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In the Beginning

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The reader will want to know what this book is about, that is how it will deal with the difficult questions about energy and the environment, and specifically with global warming. The plan is to address these matters from two interlocking points of view, considering the technical options that are available, but in the context of the policy decisions and negotiations with which they are intimately linked. In both these arenas, we address an intelligent layperson without requiring any prior expertise on the part of the reader. We outline important policies to pursue that can make a difference and propose specific steps and a list of priorities.

1.1 The Viewpoint Taken

This is a book that seeks to navigate between extremes. We believe that global warming is occurring and that human actions are a major factor in that

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warming, but we are not persuaded that all will be lost if massive policy changes and massive changes in lifestyles are not implemented immediately and everywhere. We have by our reckoning a 10–20-year "window of opportunity" to develop policies that will be effective in facilitating adaptation to existing levels of global warming and mitigating the worst effects of a long-term and very dangerous increase in global temperatures. These policies will be costly, they will require increasingly difficult adaptations as a new energy economy is put in place, and there will be policy "shocks" and costly mistakes along the way, but the changes will not be too costly or too demanding or too surprising *if* we do not use uncertainty and ideological warfare as excuses to procrastinate. We shall discuss all these matters in greater detail in the chapters that follow.

Because many forecasts of climate change have already proved to be too optimistic, that is to underestimate the magnitudes of actual events, it is possible that the window of opportunity could close more rapidly than we now expect. Recognizing the chance that such an unhappy situation could develop, we need to be prepared to implement very rapidly some more extreme and in some cases controversial responses to global warming. For this reason, our policy suggestions in Chapters 9, 10, and 11 follow a two-track strategy: a "normal" track in the next two decades that seeks to establish and sustain a policy process that deepens our ability to deal with and lessen the effects of the warming that has occurred and will continue to occur; and an "abnormal" track, focused initially on enhanced research expenditures, that seeks to avert the worst and to limit the damages from what cannot be averted. There is a loose analogy here with the Obama administration's response to the danger that recently threatened the US financial system as well as those around the globe. In that case massive multidimensional policy responses were called upon to prevent a devastating implosion. A similar emergency response might be needed if the abnormal track becomes a reality, but there are reasonable prospects to avoid such an end.

We want also to be fair in our analysis, not so much to the outright deniers of climate change or to the ideological posturers who seek only partisan advantage from the debate on climate change, but rather to the analysts who believe that we can deal with the problem more effectively and more cheaply by a variety of other means. The science and the politics of climate change are constantly evolving, new information is appearing from a variety of sources, and new configurations of political power and public opinion are constantly emerging. It is also important to emphasize that, whatever the

degree of consensus in the scientific and policy communities, the public at large is frequently confused, uncertain, or indifferent to the debate on global warming: they are primarily focused on economic issues (jobs, mortgages, pensions, etc.) and for them the long-range effects of climate change can easily slide to a low position on their political (or personal) agenda. Thus, a recent study showed that global warming was 20th on a list of issues of concern for a typical voter. This has obvious implications for what is or is not likely to be feasible for any administration to contemplate. We shall return to the issue of the effects of public opinion later, especially in Chapter 11.

This may also be a useful point to comment on the December, 2009 controversy concerning the e-mails of a number of scientists at the University of East Anglia that were (illegally) hacked. A few of the e-mails apparently revealed some minor efforts by a few scientists to hide a recent decline in temperatures and to obstruct the publication of some articles by one or another denier.[1] That the hacked e-mails were released just as the Copenhagen Conference opened contributed to public confusion and provided further (if spurious) ammunition for the opponents of rapid movement toward a new energy economy. Thus the Saudi delegate to the Copenhagen Conference cited the released e-mails in his opening speech as a reason to delay action, adding rather bizarrely that in any case the oil exporters should be compensated for any potential income losses if renewable sources began to displace hydrocarbons in the fuel economy. He did not offer parallel compensation by the oil exporters, however, to return their windfall profits to those who have been harmed by them. It is most disappointing that the scientists at East Anglia violated their own professional norms, but in a larger sense it does not make much difference.[2] There is more than abundant physical evidence of global warming, and indeed the World Meteorological Organization responded to the furor by releasing a new report indicating that the decade from 2000 to 2009 was the warmest ever. What is most crucial here, however, is not the failed attempt to refute global warming, but rather the extent to which the debate itself has become an ideological war in which any or all means of resistance seem acceptable to the participants.

These comments are not meant to deny that there are still many uncertainties about the rapidity of warming, about the implications of different degrees of warming, about the best means of dealing with it, and about the costs of different choices. What is *not* uncertain, however, is that global warming has

occurred and is occurring at an alarming pace and that it would be irresponsible to delay our responses: there are certainties as well as uncertainties in this debate and the latter should not be used to rationalize inaction. We have tried in what follows to bypass the ideological wars and to focus instead on the need to establish and sustain a policy process that provides insurance – one hopes – against the worst for ourselves and for the most vulnerable. Many of the uncertainties seem unlikely to be resolved for years or decades to come, but they will be more easily managed if a consensus, domestically and internationally, can converge on the need to act *now* against the climate changes that have occurred and are occurring, and to start preparing for those that may occur at an accelerating pace in the years ahead. The obstacles to achieving that consensus are severe, as we shall see, but we shall discuss some of the dangers of failing to do so in what follows.

