The Psychology of Global Climate Change

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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.[1] Presumably, a reasonable society does the same. A reasonable society should be willing to undertake fairly significant 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 choices.[2] Cognitive limitations on human judgment and choice sometimes lead people to make decisions that produce unwanted outcomes. Psychologists worry that these limitations can also lead whole societies astray and fall prey to a massive social trap.[3] It is the thesis of this Article that the threat of global climate change creates a social trap that, because of its psychological characteristics, society is unlikely to resolve through conventional approaches.

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

[2] *See* 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 (1995).

One can scarcely find a problem faced by contemporary society 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.[4] 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. 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 cause is the combustion of fossil fuels.[5] 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, 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 must be controlled. Although pollution

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[4] *See generally*, DAVID HUNTER ET AL., INTERNATIONAL ENVIRONMENTAL LAW AND POLICY 609- 25(1998)(for a summary of the problems posed by global climate change). For a more formal scientific report on global climate change, see INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, WORKING GROUP I, THE SCIENCE OF CLIMATE CHANGE (J. T. Houghton, ed. 1995)[hereinafter IPCC REPORT].

[5] *See* Hunter, *supra* note 4, at 612-15.

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.

Global climate change, however, differs fundamentally from other environmental problems. Whereas most pollution consists of the unintended waste products of industry, the carbon dioxide that is the primary cause of global warming is the unavoidable consequence of reducing complex hydrocarbons into simpler one; production of carbon dioxide is the definition of combustion. Many types of pollution have been reduced significantly simply by implementing more efficient combustion techniques.[6] Industry can only eliminate the emission of carbon dioxide, however, by reducing the rate at which it consumes fossil fuels. 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.[7]

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[6] *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, ed., forthcoming 1999).

[7] *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, 72-73 (Patrick Low ed., 1992); Edith Brown Weiss, *Environment and Trade as Partners in Sustainable Development: A Commentary*, 86 AM. J. INT'L L. 728, 730 (1992).

Carbon dioxide emissions, by contrast, rise continuously with a nation's wealth.[8] Consumption of fossil fuels is the trademark of a wealthy nation.

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.[9] 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 will eventually become scarce, raising its price and reducing the rate of consumption, other easily available fossil fuels can take their 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 any further exploration.[10] Consequently, no single country or group of countries can have a great impact on the worldwide rate of fossil fuel consumption. Either every country reduces fossil fuel consumption, or the net rate of consumption will remain relatively constant.

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[8] *See* World Resources Institute, *Atmosphere and Climate*, WORLD RESOURCES 1996-97, 315, 315-16 (1997).

[9] *See* Colin J. Campbell & Jean H. Laherrére, The End of Cheap Oil, 278 SCI. AM. 78 (1998).

[10] *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)(found at http://energy.usgs.gov/factsheets/nca/nca.html, visited August10, 1999.)

Even this dismal characterization of the problem of global climate change, however, does not, without more, present an insurmountable obstacle to resolution. Each consumer of fossil fuels imposes a cost on all of society–a negative externality. It might be difficult to get each consumers to account for this cost, but it is possible. The threat of global climate change is an elaborate commons dilemma. Like all problems associated with common externalities, two basic solutions to global climate change are available: binding agreements to curb the externality or the development of collective norms against creating the externality.

Given the enormous stakes, each consumer would be better off entering into an enforceable agreement to reduce fossil fuel consumption.[11] 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 must be included in an agreement and monitored closely. This fact has led advocates of undertaking precautions to reduce the risk of the global climate change to insist that an international agreement to reduce fossil fuel consumption must include every nation that actually consumes, or could potentially consume, significant quantities of fossil fuels. Because any agreement to curb fossil fuel consumption would necessarily intrude upon each signatory's domestic industrial processes and require extensive monitoring against cheating, such an agreement would doubtless have to be the mother of all treaties. Nevertheless, the magnitude of the costs of global climate change makes it rational for any nation to enter into such a treaty, despite the costs of doing so.

