42 ELR 20121 (5th Cir. May 30, 2012). The Fifth Circuit dismissed environmental groups' petitions challenging the DOI's approval of 16 oil well exploration and development plans that were issued between March 29 and May 20, 2010, under the Outer Continental Shelf Lands Act.

*Native Village of Point Hope v. Salazar*, 42 ELR 20114 (May 25, 2012). The Ninth Circuit dismissed environmental and Alaska Native groups' petitions challenging the Bureau of Ocean Energy Management's approval of an oil company's exploration plan to drill in the Beaufort Sea.

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## LAND USE

*Kaahumanu v. Hawaii*, 42 ELR 20118 (9th Cir. June 6, 2012). The Ninth Circuit upheld the constitutionality of Hawaii's regulation of commercial weddings on the state's unencumbered beaches in all respects but one.

*Karuk Tribe of California v. United States Forest Service*, 42 ELR 20116 (9th Cir. June 1, 2012). The Ninth Circuit held that the U.S. Forest Service violated the ESA when it failed to consult

with federal wildlife agencies before approving four notices of intent to conduct mining activities in coho salmon critical habitat within the Klamath National Forest.

*Match-E-Be-Nash-She-Wish Band of Pottawatomi Indians v. Patchak*, 42 ELR 20126 (U.S. June 18, 2012). The U.S. Supreme Court held that a property owner may proceed with his APA suit against the United States claiming that the Secretary of the Interior lacked authority under §465 of the Indian Reorganization Act to take title to land in trust for a Native American tribe seeking to open a casino.

*State v. AT&T Mobility, LLC*, 42 ELR 20125 (Minn. Ct. App. June 18, 2012). A Minnesota appellate court reversed a lower court decision permanently enjoining the construction of a 450-foot wireless communications tower outside of the Boundary Waters Canoe Area Wilderness, a 1.1 million-acre wilderness area composed of federal and state lands in northeastern Minnesota.

*United States v. 32.42 Acres of Land*, 42 ELR 20130 (9th Cir. June 14, 2012). The Ninth Circuit held that the United States can extinguish California's public trust rights when exercising its federal power of eminent domain.

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## NATURAL RESOURCES

*Pacific Rivers Council v. United States Forest Service*, No. 08-17565, 42 ELR 20128 (9th Cir. June 20, 2012). The Ninth Circuit reversed in part and affirmed in part a lower court decision that the U.S. Forest Service complied with NEPA and the APA when it amended the Sierra Nevada forest plan in 2004.

*Sheep Mountain Alliance v. Colorado Department of Public Health & Environment*, 42 ELR 20136 (Colo. Dist. Ct. June 13, 2012). A Colorado court invalidated a state license to construct and operate a uranium mill in Montrose County, Colorado.

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## TOXIC SUBSTANCES

*Natural Resources Defense Council v. United States Food & Drug Administration*, 42 ELR 20117 (S.D.N.Y. June 1, 2012). A district court held that the FDA violated the APA and the Food, Drug, and Cosmetic Act when it denied two petitions requesting that it withdraw approval of some uses of certain classes of antibiotics in food-producing animals.

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## WASTE

*American Petroleum Institute v. Environmental Protection Agency*, 42 ELR 20123 (D.C. Cir. June 8, 2012). The D.C. Circuit held unripe an oil and natural gas association's petition for review challenging a 2008 EPA regulation deregulating many hazardous secondary materials under RCRA.

*Center for Community Action & Environmental Justice v. Union Pacific Corp.*, 42 ELR 20122 (C.D. Cal. May 29, 2012). A district court dismissed environmental groups' complaint against two railroad companies alleging that diesel particulate matter emitted by diesel-engine locomotives, trucks, and other equipment has caused and is causing an imminent and substantial risk to human health and the environment in violation of RCRA.

*National Ass'n of Regulatory Utility Commissioners v. United States Department of Energy*, 42 ELR 20120 (D.C. Cir. June 1, 2012). The D.C. Circuit held that the DOE Secretary's 2010 determination that there was no basis for suspending, or otherwise adjusting, annual fees collected from nuclear power plant owners and operators following the government's decision to discontinue its development of Yucca Mountain violated the Nuclear Waste Policy Act.

*New York v. Nuclear Regulatory Commission*, 42 ELR 20124 (D.C. Cir. June 8, 2012). The D.C. Circuit vacated NRC rulemakings concerning the temporary storage and permanent disposal of spent nuclear fuel.

*Pennsylvania v. Lockheed Martin Corp.*, 42 ELR 20119 (3d Cir. June 5, 2012). The Third Circuit vacated as moot a lower court decision that dismissed a contractor's third-party complaint against Pennsylvania and the commonwealth's natural resources agency for cleanup costs associated with Quehanna Wild Area Nuclear Site.

*Southern Union Co. v. United States*, 42 ELR 20134 (U.S. June 21, 2012). The U.S. Supreme Court overturned an \$18 million fine imposed against a pipeline operator for storing liquid mercury at one of its facilities without a permit in violation of RCRA.

*Vermont Yankee Nuclear Power Corp. v. Entergy Nuclear Vermont Yankee, LLC*, 42 ELR 20135 (Fed. Cir. June 13, 2012). The Federal Circuit affirmed in part and reversed in part damages awarded to the current owner of the

Vermont Yankee Nuclear Power Station stemming from the government's failure to dispose of spent nuclear fuel generated at the station.

*Yankee Atomic Electric Co. v. United States*, 42 ELR 20111 (Fed. Cir. May 18, 2012). The Federal Circuit awarded a power company \$17,021,742 in its suit against the U.S. government for the cost of storing spent nuclear fuel and high-level radioactive waste beyond the time that the government promised by contract to begin storing that waste in a permanent and secure repository.

tion Act, a municipality can be held responsible for, and required to prevent, a discharge of raw sewage that originates within its borders, even when the raw sewage is discharged by a private party and not directly discharged by the municipality itself.

*Friends of Back Bay v. United States Army Corps of Engineers*, 42 ELR 20129 (4th Cir. June 18, 2012). The Fourth Circuit held that the U.S. Army Corps of Engineer violated NEPA when it issued a CWA §404 permit allowing a developer to build a mooring facility and boat ramp 3,000 feet from the Back Bay National Wildlife Refuge in Virginia Beach, Virginia.

*United States v. Renton*, 42 ELR 20110 (W.D. Wash. May 25, 2012). A district court held that the CWA's waiver of sovereign immunity applies to storm-water management fees.

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## WATER

*Department of Environmental Quality v. Worth Township*, 42 ELR 20112 (Mich. May 17, 2012). The Michigan Supreme Court held that under the state's Natural Resources and Environmental Protec-

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# In the Federal Agencies

These entries cover the period June 1, 2012, through June 30, 2012. Citations are to the *Federal Register* (FR). Entries below are organized by Final Rules, Proposed Rules, and Notices. Within each section, entries are further subdivided by subject matter area, with entries listed chronologically. This material is updated monthly. For archived materials, visit <http://www.elr.info/daily-update/archives>.

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## Final Rules

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### AIR

EPA added carbon dioxide to the list of acceptable substitutes under the Significant New Alternatives Policy program for use in the motor vehicle air conditioning sector. 77 FR 33315 (6/6/12).

EPA finalized revisions to its regional haze program, finding that the trading programs in the Cross-State Air Pollution Rule achieve greater reasonable progress toward the national goal of achieving natural visibility conditions in Class I areas than source-specific Best Available Retrofit Technology, disapproving regional haze SIPs for states that relied on the Clean Air Interstate Rule (CAIR) to satisfy certain regional haze requirements, and promulgating federal implementation plans (FIPs) to

address deficiencies in CAIR-dependent regional haze SIPs. 77 FR 33642 (6/7/12).

