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# THE PSYCHOLOGY OF GLOBAL CLIMATE CHANGE

Jeffrey J. Rachlinski\*

*In its attempt to address the threat of global climate change, society has struggled to reach a consensus regarding the need for preventive measures. Professor Rachlinski describes the threat of global climate change as a unique commons dilemma and explains that various psychological phenomena of judgment render it unlikely that society will be able to respond effectively to the threat. After considering the effects of biased assimilation, loss aversion, and other psychological processes, the author explains that an innovative approach is necessary to properly address the dilemma of global climate change.*

*Specifically, the author examines the prospect of governmental intervention through taxes or regulations as well as the development of collective norms against combustion of fossil fuels. Because the above-mentioned psychological phenomena hinder each of these potential remedies, the author ultimately concludes that the only remedy for the problem of global climate change is an elimination of the commons dilemma itself. The author suggests that by developing alternatives to fossil fuels, the problem of global climate change can be addressed in spite of social and cognitive limitations.*

## I. INTRODUCTION

More than fifty years ago, Judge Learned Hand asserted that a reasonable person takes any precaution that is less burdensome than the probability that some harm will occur multiplied by the magnitude of the harm.<sup>1</sup> Presumably, a reasonable society does the same. That society should be willing to undertake precautions to avoid catastrophic events, even if they are unlikely to occur. Over the past few decades, however, social and cognitive psychologists studying human judgment and choice have learned that reasonable people sometimes fail to make reasonable

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1. *United States v. Carroll Towing Co.*, 159 F.2d 169, 173 (2d Cir. 1947).

choices.<sup>2</sup> Cognitive limitations on human judgment and choice can lead people to make decisions that produce unwanted outcomes. Psychologists worry that these limitations can similarly lead entire societies into a massive social trap.<sup>3</sup> It is the thesis of this article that the threat of global climate change creates such a social trap, a morass that, because of its psychological characteristics, society is unlikely to resolve through conventional approaches.

One can scarcely find a contemporary problem that better fits the definition of a social trap than global climate change. The worst-case scenarios projected by the scientific community are biblical in proportion.<sup>4</sup> If the planet's climate shifts as abruptly in the next century as some scientists believe, the first few decades of the new millennium will witness massive shifts in rainfall patterns, a rising sea level that threatens to inundate coastal communities, and a dramatic increase in the frequency and severity of storms.<sup>5</sup> These horrors could make many heavily populated regions virtually uninhabitable and turn valuable farmland into deserts. Coping with adverse climate change has the potential to drain the resources of wealthy nations and dash the prospects for economic improvements in poor ones.

Although the potential for a shift in the global climate has multiple causes, the principal one is the combustion of fossil fuels.<sup>6</sup> Fossil fuels have been the lifeblood of the industrial revolution that has brought prosperity to many nations and the promise of prosperity to the rest of the world. Ironically, because of the potential impact of fossil fuel consumption on the global climate, fossil fuels might also become the principal cause of poverty in the next century.

The fear that industrial processes are a potential cause of disaster is not new. One of the fundamental precepts of the contemporary environmental movement is that industrial processes create unwanted adverse consequences that society must control. Although pollution continues to be a serious problem, many industrialized nations have implemented significant pollution-control restrictions on industrial processes. Pollution is a social problem, but it is not an insurmountable social trap.

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2. See generally JUDGMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES (Daniel Kahneman et al. eds., 1982); Matthew Rabin, *Psychology and Economics*, 36 J. ECON. LITERATURE 11 (1998).

3. See Lee Ross & Andrew Ward, *Psychological Barriers to Dispute Resolution*, 27 ADVANCES IN EXPERIMENTAL SOC. PSYCHOL. 255, 255-56 (1995).

4. See generally DAVID HUNTER ET AL., INTERNATIONAL ENVIRONMENTAL LAW AND POLICY 609-25 (1998) (summarizing the problems posed by global climate change). For a more formal scientific report on global climate change, see generally INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 1995: THE SCIENCE OF CLIMATE CHANGE (J. T. Houghton et al. eds., 1996) [hereinafter IPCC REPORT].

5. See HUNTER ET AL., *supra* note 4.

6. See *id.* at 612-15.

Global climate change, however, differs fundamentally from other environmental problems. Whereas most pollution consists of industry's unintended waste products, the carbon dioxide that is the primary cause of global warming is the unavoidable consequence of reducing complex hydrocarbons into simpler ones; production of carbon dioxide is the definition of combustion. Many types of pollution have been reduced simply by implementing more efficient combustion techniques.<sup>7</sup> Industry can only significantly reduce the emission of carbon dioxide, however, by decreasing combustion itself. Unlike other pollutants, the production of carbon dioxide through combustion has been the foundation of the industrial revolution. Pollutants other than carbon dioxide are generally lowest in both extremely poor and extremely wealthy countries, because the poorest nations lack industry, and the wealthiest insist that their industries adopt pollution-control measures.<sup>8</sup> Carbon dioxide emissions, by contrast, rise continuously with a nation's wealth.<sup>9</sup>

The relatively low cost and widespread availability of fossil fuels further compounds the problem. The marginal cost of oil production varies depending upon its origin, but the average cost is much lower than the current market price, particularly for oil from the Middle East.<sup>10</sup> As a consequence, any reduction in combustion of petroleum by one sector of industry (or by one geographic region) would be offset by a drop in price for oil and a concomitant increase in consumption by another sector. Furthermore, even though oil eventually will become scarce, raising its price and reducing consumption, other easily available fossil fuels can take its place. For example, even with its considerable appetite for coal, the United States already has an adequate domestic supply of this fossil fuel for the next two hundred years, even without further exploration.<sup>11</sup> Consequently, no single country or group of countries can have a significant impact on the worldwide rate of fossil fuel consumption. Either every country reduces fossil fuel consumption, or the net rate of consumption remains relatively constant.

Even this dismal characterization of the problem of global climate change, however, does not, without more, present an insurmountable ob-

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7. See Indur M. Goklany, *Empirical Evidence Regarding the Role of Federalization in Improving U.S. Air Quality*, in *THE COMMON LAW AND THE ENVIRONMENT: RETHINKING THE STATUTORY BASIS FOR MODERN ENVIRONMENTAL LAW* (Roger Meiners & Andrew Morriss eds., forthcoming 2000).