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

Public choice theory predicts that legislation intended to provide diffuse benefits to many and impose high costs on a few concentrated groups is unlikely to be passed in a democracy.[12] In other areas of environmental law, in the early 1970's, Congress passed such legislation, despite its impact on concentrated interests.[13] The historic success of public-spirited legislation supporting environmental protection suggests that the same might occur in the context of global warming as well. Such legislation, however, probably passed as a result of a groundswell of support for environmental protection. Unless a similar groundswell of support for reducing the risks of global climate change can be mustered, 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 keep people from engaging in behavior that inflicts harm upon others, obviously a great deal of social interaction depends upon voluntary compliance with standards of conduct.[14] 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 development of an international consensus on reducing the

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

[13] *See* Daniel A. Farber, *Politics and Procedure in Environmental Law,* 8 J.L.. ECON. & ORGANIZATIONS 59, 59-61 (1991).

[14] *See* ROBERT C. ELLICKSON, ORDER WITHOUT LAW: HOW NEIGHBORS SETTLE DISPUTES (1991); Symposium, *Social Norms, Social Meaning, and the Economic Analysis of Law,* 27 J. LEGAL STUD. 537 (1998)

consumption of fossil fuels. Just as many nations seem averse to violating standards against aggressive use of military force or widespread violations of human rights, even when doing so would be expeditious, perhaps the next century will see the development of an international environmental ethic as a response to global climate change. Even if an international agreement to reduce fossil fuel consumption cannot be had, norms against the consumption of fossil fuels might develop that have the same effect.

Several psychological phenomena of judgment, however, support a more pessimistic perspective on humanity's ability to respond effectively to the prospects of global climate change. First, because of a lack of a scientific 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 tend to adopt extreme positions, and adhere to them closely, which makes consensus in a large group difficult or impossible. Second, even if a consensus emerges that the problem requires costly solutions, other psychological phenomena suggest that people will be unwilling to undertake such a solution. 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. These factors make an international treaty extremely unlikely. They also make the development of social norms against consumption of fossil fuels an unlikely path to addressing the problem. Although a few psychological phenomena also suggest that people will respond effectively to the prospects of global climate change, on the

whole, the problem is one that society is unlikely to remedy. The conventional approaches to solving the tragedy of the commons will not facilitate an escape from the social trap of global climate change. Some innovative approach to this unique commons dilemma is required.

I. 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.[15] 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 errors in judgment.

As a consequence of this reliance on mental shortcuts, people make judgments that are inconsistent with rational choice. Reliance on heuristics and biases can keep people from balancing the costs and benefits of their actions accurately. Even though Judge Hand's formula for evaluating precautions may be a rational one, people do not necessarily conform to it. Even though a *rational* member of society would support social changes that would take precautions against the non-trivial probability of catastrophic consequences posed by global climate change, people still might oppose such precautions. Cognitive processes associated with evaluating new scientific information and with evaluating decisions involving losses suggest that people will fail to support costly precautions against the prospects of global climate

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

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. Although some cognitive processes suggest that people will respond constructively to the problem of global climate change, these processes are likely to be outweighed by the others.

A. "Biased Assimilation"

Uncertainty over the effects that combustion of fossil fuels is having on the global climate creates a psychological impediment to undertaking precautions against the threat of global climate change. By itself, uncertainty should not suffice as a justification for failing to undertake precautions. A reasonable person takes precautions to avoid the risk of catastrophic losses. People are not adept at calibrating their precautions to accommodate uncertainty, however. People see environmental hazards as mammoth threats that must be eradicated at all costs, or as trivial hype that should be ignored.[16] Measured response to the prospect of a 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.[17] People

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

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

process new information in ways that are consistent with their existing beliefs about the world.[18] This makes people's belief structures relatively stable and resistant to change. Although this is arguably a rational tendency, it does lead 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 about the world and reject evidence that is inconsistent with one's beliefs about the world.[19] One consequence of biased assimilation is that mixed evidence on a subject about which people have strong feelings will not only fail to moderate people's beliefs, but tend to make them more extreme. Psychologists have demonstrated this phenomenon on people with strongly held opinions on the death penalty.[20] 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. Researchers presented proponents and opponents with one study that supported the theory that the death penalty deters crime and one study that refuted the theory that the death penalty deters crime, along with criticisms of each study. In short, the subjects in this study encountered evidence

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[18] *See* Anthony G. Greenwald, *The Totalitarian Ego: Fabrication and Revision of Personal History*, 35 AM. PSYCHOLOGIST 603, (1980).