EPA revised its heavy-duty diesel regulations to allow modifications to emission control systems on emergency vehicles. 77 FR 34130 (6/8/12).

EPA took final action on revisions to the FIPs of several states to reduce interstate transport of fine particulate matter (PM) and ozone. 77 FR 34830 (6/12/12).

EPA determined that the New York-Northern New Jersey-Long Island nonattainment areas failed to attain the one-hour ozone standard by the 2007 deadline, but that they are currently attaining the one-hour ozone standard and that they attained and continue to attain the eight-hour ozone standards. 77 FR 36163 (6/18/12).

EPA adopted several new aircraft nitrogen oxide (NO<sub>x</sub>) emission standards, compliance flexibilities, and other regulatory requirements for aircraft turbofan or turbojet engines. 77 FR 36341 (6/18/12).

EPA added trans-1,3,3,3-tetrafluoropropene (also known as HFO-1234ze) to the list of compounds excluded from the definition of "volatile organic compound (VOC)" on the basis that this compound makes a negligible contribution to tropospheric ozone formation. 77 FR 37610 (6/22/12).

**SIP Approvals:** Alabama (regional haze) 77 FR 38515 (6/28/12). Arizona (VOC emissions) 77 FR 35279 (6/13/12); attainment of the 1997 eight-hour ozone NAAQS for the Mesa-Phoenix nonattainment area) 77 FR 35285 (6/13/12); (infrastructure requirements for ozone and fine PM) 77 FR 38239 (6/27/12); (monitoring



and reporting of VOCs, NO<sub>x</sub>, and PM emissions from stationary sources) 77 FR 38246 (6/27/12); (Nogales PM nonattainment area) 77 FR 38399 (6/27/12). California (PM emissions for the South Coast air quality management district) 77 FR 32398 (6/1/12). Florida (new source review (NSR) PSD program) 77 FR 35862 (6/15/12). Georgia (transportation conformity criteria and procedures) 77 FR 35866 (6/15/12); (regional haze) 77 FR 38501 (6/28/12). Illinois (consumer products and architectural and industrial maintenance coatings rules) 77 FR 33659 (6/7/12); (attainment of the 1997 eight-hour ozone NAAQS for the St. Louis, MO-IL nonattainment area and related actions) 77 FR 34819 (6/12/12). Indiana (best available retrofit technology and limited approval of regional haze revisions) 77 FR 34218 (6/11/12); (revision to Central Indiana 1997 eight-hour ozone maintenance air quality plan) 77 FR 37328 (6/21/12); (VOC emissions limits for consumer products) 77 FR 38725 (6/29/12). Iowa (regional haze) 77 FR 38006 (6/26/12). Maryland (exemptions to preconstruction permitting requirements) 77 FR 34808 (6/12/12); (attainment of revoked one-hour ozone NAAQS for the Baltimore nonattainment area) 77 FR 34810 (6/12/12). Massachusetts (attainment of the 1997 eight-hour ozone NAAQS for the Springfield moderate nonattainment area for the 2007-2009 and 2008-2010 monitoring periods) 77 FR 36404 (6/19/12). Missouri (regional haze) 77 FR 38007 (6/26/12). New Mexico (NSR preconstruction permitting requirements) 77 FR 35273 (6/13/12). South Carolina (emissions statements requirement for the York County portion of the bi-state Charlotte-Gastonia-Rock Hill, North Carolina-South Carolina 1997 eight-hour ozone nonattainment area) 77 FR 37812 (6/25/12); (regional haze) 77 FR 38509 (6/28/12). Texas (failure to attain the one-hour ozone NAAQS for the Houston/Galveston/Brazoria nonattainment area) 77 FR 36400 (6/19/12). Utah (partial approval of one-hour ozone maintenance plan) 77 FR 35873 (6/15/12). Virginia (limited approval of regional haze revision) 77 FR 35287 (6/13/12). Wisconsin (disapproval of infrastructure submissions) 77 FR 35870 (6/15/12).

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## HAZARDOUS & SOLID WASTE

EPA gave final authorization to Idaho's hazardous waste management program under RCRA. 77 FR 34229 (6/11/12).

EPA approved revisions to Louisiana's hazardous waste management program. 77 FR 38530 (6/28/12).

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## WILDLIFE

NOAA-Fisheries announced a 12-month finding on a petition to revise the existing critical habitat designation under the ESA for the leatherback sea turtle; it denied the petition due to insufficient information to adequately identify essential features within the area petitioned for leatherbacks. 77 FR 32909 (6/4/12).

FWS established regulations for seasons, harvest limits, and methods and means related to the taking of wildlife for subsistence uses in Alaska during the 2012-13 and 2013-14 regulatory years. 77 FR 35482 (6/13/12).

FWS designated approximately 24,527 acres in California, Oregon, and Washington as critical habitat for the western snowy plover under the ESA. 77 FR 36727 (6/19/12).

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## Proposed Rules

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### AGRICULTURE

The USDA proposed to supplement its NEPA regulations with three new categorical exclusions for activities that restore lands negatively impacted by water control structures, natural and human-caused events, and roads and trails. 77 FR 35323 (6/13/12).

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### AIR

EPA proposed several amendments to the NESHAP for stationary reciprocating internal combustion engines under §112 of the CAA. 77 FR 33812 (6/7/12).

EPA proposed to revise its heavy-duty diesel regulations to allow modifications to emission control systems on emergency vehicles, as well as other emission-related revisions; see above for direct final rule. 77 FR 34149 (6/8/12).

EPA proposed revisions to the primary and secondary NAAQS for PM to provide requisite protection of public health and welfare, respectively, and to make corresponding revisions to the data-handling conventions for PM and ambient air monitoring, reporting, and network design requirements; the Agency also proposed revisions to the PSD permitting program with respect to the proposed NAAQS revisions. 77 FR 38889 (6/29/12).

**SIP Proposals:** Alabama (infrastructure submissions) 77 FR 34288 (6/11/12). California (PM emissions for the South Coast air quality management district; see above for direct final rule) 77 FR 32483 (6/1/12); (VOC emissions for the San Joaquin Valley unified air pollution control district) 77 FR 35327 (6/13/12); (VOC emissions for the San Joaquin Valley unified air pollution control district) 77 FR 35329 (6/13/12); (VOC emissions for the South Coast air quality management district and the San Joaquin Valley unified air pollution control district) 77 FR 37359 (6/21/12). Florida (infrastructure submissions) 77 FR 34906 (6/12/12). Georgia (approval of infrastructure submission) 77 FR 35909 (6/15/12); (transportation conformity criteria and procedures; see above for direct final rule) 77 FR 35917 (6/15/12). Illinois-Missouri (St. Louis fine PM NAAQS) 77 FR 38183 (6/27/12). Indiana (VOC emissions limits for consumer products; see above for direct final rule) 77 FR 38761 (6/29/12). Kentucky (NSR and PSD permitting regulations for Jefferson County) 77 FR 33363 (6/6/12). Maryland (exemptions to preconstruction permitting requirements; see above for direct final rule) 77 FR 34897 (6/12/12). Michigan (PSD construction permit program) 77 FR 36442 (6/19/12). Mississippi (infrastructure submissions) 77 FR 34898 (6/12/12); (regional haze) 77 FR 38191 (6/27/12). Nevada (stationary sources permits) 77 FR 38557 (6/28/12). New Mexico (NSR preconstruction permitting