8. See Robert E. B. Lucas et al., *Economic Development, Environmental Regulation and the International Migration of Toxic Industrial Pollution: 1960–1988*, in *INTERNATIONAL TRADE AND THE ENVIRONMENT* 67 (1992); Edith Brown Weiss, *Environment and Trade as Partners in Sustainable Development: A Commentary*, 86 *AM. J. INT'L L.* 728, 730 (1992).

9. See World Resources Inst. et al., *The Urban Environment*, *WORLD RESOURCES* 1996–97, at 316 (1996).

10. See Colin J. Campbell & Jean H. Laherrère, *The End of Cheap Oil*, 278 *SCI. AM.*, Mar. 1998, at 78, 78.

11. See U.S. Geological Survey, Energy Resource Surveys Program, *Assessing the Coal Resources of the United States*, USGS Fact Sheet FS-157-96 (July 1996) (visited Feb. 15, 2000) <<http://energy.usgs.gov/factsheets/nca/nca.html>>.

stacle to resolution. Each consumer of fossil fuels imposes a cost on society, making the threat of global climate change an elaborate commons dilemma. It might be difficult to persuade consumers to account for this cost, but it is possible. Like all problems associated with common externalities, two basic solutions to global climate change are available: binding agreements to curb the externality and collective norms against imposing those costs.

Given the enormous stakes, each consumer would be better off entering into an enforceable agreement to reduce fossil fuel consumption.<sup>12</sup> Yet tremendous obstacles to such an agreement exist, just as they do for any commons dilemma. Because every consumer has an incentive to cheat, every consumer and every potential consumer must be included in an agreement and monitored closely. Because an agreement to curb fossil fuel consumption would necessarily intrude upon domestic industrial processes and require extensive monitoring for cheating, such an agreement would likely be the most complicated and intrusive global agreement ever negotiated. Nevertheless, the magnitude of the implications of global climate change warrants such a treaty, despite its cost.

Public choice theory predicts that democratic institutions are unlikely to adopt legislation that provides diffuse benefits to many and imposes high costs on a few concentrated groups.<sup>13</sup> Nevertheless, Congress passed public-spirited environmental legislation in the early 1970s, despite its impact on concentrated interests.<sup>14</sup> The historic success of legislation supporting environmental protection suggests that the same might occur in the context of global warming. Such legislation, however, likely passed as a result of a groundswell of support for environmental protection in the 1970s. Unless society can muster a similar level of support for reducing the risk of global climate change, legislative efforts to restrict fossil fuel consumption are unlikely.

It is also possible that norms against fossil fuel consumption will develop, thereby avoiding the need for an international agreement. Although legal scholars have frequently overlooked the importance of social standards that prevent people from engaging in behavior that inflicts harm upon others, a great deal of social interaction depends upon voluntary compliance with standards of conduct.<sup>15</sup> Indeed, much of what is called international law depends upon voluntary compliance with customs and norms of behavior. Perhaps widespread recognition of the adverse consequences of global climate change will lead to the develop-

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12. See Jonathan Baert Wiener, *Global Environmental Regulation: Instrument Choice in Legal Context*, 108 YALE L.J. 677, 687-97 (1999).

13. See generally MANCUR OLSON, JR., *THE LOGIC OF COLLECTIVE ACTION: PUBLIC GOODS AND THE THEORY OF GROUPS* (1965) (laying the foundation for public choice theory).

14. See Daniel A. Farber, *Politics and Procedure in Environmental Law*, 8 J.L. ECON. & ORG. 59, 68 (1991).

15. See Robert C. Ellickson, *Law and Economics Discovers Social Norms*, 27 J. LEGAL STUD. 537, 537 (1998).

ment of an international consensus to reduce the consumption of fossil fuels. Just as many nations refrain from violating standards against aggressive use of military force or violation of human rights, even when doing so would be expeditious, the next century might witness the development of an international environmental ethic as a response to global climate change. Even if countries cannot achieve an international agreement to reduce fossil fuel consumption, norms against the consumption of fossil fuels might develop, with the same beneficial result.

Several psychological phenomena of judgment, however, support a more pessimistic prediction of humanity's ability to respond effectively to the threat of global climate change. First, because the scientific community lacks a consensus on the degree of climate change that the planet will experience, society is unlikely to achieve a consensus on the need to undertake costly preventive measures. In other cases of scientific uncertainty, people often adopt extreme positions and adhere to them closely, thereby impeding societal consensus.<sup>16</sup> Second, even if a consensus emerges that the problem requires costly solutions, other psychological phenomena suggest that people will still be unwilling to undertake such solutions. People become attached to their current level of prosperity; they feel entitled to what they have, which makes any solution that requires significant cutbacks in the economic status quo unacceptable.<sup>17</sup> These psychological problems make an international treaty extremely unlikely. They also make the development of social norms against consumption of fossil fuels an unlikely mechanism for addressing global climate change. Although a few psychological phenomena suggest that people will respond effectively to the risk of global climate change, the problem is one that society is unlikely to remedy.<sup>18</sup> The conventional approaches to solving the tragedy of the commons thus will not facilitate an escape from the social trap of global climate change. An innovative approach to this unique commons dilemma is, therefore, required.

## II. COGNITIVE LIMITATIONS AND THE PROBLEM OF GLOBAL CLIMATE CHANGE

Psychologists have long argued that human judgment and choice are the products of an array of cognitive heuristics and biases.<sup>19</sup> The human brain has only a limited ability to process the infinitely complicated array of stimuli that people face. As a consequence, people develop shortcuts and rules of thumb to make judgments that are generally quite accurate but can lead to error.

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

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

18. See discussion *infra* Part II.C.

19. See Amos Tversky & Daniel Kahneman, *Judgment Under Uncertainty: Heuristics and Biases*, 185 SCI. 1124 (1974).

As a consequence of this reliance on mental shortcuts, people make judgments that are inconsistent with rational choice. Even though Judge Hand's formula for evaluating precautions may be rational, rational people do not necessarily follow it. Theoretically, a *rational* member of society should support social changes that take precautions against the non-trivial probability of catastrophic consequences posed by global climate change. Cognitive processes associated with evaluating new scientific information and decisions involving losses suggest, however, that people will fail to support costly precautions against the prospects of global climate change. Furthermore, the cognitive processes associated with negotiation over the allocation of losses will impair the international community's ability to adopt a treaty to deal with the risks posed by global climate change.