[19] *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 (1979).

[20] *Id.* at 2099-2100.

that the effect of the death penalty was uncertain, which should have tended moderate the subjects' views on 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 that suggested that the death penalty deters crime, did not find criticisms of this study particularly persuasive, and found the study that suggested that the death penalty does not deter crime was methodologically flawed and therefore not persuasive. Opponents of the death penalty found the opposite. At the end of the study, the beliefs of proponents and opponents of the death penalty diverged even further than they did at the outset of the study.[21]

The scientific evidence on global climate change presents plenty of fodder for biased assimilation. Although there is a general consensus that human activity is affecting the global climate,[22] estimates of the degree of the change and the impact that it will have vary tremendously. Just as many scientists believe that the weight of evidence suggests that global climate change is becoming a serious problem, others believe that the evidence suggests otherwise.[23] Predicting the climate is a complex challenge for scientists that will surely

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[21] *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).

[22] *See* HUNTER ET AL., *supra* note 4, at 611-12.

[23] *See* http://www.globalwarming.org/science/index.htm, summarizing scientific debate and providing links to conflicting reports on global climate change.

produce a mixture of support and opposition for the prediction that global climate change will cause significant adverse consequences to society.

Even among scientists that agree that global climate change is a problem, the variance in the range of prediction is striking. For example, according to some of the best models that the EPA relies upon, global climate change in the next century will increase rainfall in central Illinois from somewhere between twenty-five and seventy percent.[24] The EPA also expects average summertime temperatures in central Illinois to rise from one to four degrees Fahrenheit. 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. 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, particular the Eastern and Gulf Coast States, are both more dire and more erratic.[25]

The great degree of uncertainty that haunts the debate on global climate change will likely result in a process of biased assimilation. The scientific literature on the subject includes studies suggesting that fossil fuel consumption will have a great and lasting effect on the climate and studies suggesting that fossil fuel consumption will not have a large effect on

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[24] *See* http://www.epa.gov/globalwarming/impacts/stateimp/illinois/index.html (visited on July 27, 1999).

[25] *See* http://www.epa.gov/globalwarming/impacts/stateimp/index.html.

the climate.[26] Criticisms of both types of studies are also widely available. Furthermore, the fossil fuel industry has incentives to generate research that muddies the scientific waters.[27] The research on biased assimilation suggests that skeptics of the threat of global climate change will view studies suggesting that fossil fuel consumption is affecting the global climate as flawed, and hence not credible. Skeptic will also view studies suggesting that fossil fuels are not having an effect on the global climate as well done and persuasive. Hence, as skeptics read the scientific literature, they will become 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 1970's resulted from a groundswell of concern about environmental degradation that the threat of global climate changes is unlikely to be able to replicate. Unlike air and water pollution, global climate change is a somewhat intangible harm that requires a belief in scientific theory to understand. Biased assimilation ensures that skepticism will remain strong among some people. In turn, this will make it hard to promulgate regulations of or levy taxes on carbon emissions. Given the complexity of the task of predicting the global climate, conflicting scientific evidence will certainly haunt the debate. Rather than lead to a more temperate response to a potential catastrophe, the conflicting scientific evidence will likely stifle society's response.

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[26] *See A Heated Controversy*, ECONOMIST, Aug. 15, 1998, at 66.

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

B. The Psychology of Choosing Among Losses

Even if a consensus emerged on the scientific aspects of the problem, 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.[28] People treat a potential loss from the status quo as more significant than a potential gain from the status quo. People also make riskier choices in the face of losses than in the face of gains. Each of these influences will impede society's ability to undertake precautions to reduce the risk of global climate change. These influences also make negotiations that 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.[29] They treat adverse changes from the status quo as much more significant than beneficial changes, which psychologists refer to as "loss aversion."[30] Because of this tendency people will be relatively unwilling to sacrifice benefits

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

[29] *See* Daniel Kahneman et al., *The Endowment Effect, Loss Aversion, and the Status Quo Bias*, 5 J. ECON. PERSPECTIVES 193, 194-97 (1991).