requirements; see above for direct final rule) 77 FR 35326 (6/13/12); (regional haze requirements) 77 FR 36043 (6/15/12). North Carolina (regional haze) 77 FR 38185 (6/27/12). Oregon (transportation conformity criteria and procedures) 77 FR 32481 (6/1/12). Pennsylvania (attainment of the 1997 annual fine PM NAAQS for the Pittsburgh nonattainment area) 77 FR 34297 (6/11/12); (PSD and infrastructure requirements) 77 FR 34300 (6/11/12). South Carolina (infrastructure requirements) 77 FR 33372 (6/6/12); (infrastructure requirements) 77 FR 33380 (6/6/12); (emissions statements requirement for the York County portion of the bi-state Charlotte-Gastonia-Rock Hill, North Carolina-South Carolina 1997 eight-hour ozone nonattainment area; see above for direct final rule) 77 FR 37841 (6/25/12). Tennessee (attainment of the 1997 annual average and 2006 24-hour fine PM NAAQS for the Knoxville nonattainment area) 77 FR 33360 (6/6/12); (PSD and nonattainment NSR programs) 77 FR 34302 (6/11/12); (qualified approval of infrastructure submission) 77 FR 34306 (6/11/12); (attainment of the 2008 lead NAAQS for the Bristol nonattainment area) 77 FR 35652 (6/14/12). Texas (major revisions to NSR program) 77 FR 36964 (6/20/12). Utah (disapproval of revision on open burning) 77 FR 36443 (6/19/12); (new and modified sources) 77 FR 37859 (6/25/12). Virgin Islands (regional haze FIP) 77 FR 37842 (6/25/12). Wyoming (partial approval of regional haze plan and FIP) 77 FR 33022 (6/4/12).

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## HAZARDOUS & SOLID WASTE

EPA, after further evaluation, proposed to grant a petition to exclude (or delist) from the lists of hazardous wastes the underflow water generated by Exxon-Mobil Refining and Supply Company in Baytown, Texas. 77 FR 36447 (6/19/12).

EPA proposed to approve revisions to Louisiana's hazardous waste management program; see above for direct final rule. 77 FR 38566 (6/28/12).

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## NATURAL RESOURCES

OSM proposed to approve an amendment to Kentucky's regulatory program under SMCRA that authorizes electronic notification of enforcement documents. 77 FR 34888 (6/12/12).

OSM proposed to approve an amendment to Oklahoma's regulatory program under SMCRA regarding various aspects of the permitting requirement process. 77 FR 34890 (6/12/12).

OSM proposed to approve an amendment to Utah's regulatory program under SMCRA regarding the posting of a surety bond or its equivalent pending state judicial review. 77 FR 34892 (6/12/12).

OSM proposed to withdraw an amendment to Wyoming's regulatory program under SMCRA on coal rules and regulations. 77 FR 34894 (6/12/12).

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## WATER

EPA announced the availability of new information and data on proposed standards for cooling water intake structures at all existing power-generating facilities. 77 FR 34315 (6/11/12).

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## WILDLIFE

FWS announced the availability of a draft economic analysis of the proposed revised designation of critical habitat for the northern spotted owl under the ESA. 77 FR 32483 (6/1/12).

FWS announced a 90-day finding on a petition to delist the Inyo California towhee and to reclassify from endangered to threatened the arroyo toad, Indian Knob mountainbalm, Lane Mountain milk-vetch, Modoc sucker, and Santa Cruz cypress under the ESA; the agency found that delisting and reclassification may be warranted and initiated status reviews. 77 FR 32922 (6/4/12).

FWS announced a 90-day finding on a petition to list the southern and Mt. Rainier white-tailed ptarmigan as threatened and to designate criti-

cal habitat under the ESA; the agency found that listing may be warranted and initiated a status review of the two subspecies. 77 FR 33143 (6/5/12).

FWS proposed to list 38 species on the Hawaiian Islands of Lanai, Maui, and Molokai as endangered under the ESA, reaffirmed the listing of two endemic plants currently listed as endangered, and proposed to designate critical habitat for 39 of the plant and animal species; proposed to designate 271,062 acres of Maui Nui as critical habitat for 11 previously listed plant and animal species and to revise critical habitat for 85 plant species; proposed to delist the plant *Gahnia lanaiensis*; and proposed revisions for other plants and birds. 77 FR 34464 (6/11/12).

FWS proposed to delist Magazine Mountain shagreen from the list of endangered and threatened wildlife due to recovery of the species. 77 FR 36460 (6/19/12).

FWS proposed to withdraw its rule to list the dunes sagebrush lizard as endangered under the ESA due to a decrease in significant threats to the species. 77 FR 36871 (6/19/12).

FWS announced a 90-day finding on a petition to list the black-capped petrel as endangered or threatened and to designate critical habitat in the South Atlantic and Caribbean region under the ESA; the agency found that listing is warranted and initiated a status review. 77 FR 37367 (6/21/12).

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## Notices

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### AIR

EPA delegated authority to Maryland to implement and enforce NESHAP and new source performance standards. 77 FR 37039 (6/20/12).

EPA entered into a proposed settlement agreement that would potentially resolve petitions for judicial review filed in the D.C. Circuit and would require the Agency to finalize rulemaking to revise the NESHAP for reciprocating

internal combustion engines by December 14, 2012. 77 FR 37397 (6/21/12).

EPA entered into a proposed consent decree that requires the Agency to sign a notice of final rulemaking no later than December 14, 2012, setting forth its final decision concerning its review of NAAQS for PM and promulgating such revisions to the NAAQS and/or promulgating new NAAQS if appropriate. 77 FR 38060 (6/26/12).

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## HAZARDOUS & SOLID WASTE

EPA entered into a proposed administrative settlement under CERCLA that requires the settling party to pay \$2,500,000 in U.S. response costs in connection with the Arkansas Waste to Energy Superfund site in Osceola, Arkansas. 77 FR 38628 (6/28/12).

EPA entered into a proposed administrative settlement under CERCLA that requires the settling party to pay \$12,727.17 in U.S. response costs in connection with the Arkansas Waste to Energy Superfund site in Osceola, Arkansas. 77 FR 38628 (6/28/12).

EPA entered into a proposed administrative settlement under CERCLA that requires the settling party to pay \$50,000 in U.S. response costs in connection with the Arkansas Waste to Energy Superfund site in Osceola, Arkansas. 77 FR 38629 (6/28/12).

EPA entered into a proposed administrative settlement under CERCLA that requires the settling party to pay \$220,000 in U.S. response costs in connection with the Arkansas Waste to Energy Superfund site in Osceola, Arkansas. 77 FR 38629 (6/28/12).

EPA entered into a proposed administrative settlement under CERCLA that requires the settling party to pay \$110,000 to the Hazardous Substance Superfund for recovery of past U.S. response costs incurred at the Trinity Superfund site in Cleveland, Ohio. 77 FR 38802 (6/29/12).

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## WATER

EPA proposed to approve revisions to Washington's public water supply supervision program. 77 FR 33456 (6/6/12).

EPA proposed to approve a revision to Alabama's public water system supervision program. 77 FR 36274 (6/18/12).

EPA approved 10 alternative testing methods for use in measuring the levels of contaminants in drinking water and determining compliance with national primary drinking water regulations. 77 FR 38523 (6/28/12).

EPA's New England Region has determined that adequate facilities for the safe and sanitary removal and treatment of sewage from all vessels are reasonably available for the state waters of Vineyard and Nantucket Sounds and the islands collectively termed Southern Cape Cod. 77 FR 38797 (6/29/12).