### A. *Biased Assimilation*

Uncertainty over the consequences of fossil fuel combustion for the global climate creates a psychological impediment to undertaking precautions to reduce the risk of global climate change. By itself, uncertainty should not suffice as a justification for failing to undertake precautions. Although reasonable people take precautions to avoid the risk of catastrophic losses, they are not adept at calibrating their precautions to accommodate uncertainty. People see environmental hazards as either mammoth threats that society should eradicate at any cost or as trivial hype they should ignore.<sup>20</sup> Measured response to the prospect of catastrophe is not a particularly strong human trait.

Although many factors produce this all-or-nothing reaction to environmental threats, one of the most significant is the human tendency toward consistency in beliefs.<sup>21</sup> People process new information in ways that are consistent with their existing beliefs about the world, making belief structures relatively stable and resistant to change.<sup>22</sup> This tendency is arguably rational, yet it leads to some counterintuitive consequences, such as the phenomenon social psychologists refer to as biased assimilation.

Biased assimilation is the tendency to embrace evidence that supports one's beliefs and reject evidence that is inconsistent with one's beliefs.<sup>23</sup> One consequence of biased assimilation is that mixed evidence on

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20. See HOWARD MARGOLIS, *DEALING WITH RISK: WHY THE PUBLIC AND THE EXPERTS DISAGREE ABOUT ENVIRONMENTAL ISSUES* 72-79 (1996).

21. Psychologists refer to the process of producing internal consistency of beliefs as cognitive dissonance. See LEON FESTINGER, *A THEORY OF COGNITIVE DISSONANCE* 1-31 (1957) (describing consistency theory).

22. See Anthony G. Greenwald, *The Totalitarian Ego: Fabrication and Revision of Personal History*, 35 *AM. PSYCHOLOGIST* 603, 606-07 (1980).

23. See Charles G. Lord et al., *Biased Assimilation and Attitude Polarization: The Effects of Prior Theories on Subsequently Considered Evidence*, 37 *J. PERSONALITY & SOC. PSYCHOL.* 2098, 2099 (1979).

a topic about which people have strong beliefs will not only fail to moderate people's views but will tend to make these views more extreme.<sup>24</sup> For example, psychologists have demonstrated this phenomenon on people with strongly held opinions about the death penalty.<sup>25</sup> Proponents of the death penalty generally believe that the availability of the death penalty deters crime; opponents of the death penalty generally believe that the availability of the death penalty does not deter crime.<sup>26</sup> Researchers presented both proponents and opponents with two studies—one supporting the theory that the death penalty deters crime and one refuting the theory that it deters crime—along with criticisms of each study.<sup>27</sup> The evidence revealed that the effect of the death penalty was uncertain, which should have moderated the subjects' beliefs about the deterrent value of the death penalty. After reading all of the materials, however, the subjects adopted even more extreme positions. The proponents of the death penalty found support for their views in the study suggesting that the death penalty deters crime, did not find criticism of the study particularly persuasive, and found the study suggesting that the death penalty does not deter crime to be methodologically flawed and, therefore, unpersuasive. Conversely, opponents of the death penalty evaluated the material consistently with their beliefs and reached the opposite conclusions. Consequently, the beliefs of both the proponents and the opponents of the death penalty diverged more than they did at the study's outset.<sup>28</sup>

The scientific evidence on global climate change creates the conditions that will provide biased assimilation. Although there is a general consensus that human activity is affecting the global climate,<sup>29</sup> estimates of the degree of change and the impact that it will have vary tremendously. Whereas many scientists believe that the weight of evidence suggests that global climate change is becoming a serious problem, other scientists believe that the evidence suggests otherwise.<sup>30</sup> Predicting global climate change challenges scientists in a way sure to polarize the general public's views.

Even among scientists who agree that global climate change poses a serious problem, the variance in range of predictions is striking. For example, according to some of the best models that the Environmental Protection Agency (EPA) relies upon, global climate change in the next cen-

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24. *See id.* at 2099–104.

25. *See id.* at 2099–100.

26. *See id.*

27. *See id.* at 2100–01.

28. *See id.*; *see also* Jonathan J. Koehler, *The Influence of Prior Beliefs on Scientific Judgments of Evidence Quality*, 56 ORGANIZATIONAL BEHAV. & HUM. DECISION PROCESSES 28 (1994) (replicating the phenomenon of biased assimilation in the context of beliefs about extra-sensory perception).

29. *See* HUNTER ET AL., *supra* note 4, at 611–12.

30. *See* *Global Warming Information Page* (visited Sept. 16, 1999) <<http://www.globalwarming.org/science/index.htm>> (summarizing scientific debate and providing links to conflicting reports on global climate change).



tury will increase rainfall in central Illinois from somewhere between twenty-five percent and seventy percent in summer, fifteen percent and fifty percent in fall, and ten percent in winter and spring.<sup>31</sup> The EPA also expects average summertime temperatures in central Illinois to rise from one to four degrees Fahrenheit.<sup>32</sup> This will result in a decrease in corn production from between zero percent and thirty-two percent and will alter soybean production from between negative twenty-four percent and positive thirteen percent.<sup>33</sup> Also, the number and frequency of adverse weather events, such as extremely hot summer days and storms, *might* increase. The EPA's predictions for other regions of the United States, particularly the eastern and Gulf Coast states, are both more dire and more erratic.<sup>34</sup>

The great degree of uncertainty that haunts the debate on global climate change likely will support biased assimilation of the scientific literature. This literature includes conflicting studies suggesting that fossil fuel consumption will have both a major and minor effect on the climate.<sup>35</sup> Criticisms of both views are also widely available. Furthermore, the fossil fuel industry has incentives to generate research that muddies the scientific waters.<sup>36</sup> Research on biased assimilation suggests that skeptics of global climate change will lend little credence to studies suggesting that fossil fuel consumption is affecting the global climate. Those same skeptics will view studies supporting the opposite view as well done and persuasive. As skeptics read the scientific literature, they will become even more skeptical. Likewise, as advocates of undertaking precautions to prevent global climate change read more studies, they will become more convinced that fossil fuel consumption is affecting the global climate.