[30] *See* Tversky & Kahneman, *supra* note 28, at 1039.

they already possess to obtain other benefits. For example, in one demonstration of loss aversion, subjects expressed a preference for the status quo for either a job with a short commute, but little social contact or a job with has plenty of social contact, but a long commute.[31] Subjects told that they currently held the first job were generally unwilling to switch to the second, and subjects told that they currently held the second job were generally unwilling to switch to the first.[32] In effect, subjects treated the advantage that they already possessed as more valuable than the one that they did not, leading them to express an attachment to the status quo.

Loss aversion has been demonstrated to influence choices concerning environmental quality. People prefer higher environmental quality more if the environmental quality that they already experience is high than if it 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 to improve environmental quality from its present state.[33] Subjects in this study were more receptive to programs that restored environmental quality than ones that improved it. Because an appropriate level of environmental quality is difficult to determine, the status quo generally acts as a non-arbitrary position that people then seek to maintain.

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[31] *Id.* at 1045.

[32] *Id.*

[33] Gregory, Robin, et al., *The Role of Past States in Determining Reference Points for Policy Decisions*, 55 ORG. BEHAV. & HUM. DECISION PROCESSES 195 (1993).

A similar preference for the status quo influences decision 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.[34] As one example in 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 15 in 10,000 to 10 in 10,000.[35] Other subjects that were told that these two products posed a combined risk of 10 in 10,000 (at a cost of $10.00 and $2.00) refused to switch to a cheaper product that posed a combined risk of 15 in 10,000, even if the riskier products were offered *at no cost*. People are unwilling to tolerate increases in risk, but are reluctant to pay for reductions in risk.

As to global climate change, a preference for the status quo makes it difficult for society to undertake reforms to avoid global climate change. People will be averse to incurring 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 do so at risk of increased danger of global climate change, it would refrain from doing so. That is not the choice that society is making, however. It is choosing whether

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

[35] *Id*. at 475.

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 resisting committing to significant reductions in fossil fuel consumption.[36]

2. Risky choices in the face of losses

People are more willing to gamble to avoid a loss than to obtain a benefit.[37] For example, in one study, subjects expressed a preference for risk in the face of losses as part of an evaluation of two public-health programs designed to reduce the number of deaths from an outbreak of an Asian flu.[38] In the study, subjects were told that without any precautions, 900 people were expected to die form the flu, but that 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 save 600 people for sure, and if vaccine B were administered, it had a 2/3 chance of saving all 900 and a 1/3 chance of saving no one. In the "loss" condition, subjects were told that if vaccine A were administered, 300 people would still die, and if vaccine B were administered, there was a 2/3 chance that no one would die and a 1/3 chance

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[36] *See* HUNTER ET AL., *supra* note 4, at 660-61.

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

[38] *Id.* at 343.

that all 900 would die. Even though both the gains and the losses 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 loss condition made it clear that the risk-averse choice condemns some people, it makes the riskier choice, which held out the prospect that no deaths would occur appear more attractive.

Because of the uncertainties associated with global climate change the choices that society faces are not much different from those posed by the loss condition in the Asian flu problem. Society could accept a sure loss by reducing the consumption of fossil fuels, which would result in a reduced risk of adverse climatological consequences, or refuse to accept the losses required to reduce fossil fuel consumption and incur a greater risk of more severe climatological consequences. Because people are generally averse to incurring a sure loss advocates of fossil fuel reductions as a precaution against the prospects of global climate change face an uphill struggle.