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## DOJ NOTICES OF SETTLEMENT

*United States v. Minnie Moore Resources, Inc.*, No. 2:11-cv-00127-BLW (D. Idaho May 31, 2012). A settling CERCLA defendant responsible for past and future U.S. response costs incurred at the Minnie Moore Mine Superfund site in Blaine County, Idaho, must secure an environmental covenant to protect the remediation of the site. 77 FR 33489 (6/6/12).

*United States v. Atlanta, City of*, No. 1:98-CV-1956-TWT (N.D. Ga. May 31, 2012). A settling CWA defendant responsible for violations at its wastewater treatment facilities and collection and transmission system was granted a 13-year extension to complete the remaining work on the facilities. 77 FR 33769 (6/7/12).

*United States v. Jacob Goldberg & Son, Inc.*, No. 10 Civ. 3237 (S.D.N.Y. May 31, 2012). Under two proposed consent decrees, settling CERCLA defendants responsible for violations at the Port Refinery Superfund site in Rye Brook, New York, must pay \$245,000 in U.S.

response costs incurred at the site. 77 FR 33769 (6/7/12).

*United States v. Arecibo, Municipality of*, No. 3:12-CV-01419 (D.P.R. June 4, 2012). A settling CWA defendant responsible for multiple permit violations that resulted in the discharge of stormwater into waters of the United States and the discharge of untreated sewage onto public and private property must pay a \$305,643 civil penalty and must conduct an extensive injunctive relief plan estimated to cost approximately \$56 million. 77 FR 34064 (6/8/12).

*United States v. Allied Signal Inc.*, No. 1513 (RPP) (S.D.N.Y. June 1, 2012). A settling CERCLA defendant responsible for violations at the Cortese Landfill Superfund site in Tusten, New York, must perform additional response action to address newly identified source-area contamination at the site. 77 FR 34065 (6/8/12).

*United States v. INEOS USA LLC*, No. 3:12-cv-01404 (N.D. Ohio June 4, 2012). A settling CAA, CERCLA, and EPCRA defendant responsible for violations at its chemical manufacturing plant in Lima, Ohio, must pay a \$1,150,000 civil penalty; must implement an enhanced leak detection and repair program; must improve training, reporting, and recordkeeping; must undertake an analysis of the releases; must review and update training; and must perform a CERCLA/EPCRA audit. 77 FR 34065 (6/8/12).

*United States v. SABIC Innovative Plastics US LLC*, No. 12-cv-00076 (S.D. Ill. May 31, 2012). Settling CAA defendants responsible for violations at chemical manufacturing plants in Mt. Vernon, Indiana, and Burkville, Alabama, must pay a \$1,012,873 civil penalty, must implement an enhanced leak detection and repair program to mitigate any excess emissions, must perform additional injunctive relief, and must implement a supplemental environmental project. 77 FR 34066 (6/8/12).

*United States v. Wendt*, No. CV-12-2225 (LB) (N.D. Cal. May 30, 2012). Settling CWA defendants that discharged pollutants into waters of the United States without a permit must

pay a civil penalty, must restore the impacted areas, and must perform mitigation. 77 FR 34066 (6/8/12).

*United States v. Siemens Industry, Inc.*, No. 1:12-cv-00729 (D. Del. June 11, 2012). Settling CWA defendants responsible for violations at an oil recycling, storage, and distribution facility in Wilmington, Delaware, must pay a \$300,000 civil penalty and must take appropriate actions to comply with secondary containment requirements and with spill prevention, control, and countermeasure plan requirements. 77 FR 36003 (6/15/12).

*United States v. Enterprise Products Operating & Mid-America Pipeline Co.*, No. 12-190 (D. Neb. May 29, 2012). Settling CWA defendants responsible for discharges of natural gasoline from a pipeline in Iowa, Kansas, and Nebraska must pay a \$1,042,000 civil penalty and must undertake specified measures to improve reporting of spills and to prevent pipeline ruptures caused by third parties. 77 FR 36575 (6/19/12).

*United States v. Stearns Co.*, No. 12-cv-191-JMH (E.D. Ky.). Settling CERCLA defendants responsible for past and future response costs incurred by the U.S. Forest Service at the Lower Rock Creek Mines Superfund site in McCreary County, Kentucky, must agree to the entry of a judgment in favor of the United States in the amount of \$31.8

million, which can be accomplished through the transfer of real property interests and recoveries from insurance policies. 77 FR 36575 (6/19/12).

*United States v. Perth Amboy, City of*, No. 2:12-cv-03404 (D.N.J. June 6, 2012). A settling CWA defendant that did not properly operate and maintain its combined sewer system must pay a \$17,000 penalty and must implement injunctive relief valued at approximately \$5.4 million. 77 FR 3 7439 (6/21/12).

*United States v. Enstar LLC*, No. 1:12-cv-01563-MSK (D. Colo. June 18, 2012). A settling CERCLA defendant must pay \$2,486,440 to the United States and Colorado in reimbursement of past and future response costs incurred and to be incurred at the Butterfly and Burrell Mine site in the White River National Forest near Meeker, Colorado. 77 FR 38084 (6/26/12).

*United States v. Toll Brothers, Inc.*, No. 12-3489 (E.D. Pa. June 20, 2012). A settling CWA defendant that violated its NPDES permits must pay a \$741,000 civil penalty and must institute a nationwide management, reporting, and training program to improve compliance with stormwater requirements at its current and future construction sites. 77 FR 38084 (6/26/12).

*United States v. American Seafoods Co.*, No. 12-cv-01040 (W.D. Wash. June 14,

2012). A settling CAA defendant that violated the statute's regulations concerning the management and control of ozone-depleting substances must pay a \$700,000 civil penalty and must implement measures to ensure their compliance and to partially remedy the impact of their alleged violations, including requirements to retire the equivalent of ozone-depleting substances consumption allowances they were required to purchase for previous imports of ozone-depleting refrigerants, must convert at least two vessels employing ozone-depleting refrigerants to refrigerant systems using non-ozone-depleting substances, and must implement a comprehensive leak inspection and repair program. 77 FR 38654 (6/28/12).

*United States v. Russell Stover Candies, Inc.*, No. 5:12-cv-04081 (D. Kan. June 21, 2012). A settling CWA defendant that violated the statute's pretreatment requirements must pay a \$585,000 civil penalty and must perform injunctive relief by monitoring and sampling wastewater discharge. 77 FR 38654 (6/28/12).

*United States v. U.S. Virgin Islands*, No. 09-122 (D.V.I. June 18, 2012). A settling CERCLA defendant must take over operation and maintenance of two existing groundwater pump-and-treat systems at the Tutu Wellfield Superfund site in St. Thomas, U.S. Virgin Islands. 77 FR 38655 (6/28/12).

## In the State Agencies

The entries below cover state regulatory developments during the month of June 2012. The entries are arranged by state, and within each section, entries are further subdivided by subject matter area. For material previously reported, visit <http://www.elr.info/administrative/state-updates/archive>.

### ALASKA

#### TOXIC SUBSTANCES

The Department of Environmental Conservation proposed to amend 18 ALASKA ADMIN. CODE 90, pertaining to the Pesticide Control Regulations.

Changes would alter the process that state managers must follow when applying pesticides and clarify sections relating to government entities applying pesticides to private lands. The deadline for comment is August 2, 2012. *See* <http://notes4.state.ak.us/pn/pubnotic.nsf/1604e1912875140689256785006767f6/7bc178be3b36d62189257a06006aae44?OpenDocument>.

### ARIZONA

#### WASTE

The Department of Environmental Quality amended ARIZ. ADMIN. CODE §18.8.260 & 270, Hazardous Waste Management. Changes raise fees for

2012 and 2013. The amendments took effect July 1, 2012. *See* [http://www.azsos.gov/public\\_services/Register/2012/21/final.pdf](http://www.azsos.gov/public_services/Register/2012/21/final.pdf) (pp. 1202-16).