The first wave of environmental legislation in the 1970s resulted from a groundswell of public concern about environmental degradation.<sup>37</sup> The threat of global climate change is unlikely to produce similar concern. Unlike air and water pollution, global climate change is a somewhat intangible harm that can only be understood in the context of scientific theory. Biased assimilation predicts that many people will remain skeptical, and this skepticism will make it unlikely that Congress will regulate or tax carbon emissions. Rather than lead to a temperate response to po-

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31. See EPA, *Climate Change in Illinois* (visited Feb. 15, 2000) <<http://www.epa.gov/globalwarming/impacts/stateimp/illinois/index.html>>.

32. See *id.*

33. See *id.*

34. See EPA *Global Warming* (visited Feb. 15, 2000) <<http://www.epa.gov/globalwarming/impacts/stateimp/index.html>>.

35. See *A Heated Controversy*, *ECONOMIST*, Aug. 15, 1998, at 66.

36. See ROSS GELBSPAN, *THE HEAT IS ON: THE HIGH STAKES BATTLE OVER EARTH'S THREATENED CLIMATE* 19 (1997).

37. See Christopher H. Schroeder, *Rational Choice Versus Republican Moment— Explanations for Environmental Laws, 1969-73*, 9 *DUKE ENVTL. L. & POL'Y F.* 29 (1998).

tential catastrophe, the conflicting scientific evidence will likely stifle any response.

### B. *The Psychology of Choosing Among Losses*

Even if a scientific consensus emerges, society might still be unwilling to undertake expensive precautions to reduce the likelihood of a catastrophic change in the world's climate. Psychologists and behavioral economists have discovered that people are reluctant to undertake activities that change the status quo for the worse.<sup>38</sup> People treat a potential loss from the status quo as more significant than a potential gain from the status quo.<sup>39</sup> People also make riskier choices when faced with losses rather than gains.<sup>40</sup> Each of these psychological phenomena impedes society's ability to undertake precautions to reduce the risk of global climate change. These patterns also make negotiations to distribute costs among parties particularly difficult, thereby complicating efforts to negotiate an international treaty to reduce fossil fuel consumption.

#### 1. *Loss Aversion and the Status Quo Bias*

People become attached to the status quo.<sup>41</sup> They treat adverse changes from the status quo as more significant than beneficial changes—a reaction psychologists refer to as loss aversion.<sup>42</sup> This tendency makes people relatively unwilling to sacrifice benefits they already possess to obtain other benefits. For example, in one demonstration of loss aversion, subjects expressed a preference for the status quo when hypothetically offered either a job with a short commute and little social contact or a job with plenty of social contact and a long commute.<sup>43</sup> Subjects that were told that they currently held the short-commute job were generally unwilling to switch to the long-commute job, and subjects told that they currently held the long-commute job were generally unwilling to switch to the short-commute job.<sup>44</sup> In effect, subjects treated the advantage that they already possessed as more valuable than the advantage they did not possess, leading them to express an attachment to the status quo.

Psychologists have demonstrated that loss aversion similarly influences choices concerning environmental quality.<sup>45</sup> If the environmental

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38. See Amos Tversky & Daniel Kahneman, *Loss Aversion in Riskless Choice: A Reference-Dependent Model*, 107 Q.J. ECON. 1039, 1039 (1991).

39. See *id.*

40. See *id.*

41. See Daniel Kahneman et al., *The Endowment Effect, Loss Aversion, and the Status Quo Bias*, 5 J. ECON. PERSP. 193, 194–97 (1991).

42. See Tversky & Kahneman, *supra* note 38, at 1039.

43. See *id.* at 1045.

44. See *id.*

45. See Robin Gregory et al., *The Role of Past States in Determining Reference Points for Policy*

quality experienced is high, people prefer higher environmental quality more than if the quality is low. For example, subjects in an experiment on the value of environmental quality stated that it was much more important to restore lost environmental quality than to improve environmental quality from its present state.<sup>46</sup> Subjects in this study were more receptive to programs that restored environmental quality than ones that improved it.<sup>47</sup>

A similar preference for the status quo influences decisions to tolerate environmental risks. People are willing to tolerate risks that they already bear, even though they would not otherwise be willing to incur the same risks. For example, one study showed that consumers' willingness to pay for a household product that offered an improvement in safety is much lower than their willingness to tolerate a comparable reduction in safety offered by a lower-cost household product.<sup>48</sup> In one part of the study, subjects were willing to pay an average of \$1.04 to reduce the combined risks of inhalation and skin poisoning from a pair of household products (with a cost of \$10.00 and \$2.00) from fifteen in ten thousand to ten in ten thousand.<sup>49</sup> Other subjects that were told that these two products posed a combined risk of ten in ten thousand (at a cost of \$10.00 and \$2.00) refused to switch to a cheaper product that posed a combined risk of fifteen in ten thousand, even if the riskier products were offered *at no cost*.<sup>50</sup> The study demonstrates that people are unwilling to tolerate increases in risk but are reluctant to pay for reductions in risk.

A preference for the status quo similarly makes it difficult for society to undertake reforms to reduce the risk of global climate change. People will be averse to incurring the major economic losses that might be needed to reduce the problem. Loss aversion suggests that if society were not consuming fossil fuels today but could make itself wealthier by beginning to consume them at risk of causing global climate change, it would not do so. That is not the choice that society is making, however. It is choosing whether to incur a loss from the present status quo, rather than choosing to forego a future gain. Loss aversion might explain the willingness of many countries to freeze, or slightly reduce, their consumption of fossil fuels at 1990 levels while simultaneously refusing to commit to significant reductions in fossil fuel consumption.<sup>51</sup>

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*Decisions*, 55 ORGANIZATIONAL BEHAV. & HUM. DECISION PROCESSES 195, 200 (1993).

46. *See id.*

47. *See id.*

48. *See* W. Kip Viscusi & Wesley A. Magat, *An Investigation of the Rationality of Consumer Valuations of Multiple Health Risks*, 18 RAND J. ECON. 465, 475 (1987).

49. *See id.*

50. *See id.*

51. *See* HUNTER ET AL., *supra* note 4, at 660–61.