As with most choices, the problem of global climate change could be re-framed so as to present a decision over gains, which would then make precautions seem more attractive. If the reference point for decisions about precautions against global climate change was that society would endure a sixty percent reduction in fossil fuel consumption from present levels to eliminate completely the prospects of adverse changes in the global climate, then any lesser reduction in fossil fuel consumption would be viewed as a gain. The research on framing

predicts that if a reduction as drastic as sixty percent were the baseline from which negotiations occurred, a lesser reduction would seem much more palatable than if people viewed the 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 consumption of fossil fuels. Losses are the natural frame for discussion global climate change. In effect, the threat of global climate change means that society is actually poorer than it appears. Society must either tolerate a loss in wealth today, or risk a more significant loss in wealth tomorrow. Choices about preventive measures to reduce the risks posed by global climate change will be made from the perspective of losses. Consequently, society will be willing to endure much riskier options than it should.

3. Negotiations Involving Losses

Loss aversion and risk-seeking preferences in the face of losses both make settlement of disputes that require allocating losses difficult. Because any remedy for global climate change requires an international agreement to be of any value, the psychological effect of choosing among losses will impede the negotiations over distributing 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. One experiment showed that people express even greater resistance to parting with a possession when they obtained that possession through even

a weak demonstration of their skills.[39] This effect has been referred to as a kind of enhanced loss aversion.[40] Although in many contexts, people are willing to sacrifice a great deal so as to be fair,[41] people also find it easy to come to believe that a fair resolution of a dispute benefits them over others.[42] 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.[43] Usually, people enter into settlements as a means of avoiding a riskier outcome. Negotiated arrangements remove the risk of a confrontational resolution of a dispute in which a winner may take 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

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

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

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

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

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

allocating losses.[44] People are much more willing to engage in confrontations in an attempt to avoid losses than to incur gains.

To lower the risks of global climate change in the next century, the world's nations have to reduce the collective rate of combustion of fossil fuels. An international treaty therefore has to allocate some economic costs 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 level of fossil fuel consumption and some developing countries feel entitled to an expansion of their rate of consumption of fossil fuels. This will make losses difficult for countries to tolerate and may make many countries inclined to gamble that the impact of carbon emissions is at the low end of the uncertain estimates, rather than incur the certain loss of economic activity.

D. 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.[45] The availability heuristic often provides a good cognitive shortcut to estimating

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

[45] *See* Amos Tversky & Daniel Kahneman, *Availability: A Heuristic for Judging Frequency and Probability*, 4 COGNITIVE PSYCHOL. 207 (1972).

frequency or probability when the actual statistics are not available. It can, however, lead to mistakes in judgment. Events are particularly salient or receive a great amount of publicity are disproportionately easy to imagine. As a result, people generally over-estimate the frequency of these events.[46]

In fact, people's reliance on the availability heuristic frequently produces mistaken assessments of the risks of environmental hazards.[47] Over the past three decades, environmental hazards have received a tremendous degree of publicity. For example, people easily remember the events at Love Canal, and as a result, estimate the rate at which residents are exposed to hazardous chemicals in their homes as being much higher than it actually is.[48] As a consequence, the demand for regulations to remedy the problem of hazardous waste disposal facilities may be much greater than the magnitude of the actual problem. In fact, 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.[49]

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[46] 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).

[47] *See* Timur Kuran & Cass R. Sunstein, *Availability Cascades and Risk Regulation*, 51 STAN. L. REV. 683, 692- 03 (1999).

[48] *Id.* at 691-98.

[49] *Id.* at 687-90.

The threat of global climate change provides more than adequate opportunity to create an availability cascade. With or without a dramatic change in the climate, bad weather finds its way to the news every year in dozens of different ways. The climate itself is difficult for laypersons to track, but the alleged symptoms of global climate change are easily available to everyone's memories. Droughts, tornadoes, hurricanes, floods, and heat waves consistently find their way onto the nightly news, whether or not these are the products of global climate change. This availability makes the prospects of a disastrous change in the climate seem likely.

Not only does the availability of bad weather make the prospects of global climate change seem more likely, the concept of global climate change provides a handy explanation for the disasters that weather perpetrates. People prefer to see the world as a stable, and well-ordered place where disasters have explanations.[50] People prefer to believe that bad events do not occur at random and are the results of some prior bad act.[51] The weather cannot be controlled, but global climate change provides an account of weather-related disasters consistent with the 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. A belief that fossil fuels are changing the

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[50] *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).