The Department of Environmental Quality amended ARIZ. ADMIN. CODE §18.13, Solid Waste Management. Changes raise fees for 2012 and 2013. The amendments took effect July 1, 2012. *See* [http://www.azsos.gov/public\\_services/Register/2012/21/final.pdf](http://www.azsos.gov/public_services/Register/2012/21/final.pdf) (pp. 1217-38).

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## DELAWARE

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### AIR

The Department of Natural Resources and Environmental Control amended 7 DEL. ADMIN. CODE Ch. 60 §1131, Low Enhanced Inspection & Maintenance Program. Changes establish a permitting program for vehicles being driven by technicians for drive-cycle testing that was created by state legislation. The rule took effect June 11, 2012. *See* <http://regulations.delaware.gov/register/june2012/final/15%20DE%20Reg%201762%2006-01-12.htm>.

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## ILLINOIS

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### AIR

The Pollution Control Board amended 35 ILL. ADMIN. CODE §223, Standards and Limitations for Organic Material Emissions for Area Sources. Changes add volatile organic compound limitations applicable to certain consumer products. The amendment took effect May 4, 2012. *See* [http://www.cyberdriveillinois.com/departments/index/register/register\\_volume36\\_issue20.pdf](http://www.cyberdriveillinois.com/departments/index/register/register_volume36_issue20.pdf) (pp. 7569-612).

### WASTE

The Pollution Control Board amended 35 ILL. ADMIN. CODE §720, Hazardous Waste Management System: General. Changes update the Illinois Resource Conservation and Recovery Act Sub-

title C hazardous waste rules to correspond with U.S. EPA amendments. The amendment took effect June 4, 2012. *See* [http://www.cyberdriveillinois.com/departments/index/register/register\\_volume36\\_issue24.pdf](http://www.cyberdriveillinois.com/departments/index/register/register_volume36_issue24.pdf) (pp. 8740-72).

The Pollution Control Board amended 35 ILL. ADMIN. CODE §728, Land Disposal Restrictions. Changes implement federal amendments that revise land disposal restrictions applicable to carbamate wastes to allow the use of best demonstrated available technologies for treating carbamate wastes. The amendment took effect June 4, 2012. *See* [http://www.cyberdriveillinois.com/departments/index/register/register\\_volume36\\_issue24.pdf](http://www.cyberdriveillinois.com/departments/index/register/register_volume36_issue24.pdf) (pp. 8790-962).

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## INDIANA

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### AIR

The Air Pollution Control Board proposed to amend 326 IND. ADMIN. CODE §§1.2 & 4.1, concerning open burning with air curtain destructors. Changes amend the definition of “air curtain destructor” to include portable self-contained units. There will be a public hearing August 1, 2012. *See* <http://www.in.gov/legislative/iac/20120530-IR-326110317PRA.xml.pdf>.

### WATER

The Natural Resources Commission proposed to amend 312 IND. ADMIN. CODE §11, which regulates the management of public freshwater lakes, to allow extended license durations for qualified temporary structures and dredging activities. The rule took effect June 22, 2012. *See* [www.in.gov/legislative/iac/20120523-IR-312120270NIA.xml.pdf](http://www.in.gov/legislative/iac/20120523-IR-312120270NIA.xml.pdf).

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## MICHIGAN

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### WASTE

The Department of Environmental Quality amended MICH. ADMIN.

CODE R. 29.2107 and R. 29.2108, Underground Storage Tank Regulations. Changes add a number of definitions and add requirements on operator training. *See* [http://www.michigan.gov/documents/lara/MR9\\_060112\\_387740\\_7.pdf](http://www.michigan.gov/documents/lara/MR9_060112_387740_7.pdf) (pp. 27-36).

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## MONTANA

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### WATER

The Board of Environmental Review amended MONT. ADMIN. CODE R. 17.38, pertaining to public water and sewage system requirements. Changes pertain to treatment requirements, control tests, testing and sampling, records and reporting requirements, definitions, and incorporation by reference. *See* <http://sos.mt.gov/arm/Register/archives/MAR2012/MAR12-11.pdf> (pp. 1141-46).

The Department of Environmental Quality amended MONT. ADMIN. CODE R. 17.55.109, pertaining to incorporation by reference. Changes incorporate Numeric Water Quality Standards and Drinking Water Maximum Contaminant Levels. *See* <http://sos.mt.gov/arm/Register/archives/MAR2012/MAR12-11.pdf> (p. 1147).

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## NEVADA

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### ENERGY

The Office of Energy proposed to amend NEV. ADMIN. CODE §701A, relating to energy tax incentives. *See* <http://www.leg.state.nv.us/register/2011Register/R125-11RP1.pdf>.

The Public Utilities Commission adopted NEV. ADMIN. CODE §701B.235, relating to renewable energy systems. Changes revise provisions relating to utilities and contractors concerning the Solar Thermal Systems Demonstration Program and capacity goals for the Wind Energy Systems Demonstration Program and Waterpower Energy Systems Demonstration Pro-

gram. The rules took effect March 23, 2012. *See* <http://www.leg.state.nv.us/register/2011Register/R083-11A.pdf>.

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## LAND USE

The State Conservation Commission proposed to amend NEV. ADMIN. CODE §548, providing minimum audit standards for Conservation Districts and listing the date certain reports are required to be submitted. *See* <http://www.leg.state.nv.us/register/2012Register/R081-12I.pdf>.

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## WASTE

The State Environmental Commission amended NEV. ADMIN. CODE §444A.120 and 130. Changes revise the standards for municipal recycling programs by adding provisions for recycling services at apartment complexes and condominiums. Amendments took effect June 4, 2012. *See* <http://www.leg.state.nv.us/register/2011Register/R049-11A.pdf>.

The State Environmental Commission amended NEV. ADMIN. CODE §§459.2-459.8, relating to USTs. Changes relate to the designation and training of operators. *See* <http://www.leg.state.nv.us/register/2011Register/R052-11A.pdf>.

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## NEW HAMPSHIRE

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### AIR

The Department of Environmental Services readopted and amended Env-A 1401, 1402, and 1450, Regulated Toxic Air Pollutants. The rule took effect June 1, 2012. *See* <http://www.gencourt.state.nh.us/rules/register/2012/june-7-12.pdf> (p. 6).

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## NEW MEXICO

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### CLIMATE

The Environmental Improvement Board repealed N.M. ADMIN. CODE

§20.2.100, Greenhouse Gas Reduction Program. The repeal took effect June 7, 2012. *See* <http://www.nmcprr.state.nm.us/nmregister/xxiii/xxiii10/20.2.100repeal.pdf>.

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## WASTE

The Environmental Improvement Board proposed to amend N.M. ADMIN. CODE §20.7.3, Liquid Waste Disposal Rules. Amendments represent a general overhaul and updating of the rules. Major changes include eliminating the practice of lot-splitting to avoid groundwater discharge permits, providing amnesty to older liquid waste systems that may not strictly comply with regulations, and providing more specific regulations on low-pressure pipe systems. There will be a public hearing August 6, 2012. *See* <http://www.nmcprr.state.nm.us/nmregister/xxiii/xxiii10/Environnotice.pdf>.

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## NEW YORK

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### WILDLIFE

The Department of Environmental Conservation proposed to repeal and replace N.Y. COMP. CODES R. & REGS. tit. 6, §193.3, Protected Native Plants List. The new section would update the lists of endangered, threatened, rare, or exploitably vulnerable plants to reflect changes in plant populations since the lists were last updated in 2000. *See* <http://www.dos.ny.gov/info/register/2012/may23/pdfs/rules.pdf> (pp. 4-6).