## 2. *Risky Choices in the Face of Loss*

People are more willing to gamble to avoid a loss than to obtain a benefit.<sup>52</sup> In one study, for example, subjects expressed a preference for risk in evaluating two public-health programs designed to reduce the number of deaths from an outbreak of an Asian flu.<sup>53</sup> The study presented subjects with two conditional situations (“gains” and “losses”). The subjects were told that without any precautions, nine hundred people were expected to die from the flu, but they could administer one of two vaccines to the population at risk. In the “gains” condition, subjects were told that if vaccine A were administered, it would certainly save six hundred people, and if vaccine B were administered, it had a two-thirds chance of saving all nine hundred and a one-third chance of saving no one. In the “losses” condition, subjects were told that if vaccine A were administered, three hundred people would still die, and if vaccine B were administered, there was a two-thirds chance that no one would die and a one-third chance that all nine hundred would die. Even though both conditions presented an identical pair of choices, a majority of subjects who read the gains condition expressed a risk-averse preference by endorsing vaccine A, whereas a majority of subjects who read the losses condition expressed a risk-seeking preference by endorsing vaccine B. Because the losses condition made it clear that the risk-averse choice would condemn some people, it was the riskier choice; the prospect that no deaths would occur was more attractive.

As a result of the uncertainties associated with global climate change, the choices that society faces are similar to those posed by the losses condition in the Asian flu problem. Society could accept sure losses by reducing the consumption of fossil fuels, which would result in a reduced risk of adverse climatological consequences. On the other hand, society could refuse to accept the losses required to reduce fossil fuel consumption and incur a greater risk of adverse climatological consequences. Because people are generally averse to incurring sure losses, advocates of fossil fuel reduction as a precaution against global climate change face an uphill struggle.

As with most choices, the problem of global climate change could be reframed as a decision involving gains, thus making the precautions seem more attractive. Informing society that it must endure a sixty percent reduction in fossil fuel consumption from present levels to eliminate the prospects of adverse changes in the global climate would make any lesser reduction in fossil fuel consumption seem like an improvement from the status quo. If a reduction as drastic as sixty percent were the reference point from which negotiations occurred, a lesser reduction

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52. See Daniel Kahneman & Amos Tversky, *Choices, Values, and Frames*, 39 AM. PSYCHOLOGIST 341, 342-44 (1984).

53. See *id.* at 343.

would seem much more palatable than if people viewed the current status quo as the reference point.

Nevertheless, the reference point for negotiations and discussion has been, and will likely continue to be, the current levels of fossil fuel consumption. Losses are the natural frame for discussion of global climate change. In effect, the threat of global climate change means that society is actually poorer than it appears. Society must either tolerate losses in wealth today or risk more significant losses in wealth tomorrow. Choices about preventive measures to reduce the risks posed by global climate change will, therefore, be made from the perspective of losses. Consequently, society will be willing to endure much riskier options than it should.

### 3. *Negotiations Involving Loss*

Both loss aversion and risk-seeking preferences in the face of losses make settlement of disputes that require allocating losses difficult. Because any remedy for global climate change requires an international agreement, the psychological effect of choosing among losses will impede negotiations to distribute the costs of reductions in fossil fuel consumption among each country.

Loss aversion can impede a negotiated resolution of any dispute, particularly when it is accompanied by a sense of entitlement. People express great resistance to parting with a possession if they obtained that possession through a demonstration of their skills, even if that demonstration was obviously meaningless.<sup>54</sup> This effect has been referred to as a kind of enhanced loss aversion.<sup>55</sup> Although in many contexts people are willing to sacrifice a great deal to be fair,<sup>56</sup> they also come to believe that a fair resolution of a dispute benefits them over others.<sup>57</sup> If two sides to a dispute feel entitled to more than half of the pie, then a negotiated resolution of their conflicting entitlements will be difficult. Paradoxically, the preference for a fair outcome can combine with a sense of entitlement to create a significant impediment to allocating losses.

The preference for risk-seeking choices in the face of losses can also impede a negotiated allocation of losses.<sup>58</sup> Usually, people enter into settlements as a means of avoiding a riskier outcome. Negotiated arrangements remove the risk of a confrontational resolution to a dispute in

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54. See George Loewenstein & Samuel Issacharoff, *Source Dependence in the Valuation of Objects*, 7 J. BEHAV. DECISION MAKING 157, 165 (1994).

55. See Daniel Kahneman, *Reference Points, Anchors, Norms, and Mixed Feelings*, 51 ORGANIZATIONAL BEHAV. & HUM. DECISION PROCESSES 296, 304 (1992).

56. See Daniel Kahneman et al., *Fairness as a Constraint on Profit Seeking: Entitlements in the Market*, 76 AM. ECON. REV. 728, 740 (1986).

57. See George Loewenstein et al., *Self-Serving Assessments of Fairness and Pretrial Bargaining*, 22 J. LEGAL STUD. 135, 139 (1993).

58. See Jeffrey J. Rachlinski, *Gains, Losses, and the Psychology of Litigation*, 70 S. CAL. L. REV. 113, 173-76 (1996).

which a winner takes all. Because people tend to take risks to avoid losses, a risk-free settlement of a dispute is much less attractive when the negotiation involves allocating losses.<sup>59</sup> People are much more willing to engage in confrontations in an attempt to avoid losses than to obtain gains.

To lower the risks of global climate change in the next century, the world's nations must reduce the collective rate of combustion of fossil fuels. An international treaty, therefore, must allocate some economic losses among every country. To make matters worse, the negotiations will require overcoming the enhanced loss aversion that comes with entitlement. Countries feel entitled to their current levels of fossil fuel consumption, and some developing countries feel entitled to expand their rates of consumption of fossil fuels. This will make it difficult for countries to tolerate loss, and many countries might downplay the impact of carbon emissions rather than incur the certain loss of economic activity.

### C. *Psychological Processes Supporting a Concern for Global Warming*

At least one psychological process suggests that people will become concerned about global warming: the availability heuristic. When estimating the likelihood or frequency of an event, people rely on the ease with which an example of that event can be imagined or called to mind.<sup>60</sup> The availability heuristic often provides a good cognitive shortcut to estimating frequency or probability when the actual statistics are not available. It can, however, lead to mistakes in judgment. Events that are particularly salient or receive a great amount of publicity are disproportionately easy to imagine. As a result, people generally overestimate the frequency of these events.<sup>61</sup>

People's reliance on the availability heuristic frequently produces mistaken assessments of the risks of environmental hazards.<sup>62</sup> Over the past three decades, environmental hazards have received a tremendous degree of publicity. For example, people easily remember the events at Love Canal<sup>63</sup> and, as a result, estimate the rate at which residents are exposed to hazardous chemicals in their homes as higher than it actually is.<sup>64</sup> Consequently, the demand for regulations to remedy the problem of

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59. See Margaret A. Neale et al., *The Framing of Negotiations: Contextual Versus Task Frames*, 39 ORGANIZATIONAL BEHAV. & HUM. DECISION PROCESSES 228, 229 (1987).