[51] *Id.* at 1030-31.

climate converts weather-related disasters from random disasters inflicted by untamed natural resources into the just retribution for human shortsightedness.

Furthermore, several people and groups have an interest in starting an "availability cascade" to support undertaking precautions against global warming. These range from politicians who have embraced the environmental protection, most notably Al Gore,[52] environmental organizations,[53] and those industries that produce energy-saving devices and sources of electricity other than fossil fuels.[54] Although many powerful industries would prefer to keep the public's fear of global climate change low, the nature of availability cascades favors a rise in concern over environmental disasters. Interests that favor undertaking preventive steps against global climate change need only publicize adverse weather events and tie them to global climate change to produce a change in public attitudes.[55]

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[52] *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).

[53] Several major environmental organizations have grown interested in the problem of global climate change. See, e.g., http://www.nrdc.org/nrdcpro/fpprog.html (describing the National Resources Defense Council's efforts to combat global climate change, visited August 10, 1999).

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

[55] In fact, the advocates of taking precautions against global climate change have enlisted the assistance of television weather forecasters in an effort to increase the examples of the impact of global climate change that are available to the public. *See* Peter Jennings Reporting the Apocalypse and Al Gore (ABC Television Broadcast, Apr. 11, 1998)(describing the Vice President's efforts to use weather forecasters to spur the public's concern over global climate change).

E. Conclusions on Psychological Processes and Global Climate Change

The availability heuristic, along with 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 for a consensus to form on the issue. Furthermore, even if a consensus emerges that global warming poses a serious threat, the reluctance to endure losses will make it difficult for people to tolerate significant economic losses to reduce the risk of global climate change. The tendency to make risky choices in the face of losses also suggests that people will prefer to gamble that the dangers posed by global climate change will be less than expected. Even should most countries decide that global climate change is a threat that is worth undertaking significant losses to avert, the cognitive phenomena associated with losses will make an international agreement to reduce fossil fuel consumption difficult to negotiate. In short, although psychological processes make conflicting predictions about the choices that society is likely to make, the weight of the predictions is against undertaking precautions to reduce the threat posed by global climate change.

II. THE PROSPECTS FOR PREVENTING FOR GLOBAL CLIMATE CHANGE

Like most environmental problems, the dangers posed by global climate change are a form of commons dilemma. As such, they can be reduced either through governmental

intervention, consisting either of taxes or regulations, or the development of collective norms against the combustion of fossil fuels. The psychological phenomena discussed in this paper present significant obstacles to each of these remedies, thereby suggesting that a third approach is needed.

A. Governmental Intervention

Governmental intervention to remedy a commons dilemma is not new. Historically, governmental remedies for a commons problem include taxation and regulation. A taxation approach to remedying global climate change would consist of imposing some tax on fossil fuel consumption that compensates for the hidden dangers of risk of global climate change. In the case of environmental harm, governments usually adopt regulations that limit the extent of the costs that a polluter can impose on others, rather than pursue a taxation approach. In the case of global climate change this 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 some activities outright.

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 would set targeted reductions for each country, leaving the individual

countries to choose among these methods for themselves.[56] Scholars studying the problem of global climate change agree that the most likely approach most countries would take will be some sort of mechanism to tax combustion of fossil fuels.[57] Direct regulation would be akin to rationing, and would lead to a tremendous fighting, and probably 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 prospects of such an agreement, arguing that the tremendous dangers posed by global climate change will inspire countries to be willing to undertake drastic precautions.[58]

Assuming that it is rational for countries to be willing to enter into and implement an agreement to reduce their consumption of fossil fuels significantly, then there is some question as to why countries do not seem to be willing to take the steps needed to avoid the risks posed by global climate change. The pace of the negotiations is slow, and no country contemplates undertaking anywhere near the levels of reduction in combustion that scientists believe are necessary to avert global climate change.[59] If the nations of the world have

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[56] *See* HUNTER ET AL., *supra* note 4, at 660-63.