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## NORTH CAROLINA

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### WATER

The Department of Environmental Management amended 15A N.C. ADMIN. CODE 02C, relating to injection wells, aquifer storage, and geothermal wells. Changes are necessary to comply with federal regulations. The amendments took effect May 1, 2012. *See* <http://www.ncoah.com/rules/register/>

Volume26Issue23June12012.pdf (pp. 1906-36).

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## OHIO

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### AIR

EPA adopted changes to OHIO ADMIN. CODE §3745.25, Ohio's Ambient Air Quality Standards. Changes ensure that the state's regulations are as stringent as federal rules. The adoption took effect June 14, 2012. *See* <http://www.wapp.epa.ohio.gov/legal/pub-nots/120608.pdf>.

EPA amended OHIO ADMIN. CODE §§3745.19.01 & 3745.19.06, Open Burning Regulations. Changes do not significantly alter the rule but do add the burning of confiscated marijuana to the list of permitted open-burning activities. The amendments took effect May 27, 2012. *See* <http://www.wapp.epa.ohio.gov/legal/pubnots/120518.pdf>.

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## OKLAHOMA

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### AIR

The Department of Environmental Quality amended OKLA. ADMIN. CODE §§252.100.2, 252.100.25, and 252.100.35, Incorporation by Reference, Visible Emissions and Particulates, and Control of Emission of Sulfur Compounds. Changes update incorporations by reference to adopt the latest U.S. EPA regulations and move an existing continuous opacity-monitoring requirement. There will be a public hearing on August 21, 2012. *See* [http://www.oar.state.ok.us/register/Volume-29\\_Issue-19.htm#a18436](http://www.oar.state.ok.us/register/Volume-29_Issue-19.htm#a18436).

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## TOXIC SUBSTANCES

The Department of Environmental Quality amended OKLA. ADMIN. CODE §252.110.1, .5, and .15, Lead Based Paint Management. Changes add the federal lead-based paint renovation, repair, and painting requirements. The changes took effect July 1, 2012. *See*

[http://www.oar.state.ok.us/register/Volume-29\\_Issue-19.htm#a300802](http://www.oar.state.ok.us/register/Volume-29_Issue-19.htm#a300802).

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## WASTE

The Department of Environmental Quality amended OKLA. ADMIN. CODE §252.515, Management of Solid Waste, because of recent statutory changes to the Oklahoma Used Tire Recycling Act. Changes include updates to terminology, increased percentage requirements for tire dump cleanups, and a process for allocating funds for dump remediation. *See* [http://www.oar.state.ok.us/register/Volume-29\\_Issue-19.htm#a309513](http://www.oar.state.ok.us/register/Volume-29_Issue-19.htm#a309513).

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## WATER

The Department of Environmental Quality amended OKLA. ADMIN. CODE §252.4.7, Water Quality Division Tiers and Timelines. Changes add water reuse systems to the environmental permitting process. The rule changes took effect July 1, 2012. *See* [http://www.oar.state.ok.us/register/Volume-29\\_Issue-19.htm#a271918](http://www.oar.state.ok.us/register/Volume-29_Issue-19.htm#a271918).

The Department of Environmental Quality amended OKLA. ADMIN. CODE §252.626. Among other changes, the amendments remove the provision regarding large volume off-stream storage basins and modify the standards for residuals management. The amendments took effect July 1, 2012. *See* [http://www.oar.state.ok.us/register/Volume-29\\_Issue-19.htm#a348942](http://www.oar.state.ok.us/register/Volume-29_Issue-19.htm#a348942).

The Department of Environmental Quality adopted OKLA. ADMIN. CODE §252.627, Operation and Maintenance of Water Reuse Systems. The rule establishes standards for the operation and maintenance of systems that create reclaimed water for beneficial use. The new rule establishes four categories of water based on levels of treatment. The amendments took effect July 1, 2012. *See* [http://www.oar.state.ok.us/register/Volume-29\\_Issue-19.htm#a366871](http://www.oar.state.ok.us/register/Volume-29_Issue-19.htm#a366871).

The Department of Environmental Quality proposed to amend OKLA. ADMIN. CODE §252.641, Individual and Small Public On-Site Sewage Treatment Systems. Changes relate

to water body protection for on-site sewage treatment systems. The rule changes took effect July 1, 2012. *See* [http://www.oar.state.ok.us/register/Volume-29\\_Issue-19.htm#a385826](http://www.oar.state.ok.us/register/Volume-29_Issue-19.htm#a385826).

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## OREGON

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### ENERGY

The Department of Energy repealed OR. ADMIN. R. 330.150, the duplicate renewable Portfolio Standard. The rules in the standard are still in effect under OR. ADMIN. R. 330.160. Changes took effect May 1, 2012. *See* [http://arcweb.sos.state.or.us/doc/rules/bulletin/June\\_2012\\_Bulletin.pdf](http://arcweb.sos.state.or.us/doc/rules/bulletin/June_2012_Bulletin.pdf) (p. 80).

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## TENNESSEE

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### LAND USE

The Environment and Conservation Agency proposed to amend TENN. ADMIN. CODE §0400.01.24 to repeal and reintroduce the Abandoned Mine Lands Reclamation Program. There will be a public hearing August 21, 2012. *See* [http://state.tn.us/sos/rules\\_filings/06-04-12.pdf](http://state.tn.us/sos/rules_filings/06-04-12.pdf).

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### WASTE

The Environment and Conservation Agency proposed to add TENN. ADMIN. CODE §0400.40.15, Biosolids Management, to promulgate rules for land application of biosolids. The rules are substantially similar to federal regulations, which the state has no authority to enforce. The deadline for comment is September 7, 2012. *See* [http://state.tn.us/sos/rules\\_filings/05-13-12.pdf](http://state.tn.us/sos/rules_filings/05-13-12.pdf).

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## TEXAS

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### GOVERNANCE

The Commission on Environmental Quality added 30 TEX. ADMIN. CODE

§80.110, pertaining to contested case hearings. The rule determines factors the public interest counsel must consider before deciding on a commission proceeding and before prioritizing workload. The rule took effect June 7, 2012. *See* <http://www.sos.state.tx.us/texreg/pdf/backview/0601/0601is.pdf> (pp. 1055-57).

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### WASTE

The Commission on Environmental Quality amended 30 TEX. ADMIN. CODE §§336.702, 336.745, and 336.747, Licensing Requirements for Near-Surface Land Disposal of Low-Level Radioactive Waste. Changes implement provisions of a Senate bill that addresses incidental commingling of low-level radioactive waste. The rule took effect June 7, 2012. *See* <http://www.sos.state.tx.us/texreg/pdf/backview/0601/0601is.pdf> (pp. 1057-68).

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## VIRGINIA

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### ENERGY

The Department of Environmental Quality amended 9 VA. ADMIN. CODE §15.60, Small Renewable Energy Projects (Solar) Permit by Rule. Changes implement state laws relating to natural resource and wildlife protection in the construction of small energy projects. The rule took effect July 18, 2012. *See* <http://legis.state.va.us/codecomm/register/vol28/iss21/v28i21.pdf> (pp. 1640-49).

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## WASHINGTON

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### WASTE

The Department of Ecology proposed to amend WASH. ADMIN. CODE §173.351, pertaining to criteria for municipal solid waste landfills. Among other changes, the amendments would adopt federal regulations, allow the department to issue research, development, and demonstration permits,

and allow greater flexibility for alternate liner designs. The intended date of adoption is October 3, 2012. *See* <http://apps.leg.wa.gov/documents/laws/wsr/2012/11/12-11-097.htm>.