60. See Amos Tversky & Daniel Kahneman, *Availability: A Heuristic for Judging Frequency and Probability*, 5 COGNITIVE PSYCHOL. 207, 208 (1973).

61. See Paul Slovic et al., *Facts Versus Fears: Understanding Perceived Risk*, in JUDGMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES 463, 466–70 (Daniel Kahneman et al. eds., 1982).

62. See Timur Kuran & Cass R. Sunstein, *Availability Cascades and Risk Regulation*, 51 STAN. L. REV. 683, 692–703 (1999).

63. The Love Canal area in Niagara Falls, New York, was evacuated by governmental decree after residents noticed chemicals seeping into their homes. See generally Richard L. Stroup, *Superfund: The Shortcut that Failed*, in BREAKING THE ENVIRONMENTAL POLICY GRIDLOCK 115–16 (Terry L. Anderson ed., 1997).

64. See Kuran & Sunstein, *supra* note 62, at 691–98.

hazardous waste disposal facilities may be much greater than the actual problem. People and organizations that benefit from the development of law designed to remedy environmental problems might take advantage of the availability heuristic to raise public fear of environmental problems. These interests might create an “availability cascade,” wherein publicity over an environmental threat leads to a groundswell of support for ameliorative regulation.<sup>65</sup>

The threat of global climate change provides more than adequate opportunity to create an availability cascade. The climate itself is difficult for laypersons to track, but the alleged symptoms of global climate change are easy to imagine. With or without a dramatic change in climate, bad weather constantly finds its way into the news. Droughts, tornadoes, hurricanes, floods, and heat waves consistently receive coverage on the nightly news, whether or not they are the products of global climate change. This attention makes it easier to recall instances of weather-related tragedies, making the prospect of a disastrous change in the climate seem likely.

The concept of global climate change also provides an acceptable explanation for the disasters that weather perpetrates. People prefer to see the world as a stable, well-ordered place where disasters have explanations<sup>66</sup> and believe that bad events do not occur at random and are the results of some prior bad act.<sup>67</sup> Although weather cannot be controlled, global climate change provides an account of weather-related disasters consistent with people’s desire to see bad events as the products of bad behavior. The belief that human activity has produced weather-related disasters through global climate change restores some measure of human control over catastrophes. Stated alternatively, the belief that the use of fossil fuels is changing the climate suggests that weather-related disasters constitute just retribution for human shortsightedness.

Furthermore, several groups have an interest in starting an availability cascade to support undertaking precautions against global warming. Interested parties include politicians who have embraced environmental protection (most notably Al Gore),<sup>68</sup> environmental organizations,<sup>69</sup> and those industries that produce energy-saving devices

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65. *See id.* at 687–90.

66. *See generally* Michael J. Lerner & Dale T. Miller, *Just World Research and the Attribution Process: Looking Back and Looking Ahead*, 85 *PSYCHOL. BULL.* 1030 (1978) (discussing the just world hypothesis).

67. *See id.* at 1030–31.

68. *See* AL GORE, *EARTH IN THE BALANCE: ECOLOGY AND THE HUMAN SPIRIT* 4–8 (1993) (discussing the source of his concerns about global climate change).

69. Several major environmental organizations have become interested in the problem of global climate change. *See, e.g.*, Natural Resources Defense Council, *Programs* (visited Feb. 15, 2000) <<http://www.nrdc.org/nrdcpro/fpprog.html>> (describing the National Resources Defense Council’s efforts to combat global climate change).

and sources of electricity other than fossil fuels.<sup>70</sup> Although many powerful industries would prefer to keep the public's fear of global climate change at a minimum, the nature of availability cascades favors a rise in concern about environmental disasters.<sup>71</sup> Parties that support undertaking preventive steps to reduce the risk of global climate change need only publicize adverse weather events and tie them to global climate change to alter public attitudes.<sup>72</sup>

#### *D. Conclusions on Psychological Processes and Global Climate Change*

Both the availability heuristic and the desire to believe that disasters are within human control suggest that public concern about global climate change can rise. The path will not be a smooth one, however, as scientists will surely continue to generate conflicting evidence on the dangers posed by global climate change, thereby making it difficult to form a consensus on the issue. Furthermore, even if a consensus emerges that global warming poses a serious threat, people will be reluctant to endure economic losses to reduce the risk of global climate change. In addition, the tendency to make risky choices in the face of loss suggests that people will prefer to gamble that global climate change will not occur. Even if most countries decide that global climate change is a threat that is worth undertaking significant losses to avert, the cognitive phenomena associated with loss will make an international agreement to reduce fossil fuel consumption difficult to negotiate. In short, although psychological processes suggest conflicting predictions, overall these processes indicate that society will not undertake precautions to reduce the threat posed by global climate change.

### III. THE PROSPECTS FOR PREVENTING GLOBAL CLIMATE CHANGE

Like most environmental problems, the dangers posed by global climate change are a form of a commons dilemma: As such, they can be reduced through governmental intervention, consisting either of taxes or regulations, or through the development of collective norms against the combustion of fossil fuels. Yet the psychological phenomena discussed earlier present significant obstacles to each of these remedies, thereby suggesting the need for a third approach.

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70. For example, the nuclear power industry could benefit from efforts to reduce reliance on fossil fuels as a source of energy.

71. See Peter Jennings *Reporting the Apocalypse and Al Gore* (ABC television broadcast, Apr. 11, 1998) [hereinafter *Peter Jennings*].

72. In fact, the advocates of taking precautions against global climate change have enlisted the assistance of television weather forecasters in an effort to increase public awareness about global climate change. See Peter Jennings, *supra* note 71 (describing Vice President Gore's efforts to use weather forecasters to spur the public's concern over global climate change).



### A. *Governmental Intervention*

Governmental intervention to remedy a commons dilemma is not new. Historically, governmental remedies for a commons problem have included taxation and regulation.<sup>73</sup> A taxation approach to remedying global climate change would consist of imposing some tax on fossil fuel consumption that compensates for the risk of global climate change accompanying fossil fuel consumption. In the context of environmental harm, governments typically adopt regulations that limit the costs a polluter can impose. In the context of global climate change, this approach would consist of any set of regulations designed to directly reduce the rate of fossil fuel consumption. For example, this might include banning the sale of vehicles that have less than a certain gas mileage or forbidding the use of fossil fuels for certain activities.