[57] *See* Wiener, *supra* note 11, at 727-35.

[58] *See* HUNTER ET AL., *supra* note 4, at 611.

[59] Compare the agreements contained in the KYOTO PROTOCOL TO THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, ANNEX B (no country commits to more than an 8 percent reduction in emissions) to the 60 percent reductions called for in the IPCC REPORT, *supra* note 4, at xviii, Table 2.)

governments that make rational choices, then they should be willing to undertake much more significant precautions than they are currently considering.

Part of the reason that countries do not seem interested in taking costly precautions against global climate change might be barriers that result from the psychological phenomena described in this Article. As predicted by the research on biased assimilation, there is a lack of a consensus in the general public 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 beliefs on the dangers posed by fossil fuel consumption. In a 1997 survey, a similar percentage of people asserted that they worried a great deal about global warming (24 percent) as asserted that they were not at all worried about global warming (17 percent).[60] Also, experts on the subject often cite the same set of research to reach conflicting opinions about the need to take precautions against the risks posed by global climate change, just as the applications of biased assimilation predicts.[61] Contrary to the predictions of the availability heuristic, however, concern about global climate change is *declining*.[62]

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[60] *See* Survey by Pew Center for People and the Press, November 1997 questionnaire, reported at http://www.globalwarming.org/sciup/index.htm (visited August 10, 1999).

[61] Skeptics often cite some of the same observations used to support global climate change. *See, e.g.*, http://www.globalwarming.org/sciup/index.htm (describing how evidence of retreating glaciers is evidence not of global climate change resulting from fossil fuel emissions, but of naturally occurring processes.

[62] *See* Survey by Pew Center for People and the Press, November 1997 questionnaire, reported at http://www.globalwarming.org/sciup/index.htm (visited August 10, 1999)(63 percent of respondents in 1989 asserted that they worried about global warming a fair amount or a great deal, as compared to 54 percent in 1997).

The psychological phenomena associated with losses also seem to be operating against a comprehensive international agreement to undertake precautions against the threat of 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,[63] but key developing countries, including as China and India, are still not included in the Kyoto protocols for reduction in fossil fuel emissions.[64] This contrast reveals the complexities associated with competing senses of entitlement. Americans believe that they are entitled to same proportion of fossil fuel emissions that they currently possess, while Chinese and Indians feel entitled to a greater share. Furthermore, the international negotiations have embraced the current levels of consumption as a status quo, which has led to discussing only reductions from current levels that are far less than the scientists believe are adequate.[65] In short, cognitive biases against international agreements and against domestic willingness to undertake serious precautions to prevent global climate change reveal the influence of loss aversion, the status quo bias, and risk-seeking preferences in the face of losses.

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[63] *See* HUNTER ET AL., *supra* note 4, at 672-73. *See also*, Survey by Pew Center for People and the Press, November 1997 questionnaire, reported at http://www.globalwarming.org/sciup/index.htm (visited August 10, 1999)(70% of respondents agreed that all countries should make the same reductions in fossil fuel emissions, regardless of their wealth).

[64] KYOTO PROTOCOL TO THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE.

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

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

B. Social Norms

Social norms against taking advantage of an opportunity to over-exploit a commonly held resource sometimes arise to resolve commons dilemmas. For example, Native American in the Pre-Columbian Pacific Northwest had every opportunity and incentive to over-exploit salmon fisheries, but developed careful norms in favor of conservative harvesting that preserved these resources.[66] Similarly, ranchers in Shasta County, California, have developed a set of social norms governing crop damage from livestock that resolve an otherwise thorny

[66] *See* ARTHUR F. MCEVOY, THE FISHERMAN'S PROBLEM: ECOLOGY AND LAW IN THE CALIFORNIA FISHERIES, 1850-1980 32-40 (1985)

commons dilemma.[67] 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 for the recycling.[68] 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 consists of electricity produced largely by methods other than fossil fuel consumption.[69] Despite the fact that green electricity costs between more than conventional electricity, some consumers have chosen to use.[70] The City of Santa Monica recently decided to switch to green electricity, as have several businesses, including a Toyota

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[67] *See* Robert Ellickson, *Of Coase and Cattle: Dispute Resolution Among Neighbors in Shasta County*, 38 STAN. L. REV. 623 (1986).