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## WISCONSIN

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### WASTE

The Department of Natural Resources amended Wis. ADMIN. CODE NR

§§500, 502, and 518, pertaining to composting of solid waste. Changes require most compost operators to maintain records of temperature and turning to ensure pathogen reduction. Amendments took effect June 1, 2012. *See* <http://docs.legis.wisconsin.gov/code/register/2012/677b/register.pdf> (p. 17).



# RECENT JOURNAL LITERATURE

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"Recent Journal Literature" lists recently published law review and other legal periodical articles. Within subject-matter categories, entries are listed alphabetically by author or title. Articles are listed first, followed by comments, notes, symposia, surveys, and bibliographies.

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# TOPICAL INDEX

## AIR

- BCCA Appeal Group v. United States Environmental Protection Agency, 42 ELR 20131 (5th Cir. June 15, 2012) . . . . . 10766
- Mack Trucks, Inc. v. Environmental Protection Agency, 42 ELR 20133 (D.C. Cir. June 12, 2012) . . . 10766
- Sierra Club v. Korleski, 42 ELR 20113 (6th Cir. May 25, 2012). . . . . 10766

## CLIMATE CHANGE

- Alec L. v. Jackson, 42 ELR 20115 (D.D.C. May 31, 2012). . . . . 10766
- Article: Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization . . . . . 10713
- Article: Uncertainty . . . . . 10725
- Article: What Climate Change Can Do About Tort Law . . . . . 10739
- Association of Irrigated Residents v. California Air Resources Board, 42 ELR 20127 (Cal. App. 1st Dist. June 19, 2012) . . . . . 10767
- Comment: A Comment on *What Climate Change Can Do About Tort Law* . . . . . 10752
- Comment: A Response to *Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization*. . . . . 10722
- Comment: A Response to *What Climate Change Can Do About Tort Law* . . . . . 10749
- Comment: Climate Policy and Uncertainty:  $\alpha$ -Precautionary Principle Versus Real Options Analysis . . . . . 10733
- Comment: Comment on Doug Kysar's *What Climate Change Can Do About Tort Law*. . . . . 10745
- Comment: Comment on *Uncertainty* . . . . . 10737
- Comment: Prizes Versus Patents: A Comment on Jonathan Adler's *Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization*. . . . . 10719
- Thrun v. Cuomo, 42 ELR 20132 (N.Y. Sup. Ct. June 13, 2012). . . . . 10767

## ENERGY

- Article: Residential Renewable Energy: By Whom? . . 10755
- Gulf Restoration Network, Inc. v. Salazar, 42 ELR 20121 (5th Cir. May 30, 2012) . . . . . 10767
- Native Village of Point Hope v. Salazar, 42 ELR 20114 (May 25, 2012) . . . . . 10767

## LAND USE

- Kaahumanu v. Hawaii, 42 ELR 20118 (9th Cir. June 6, 2012). . . . . 10767
- Karuk Tribe of California v. United States Forest Service, 42 ELR 20116 (9th Cir. June 1, 2012) . . . 10767

- Match-E-Be-Nash-She-Wish Band of Pottawatomi Indians v. Patchak, 42 ELR 20126 (U.S. June 18, 2012). . . . . 10767
- State v. AT&T Mobility, LLC, 42 ELR 20125 (Minn. Ct. App. June 18, 2012) . . . . . 10767
- United States v. 32.42 Acres of Land, 42 ELR 20130 (9th Cir. June 14, 2012) . . . . . 10767

## NATURAL RESOURCES

- Pacific Rivers Council v. United States Forest Service, No. 08-17565, 42 ELR 20128 (9th Cir. June 20, 2012). . . . . 10767
- Sheep Mountain Alliance v. Colorado Department of Public Health & Environment, 42 ELR 20136 (Colo. Dist. Ct. June 13, 2012) . . . . . 10767

## TOXIC SUBSTANCES

- Natural Resources Defense Council v. United States Food & Drug Administration, 42 ELR 20117 (S.D.N.Y. June 1, 2012) . . . . . 10767

## WASTE

- American Petroleum Institute v. Environmental Protection Agency, 42 ELR 20123 (D.C. Cir. June 8, 2012). . . . . 10767
- Center for Community Action & Environmental Justice v. Union Pacific Corp., 42 ELR 20122 (C.D. Cal. May 29, 2012) . . . . . 10767
- National Ass'n of Regulatory Utility Commissioners v. United States Department of Energy, 42 ELR 20120 (D.C. Cir. June 1, 2012). . . . . 10767
- New York v. Nuclear Regulatory Commission, 42 ELR 20124 (D.C. Cir. June 8, 2012) . . . . . 10767
- Pennsylvania v. Lockheed Martin Corp., 42 ELR 20119 (3d Cir. June 5, 2012). . . . . 10768
- Southern Union Co. v. United States, 42 ELR 20134 (U.S. June 21, 2012) . . . . . 10768
- Vermont Yankee Nuclear Power Corp. v. Entergy Nuclear Vermont Yankee, LLC, 42 ELR 20135 (Fed. Cir. June 13, 2012). . . . . 10768
- Yankee Atomic Electric Co. v. United States, 42 ELR 20111 (Fed. Cir. May 18, 2012). . . . . 10768

## WATER

- Department of Environmental Quality v. Worth Township, 42 ELR 20112 (Mich. May 17, 2012) . . 10768
- Friends of Back Bay v. United States Army Corps of Engineers, 42 ELR 20129 (4th Cir. June 18, 2012). . . . . 10768
- United States v. Renton, 42 ELR 20110 (W.D. Wash. May 25, 2012) . . . . . 10768

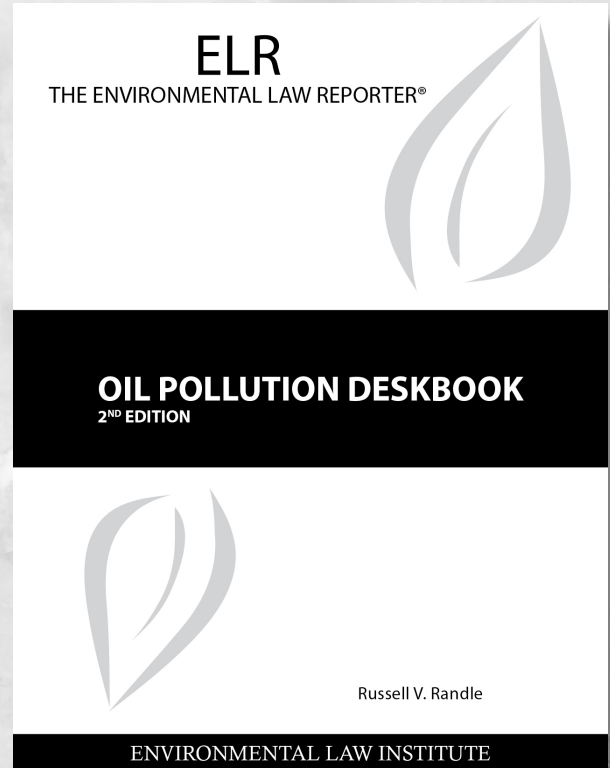
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## About the Author

**R**ussell V. Randle has practiced, published, and taught about most aspects of environmental law since 1981, during which time he has served as chair of Patton Boggs LLP's environmental group, Year-in-Review Vice-Chair of the American Bar Association's (ABA's) Superfund Committee (part of the ABA's Section on Environment, Energy, and Resources), and author of numerous articles on environmental issues, including several about the 2010 *Deepwater Horizon* disaster. Russ graduated from Princeton University, magna cum laude, in 1977; from Yale Law School in 1980, where he was an editor on the Yale Law Journal; and clerked for U.S. District Judge John H. Pratt (1980-81).