The international agreements to reduce climate change currently under discussion do not directly discuss which method of reducing fossil fuel consumption countries must undertake. Rather, they set targeted reductions for each country, leaving the individual countries to choose among the methods for themselves.<sup>74</sup> Scholars studying the problem of global climate change agree that the most likely approach for many countries would be some sort of mechanism to tax combustion of fossil fuels.<sup>75</sup> Direct regulation would be akin to rationing, which would lead to tremendous fighting and political gridlock over which industries would have to cut back on fossil fuel. Although a carbon tax would hurt certain industries more than others, it would raise fewer public choice obstacles than direct regulation. Scholars are optimistic about the likelihood of such an agreement, arguing that the tremendous dangers posed by global climate change will inspire countries to undertake drastic precautions.<sup>76</sup>

Assuming that it is rational for countries to enter into and implement an agreement to reduce their consumption of fossil fuels, it is unclear why countries are unwilling to take the steps needed to avoid global climate change. The pace of the negotiations is slow, and no country contemplates undertaking anywhere near the level of reduction in combustion that scientists believe is necessary to avert global climate change.<sup>77</sup> If they followed Judge Hand's advice on reasonable precautions, the nations of the world would be willing to undertake much more significant precautions than they currently are considering.

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73. See Wiener, *supra* note 12, at 705.

74. See HUNTER ET AL., *supra* note 4, at 660–63.

75. See Wiener, *supra* note 12, at 727–35.

76. See HUNTER ET AL., *supra* note 4, at 611.

77. Compare the agreements contained in the KYOTO PROTOCOL TO THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, ANNEX B (Dec. 1997) (agreeing that no country commits to more than an eight percent reduction in emissions) to the sixty percent reductions called for in the IPCC REPORT, *supra* note 4, at 69–124.

The psychological phenomena described in this article seem to be preventing countries from taking reasonable precautions against the risk of global climate change. As predicted by the research on biased assimilation, there is a lack of consensus in many of the countries that should be leading the world in efforts to reduce rates of consumption of fossil fuels. In the United States, for example, there is a clear polarization of opinions regarding the dangers posed by fossil fuel consumption. In a 1997 survey, a statistically similar percentage of people asserted that they worried a great deal about global warming (twenty-four percent) as asserted that they were not at all worried about global warming (seventeen percent).<sup>78</sup> Also, experts on the subject often cite the same set of research in reaching conflicting opinions about the need to take precautions against global climate change, just as the application of biased assimilation predicts.<sup>79</sup> Contrary to the predictions of the availability heuristic, concern about global climate change is *declining*.<sup>80</sup>

The psychological phenomena associated with losses also seem to be obstructing a comprehensive international agreement to undertake precautions against global climate change. Most people in the United States believe that other countries must also commit to doing their part before the United States should agree to anything,<sup>81</sup> but key developing countries, including China and India, are still not included in the Kyoto protocols for reduction in fossil fuel emissions.<sup>82</sup> This contrast reveals the complexities associated with competing senses of entitlement. Americans believe that they are entitled to the same proportion of fossil fuel emissions that they currently possess, while Chinese and Indians feel entitled to a greater share. Furthermore, international negotiations have embraced current levels of consumption as the status quo, leading to proposals that would inadequately reduce consumption.<sup>83</sup> In short, cognitive biases against international agreements and against domestic willingness to undertake serious precautions to prevent global climate change reveal

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78. See The Pew Research Center for People and the Press, *Americans Support Action on Global Warming* (visited Feb. 15, 2000) <<http://www.people-press.org/nov97que.htm>> [hereinafter *Global Warming Survey*].

79. Skeptics often cite some of the same observations used to support global climate change. See, e.g., *Glaciers Don't Show Global Warming* (visited Nov. 29, 1999) <<http://www.globalwarming.org/sciup/sci4-8-99.html>> (describing how evidence of retreating glaciers is evidence not of global climate change resulting from fossil fuel emissions but of naturally occurring processes).

80. See *Global Warming Survey*, *supra* note 78 (reporting that 63% of respondents in 1989 asserted that they worried about global warming a fair amount or a great deal, as compared to 54% in 1997).

81. See HUNTER ET AL., *supra* note 4, at 672-73; see also *Global Warming Survey*, *supra* note 78 (reporting that 70% of respondents agreed that all countries should make the same reductions in fossil fuel emissions, regardless of their wealth).

82. See KYOTO PROTOCOL TO THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (Dec. 1997).

83. See Henry Shue, *Subsistence Emissions and Luxury Emissions*, 15 LAW & POL'Y 39, 41 (1993).

the influence of loss aversion, the status quo bias, and risk-seeking preferences in the face of losses.

It will be no surprise if the governments of the world are ultimately unable to settle upon a means of undertaking the kind of serious preventive measures warranted by the threat of global climate change. They might be able to take some limited steps within the boundaries set by cognitive limitations, such as freezing combustion at current rates or agreeing to slight reductions. Unless worldwide availability cascades swamp the inherent biases toward the status quo, however, the international community will not agree to undertake the significant reductions the scientific community has suggested. To be sure, agreements that freeze current levels of fossil fuel consumption will prevent combustion levels from increasing and thereby aggravate the problem. Yet, governments and the people they represent are too attached to the status quo to undertake significant reductions.

### B. *Social Norms*

Social norms against exploiting a commonly held resource sometimes arise to resolve commons dilemmas. For example, Native Americans in the Pre-Columbian Pacific Northwest had every opportunity and incentive to overexploit salmon fisheries, but they developed careful norms in favor of conservative harvesting practices, which preserved these resources.<sup>84</sup> Similarly, ranchers in Shasta County, California, have developed social norms governing crop damage from livestock that resolve an otherwise thorny commons dilemma.<sup>85</sup> In the environmental context, voluntary recycling programs in the United States have become almost ubiquitous, even among people who have little or no monetary incentive to recycle.<sup>86</sup> It is, therefore, possible that a widespread norm against fossil fuel combustion might develop such that even without taxation or regulation, consumption of fossil fuels will decline.