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

[69] *See* Steve Johnson, *California Environmentalists Can't Agree on Which California Power Provider is Best*, SAN JOSE MERCURY NEWS, May 31, 1999 (page unavailable from WESTLAW).

[70] *See* Kirsten Searer, *Utility Cuts Rates for 'Green Power'*, ORANGE COUNTY REGISTER, March 9, 1999 (page unavailable from WESTLAW).

manufacturing facility.[71] Presumably, many other industries could be induced to switch to green electricity by consumers who want products manufactured with green electricity as well.

Despite this trend, the psychological influences described in this Article suggest that the voluntary activities of ordinary citizens will not dramatically reduce fossil fuel consumption. The polarization in attitudes about global climate change will mean that only part of the population will feel the need to switch to green electricity. If the number of consumers that switch to green electricity starts to rise precipitously, the demand for fossil fuel produced electricity will decline, but so will its price. Consumers who are willing to pay the 10% price differential today might not be willing to pay a much larger gap that would result if demand for fossil fuels declined and price for these fuels also declined. Furthermore, demand for green electricity cannot be restricted to California or the United States.[72] For the 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

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[71] *See Council Seeks to Switch Facilities to Green Power*, LOS ANGELES TIMES, Feb. 26, 1999, at B4; Nancy Rivera Brooks, *Companies Give 'Green' Power the Green Light Utilities: AirTouch, Patagonia and Toyota seek to enhance their image by buying electricity from renewable sources*, LOS ANGELES TIMES, September 27, 1998, at D8.

[72] Even in California, only two percent of consumers have opted for green electricity. *See* Johnson, *supra* note 69.

increase their electric bill. 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. The analogy here is not to recycling, but to purchasing products that are slightly more expensive because they are made from recycled materials.

Like international agreements, pro social preferences will, at best, keep down the rate of increase in fossil fuel consumption. Some consumers will be willing to pay some amount 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 likelihood of global climate change.

C. The Need for Other Solutions

Psychological barriers 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 also have only a marginal effect. Given the amount of fossil fuels left to consume (mostly in the form of coal), society will be risking 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 makes much more sense than pursuing any program of regulation or taxation, or hoping consumers begin shunning fossil fuels. Rather than trying to fight psychological (and economic) pressures to continue consuming fossil fuels, developing an alternative means of generating electricity takes advantage people's innate desires to develop and advance their condition and that of their children. Newer sources of electricity would have to be much cheaper so as to compete with the readily available supply of inexpensive fossil fuels, and in the processes would increase the planet's wealth rather than decease it. Developing newer, cheaper sources of electricity represents a solution to the problem that does not attempt to swim upstream of economic and psychological forces.

There is precedent for the success of relying on the availability of relatively cheap alternatives as a remedy for global environmental problems. The international agreement to reduce ozone-depleting chemicals could not have been negotiated without the easy availability of alternative coolants.[73] To be sure, switching away from ozone depleting chemicals has not been costless, but it has not inflicted the kind of impoverishment that reducing fossil fuel consumption by sixty percent represents. The availability of similarly priced alternatives gave the world a way to switch without widespread poverty, and provided the environmentalists with a ready ally in the producers of the alternative chemicals.

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[73] *See* HUNTER ET AL., *supra* note 4, at 561.

Developing alternatives to fossil fuels, however, requires governmental intervention. If a very cheap means of producing electricity without consuming fossil fuels were about to become available, industry would be rapidly pursuing it already. To avoid the risks that global climate change poses, what is needed is not a rapidly negotiated, ineffective global climate change treaty, but large-scale investment in basic research on alternatives to fossil fuels. In the past, when technological exigencies have arisen, the United States has been able to marshal its best scientists together to make miraculous scientific advances. When it felt that exigencies arose, the United States has been 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 another dime promoting green electricity or negotiating the next ground 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 be left to hope that the pessimistic climatologists are wrong.