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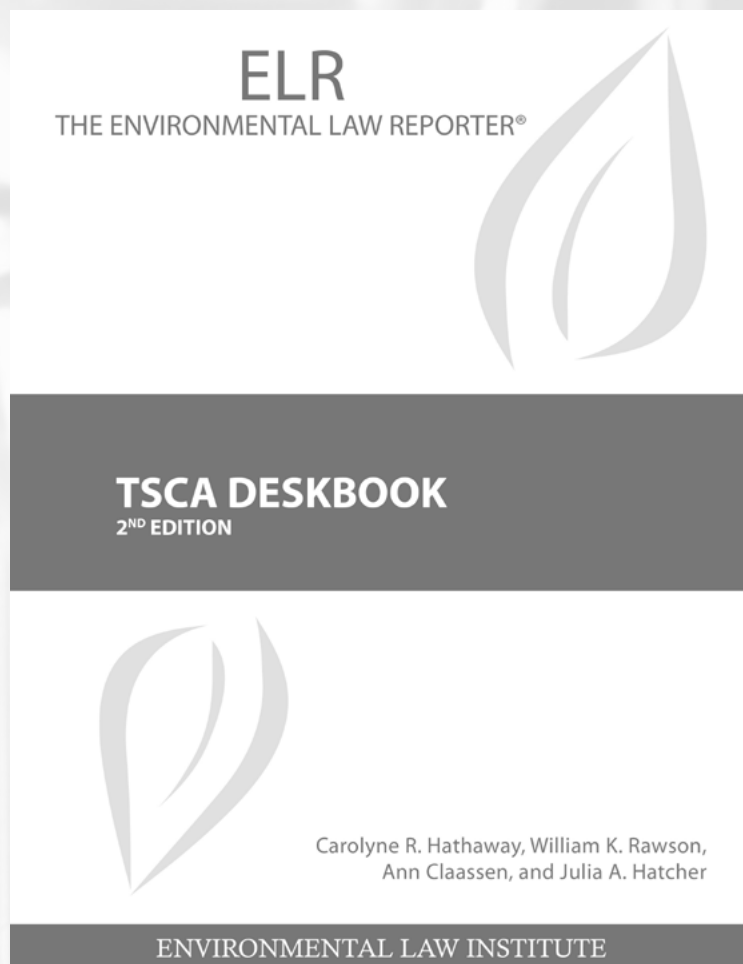
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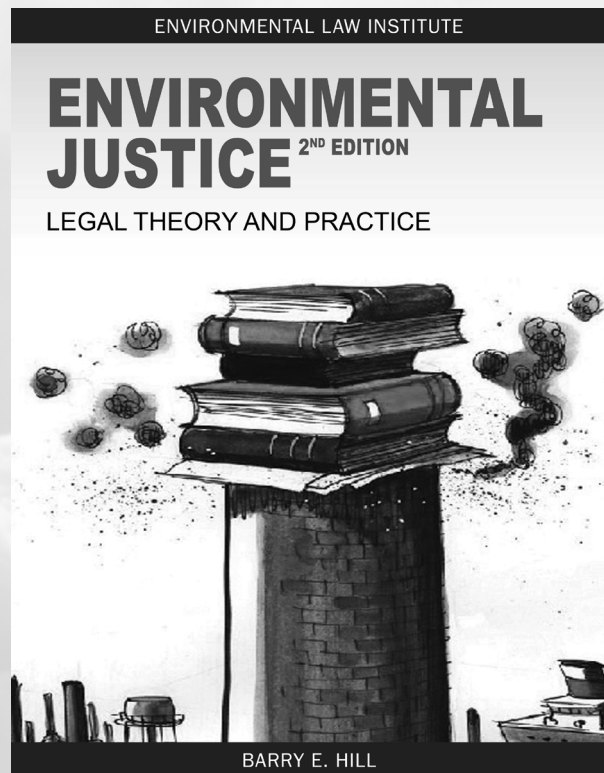
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John C. Dernbach, Principal Author

We already know more or less what we need to do to make the United States more sustainable; we are much less clear about how to actually do it. In *Acting as if Tomorrow Matters*, the third in a trilogy of books on U.S. sustainability by Widener University law professor John C. Dernbach, more than four dozen experts in a variety of fields provide a how-to guide for making the United States more environmentally sustainable.

They survey what has happened in the United States on sustainability over the past two decades and then describe the patterns or drivers for that progress across a variety of sectors. They also describe the main types of obstacles that have impeded sustainability in the United States and provide a detailed prescription to accelerate progress and overcome those obstacles.

*Acting as if Tomorrow Matters* explains how to make a greater variety of more-sustainable decisions even more attractive, how law can provide an even better enabling environment for sustainability, and how public opinion and leadership can be more effectively engaged to support sustainability.

### Principal Author



**J**ohn C. Dernbach is Distinguished Professor of Law at Widener University and Co-Director of Widener's Environmental Law Center.

He is the editor of two comprehensive assessments of U.S. sustainable development activities that include recommendations for future efforts:

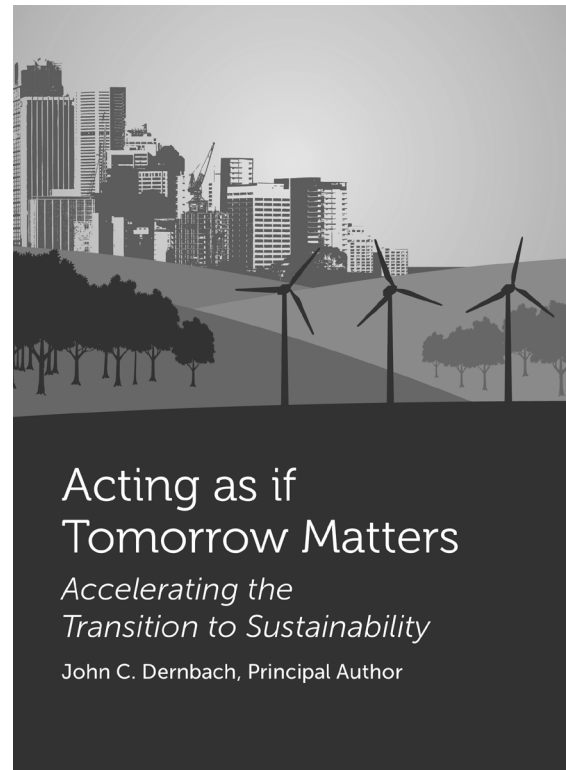
*Agenda for a Sustainable America* (ELI Press, 2009) and *Stumbling Toward Sustainability* (ELI Press, 2002).

*"Acting as if Tomorrow Matters offers a sweeping review of America's sustainability journey, tracking progress—and slippage—across a wide range of critical issues over the past 20 years. Even more powerfully, it charts a course toward a truly sustainable future, highlighting the advances in law, governance, incentives, education, and political mobilization that will be required."*

—Daniel C. Esty, *Hillhouse Professor of Environmental Law and Policy, Yale University; Commissioner, Connecticut Department of Energy and Environmental Protection*

*"John Dernbach has been the leading chronicler of the 20-year quest for sustainability in the United States since the 1992 Rio Earth Summit. What Professor Dernbach has observed in the United States is reflective of what is going on around the world."*

—Jacob Scherr, *Director of Global Strategy and Advocacy, Natural Resources Defense Council*



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