There is, in fact, some evidence that such a trend is emerging. In some parts of the United States, the deregulation of the electric utility industry has given some consumers the opportunity to purchase "green" electricity. The precise definition of green electricity varies by location, but basically it is electricity produced largely by methods other than fossil fuel consumption.<sup>87</sup> Despite the fact that green electricity costs more

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84. See ARTHUR F. MCEVOY, *THE FISHERMAN'S PROBLEM: ECOLOGY AND LAW IN THE CALIFORNIA FISHERIES, 1850-1980*, at 32-40 (1986).

85. See Robert C. Ellickson, *Of Coase and Cattle: Dispute Resolution Among Neighbors in Shasta County*, 38 *STAN. L. REV.* 623, 672-73 (1986).

86. See Cass R. Sunstein, *Social Norms and Social Roles*, 96 *COLUM. L. REV.* 903, 906-07 (1996).

87. See Steve Johnson, *It's Not Easy Going Green: Even Advocates Can't Agree on Which Provider Is Greenest*, *SAN JOSE MERCURY NEWS*, May 31, 1999, at 1C.

than conventional electricity, some consumers have chosen to use it.<sup>88</sup> The city of Santa Monica, California, recently decided to switch to green electricity, for example, as have several businesses, including a Toyota manufacturing facility.<sup>89</sup> Presumably, many industries could be induced to switch to green electricity by consumers who prefer products manufactured with it.

Despite this trend, the psychological influences described earlier suggest that the voluntary activities of ordinary citizens will not dramatically reduce fossil fuel consumption. Polarization in attitudes about global climate change will prompt only part of the population to switch to green electricity. If the number of consumers that switch to green electricity starts to rise precipitously, the demand for conventional electricity will decline, but so will its price. Consumers of green electricity who are willing to pay the ten percent price premium today might not be willing to pay a comparatively greater differential that would result if demand for fossil fuels declined. Furthermore, if demand for green electricity only arose in the United States, it would have little impact on the risk of global climate change.<sup>90</sup> For a voluntary program to be successful, it must mimic the effects of an international agreement and be global in scope.

Loss aversion will also have a negative effect on the market for green electricity. Unlike recycling, which requires consumers to use their time to subsidize environmental quality, green electricity requires consumers to use their money; consumers must voluntarily increase their electric bills. Thus, at a moment when people are already facing a loss (in the form of a utility bill), they are asked to contribute more to a cause that might seem somewhat ephemeral to many. Green electricity is more analogous to public support for products that are produced with recycled materials than the act of recycling itself.

Like international agreements, social preferences will, at best, keep down the rate of increase in fossil fuel consumption. Some consumers will be willing to pay for green electricity, particularly in the United States. This trend, however, will not support the kind of reduction in fossil fuel consumption that scientists suggest will be necessary to significantly reduce the danger of global climate change.

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88. See Kirsten Searer, *County Utility Makes Green Power Cheaper: Commonwealth Converts Its Customers to Environmentally Friendly Energy and Cuts Rates*, ORANGE COUNTY REGISTER, Feb. 9, 1999, at C1.

89. See Nancy Rivera Brooks, *Companies Give 'Green' Power the Green Light Utilities: Air-Touch, Patagonia and Toyota Seek to Enhance Their Image by Buying Electricity from Renewable Sources*, L.A. TIMES, Sept. 27, 1998, at D8; *Council Seeks to Switch Facilities to Green Power*, L.A. TIMES, Feb. 26, 1999, at B4.

90. Even in California, only two percent of consumers have opted for green electricity. See Johnson, *supra* note 87.

### C. *The Need for Other Solutions*

Psychological processes make it unlikely that the world's nations will undertake a conventional set of precautions against the likelihood of global climate change. Governments are unlikely to adopt the level of regulation or taxation necessary to promote a sufficient degree of reduction in fossil fuel consumption, and voluntary measures will have only a marginal effect. Given the amount of fossil fuels left to consume (mostly in the form of coal), society risks significant climate change unless there is some innovation beyond regulation, taxation, or voluntary social norms.

The best source of a remedy for global climate change is not the conventional remedies for commons dilemmas but a dramatic effort to eliminate the commons dilemma itself. Government-led investment in alternative energy sources is more sensible than pursuing a program of regulation or taxation or hoping consumers will shun fossil fuels. Rather than try to fight psychological (and economic) pressures to continue consuming fossil fuels, the development of alternative means of generating electricity takes advantage of people's innate desire to develop and advance their condition and that of their children. Newer sources of electricity would have to be significantly cheaper so as to compete with the readily available supply of inexpensive fossil fuels and at the same time increase rather than decrease the planet's wealth. This solution to the problem harnesses rather than opposes economic and psychological forces in support of a solution.

There is precedent indicating that relatively inexpensive alternatives can successfully remedy global environmental problems. The international agreement to reduce ozone-depleting chemicals could not have been negotiated without the easy availability of alternative coolants.<sup>91</sup> To be sure, discontinuing the use of ozone-depleting chemicals was not costless. It has not, however, inflicted the kind of impoverishment that a sixty-percent reduction in fossil fuel consumption would. The availability of similarly priced alternatives gave countries a way to switch without incurring significant economic losses. Furthermore, political consensus on the issue was easily achieved because both environmentalists and one powerful industrial group, the manufacturers of alternatives to ozone-depleting chemicals, supported legislative action.

Developing alternatives to fossil fuels, however, requires governmental intervention. If an inexpensive means of producing electricity without consuming fossil fuels were about to become available, industry would be already rapidly pursuing it. To avoid the risk of global climate change, large-scale research regarding alternatives to fossil fuels is needed. In the past, when technological exigencies have arisen, the United States has been able to marshal its best scientists to make mi-

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91. See HUNTER ET AL., *supra* note 4, at 561.

raculous scientific advances. The United States was able to construct an atomic bomb, develop the polio vaccine, and send humans to the moon, all under severe time constraints. Global climate change represents a similar exigency. Rather than spend public resources promoting green electricity or negotiating the next round of global climate change treaties, the United States should commit itself to developing a cheap alternative to fossil fuels. Instead of trying to conquer the social and cognitive limitations of the human mind, such a program would take advantage of human motivation, determination, and imagination. The alternative is to convert every barrel of oil and every ton of coal into carbon dioxide and hope that the pessimistic climatologists are mistaken.