We have undertaken here to present a practical approach to a broad set of challenges, but recognize also that many readers will want refresher commentary on some of the technical issues, even when they are sufficiently savvy with respect to the political implications. As a result several of the chapters that follow address and explain the scientific ideas that underlie many of the technical proposals that have been put forth. The goal in each case is to supply a background that is sufficient for a fuller understanding of the details involved.

The chapter on *Surveying the Field* puts the discussion of energy into an international framework by addressing matters of supply and demand of the major fossil fuels with respect to time and place. The common units for measuring energy and power (megawatts and gigawatts) and those for measuring petroleum quantities (gallons and barrels) are introduced in order to make possible later quantitative comparisons. They are then used in examining the known facts and doubts on long-term reserves. Above all, the discussion is focused on recognizing that energy is transformable, on the idea that humans do not make energy, but rather that we have learned to transform it from some available form into another one that is more useful for our purposes. This fundamental notion underlies all the impressive engineering that has produced dramatic changes in our social and economic lives in the late nineteenth and twentieth centuries, and is the foundation upon which the later chapters on *Renewable Energy* and *Energy Storage* are built.

In Chapters 5 and 6, solar energy and its connections with the various wind, water power, and biofuel technologies are elucidated, but there are also important questions to be asked and answered as to what energy qualifies as

renewable, because a great many political and economic outcomes depend on the definition of this term. Since renewable energy sources are given governmental grants and tax benefits in both domestic and international arenas, it is important to assess whether the beneficiaries of preferential treatment do in fact contribute to the goals that stimulated the legislation in the first place, or whether they are merely hangers-on who seek profit in being identified as purveyors or manufacturers of equipment or goods that can be labeled as renewable.

The chapter on *Energy Storage* surveys the wide range of existing and/or proposed technologies that serve that purpose, highlighting the strengths and weaknesses of each. The reader is led to understand why extensive storage is vital in the development of all the renewable sources, and to recognize that some technologies are actually storage devices, although they may not immediately appear to fall in this category.

Chapter 7 delves into the domestic and international political constraints that have delayed or obstructed a rapid and effective response to climate change. We may know, in general, many of the things we ought to be doing but unless we can remove or reform the political obstacles, we may find ourselves dealing with global warming as an emerging catastrophe. Chapter 7 is both critical about the negotiating failures of the past and prescriptive about what might be done to improve the prospects for more successful future negotiations. The final chapter, *Prospects after Copenhagen*, adds some further comments on the possibilities of reform.

Chapters 8, 9, and 10 are oriented to the near and not so near future: we propose a series of steps that ought to be taken and put them in the form of a list of priorities with dates attached. Many of these moves are in and into the technology realm, but they also include steps of negotiation and policy change internationally as well as domestically. It appears at times that negotiating with our own US Congress is as difficult, sometimes more difficult, than finding agreement abroad.

Chapter 11 discusses what the Copenhagen Conference of December, 2009 did and did not accomplish. Was it a useful exercise in international policy-making or a waste of time and resources? We shall also return there to some of the political questions left unresolved in Chapter 7, especially about the effects of public opinion and the possibilities of reforms that might generate more effective responses to climate change.

The central theme that is to be developed may be summarized as “It’s not too late – yet”. There is a window of opportunity that covers a decade or two,

during which a variety of technical and political moves can offer various degrees of prevention, amelioration, and/or remedy for the most egregious harm to our planet and its inhabitants. Our approach is pragmatic, suggesting priorities for feasible alternatives, emphasizing decisions that are moral as well as practical. We will attempt to show that fairness and intergenerational equity are central and necessary components of any decisions that hope to bring about change.

1.2 What is Your Problem?

There is a broad consensus in both the scientific and policy communities that something needs to be done – and soon – about the world-wide energy utilization that is bringing about continuing global changes leading to serious environmental deterioration. An uncontrolled global warming would create catastrophic consequences for the earth and its various political, economic, and social subsystems. There is, however, widespread disagreement about what should be done when, and how the costs of any policy choices should be distributed. Disagreement is hardly surprising given continuing scientific uncertainties as to the extent of anticipated changes, the vast time scales involved, and the potentially enormous costs of making a transition to a new energy economy and perhaps even to a new or significantly altered theory of economic growth. The uncertainties are compounded because the necessary changes are likely to require an unprecedented degree of international cooperation and a degree of domestic policy consensus that may be unlikely as powerful interest groups resist changes to the old order. In addition, one needs to recognize the obvious fact that it is normal economic activity – growth, development, trade, industrialization – that is at the root of the energy and environmental crises, further complicating the problem of achieving consensual change.

The potentially devastating consequences of doing nothing about energy and the environment are well documented and frequently cited. Less recognition has been given to the positive strides that have been made in this regard in the last three decades, emerging signs of change that are significant and notable. Major contributions have come forth, for example, following the organization in 1974 of the Worldwatch Institute, whose mission statement includes:

> The Worldwatch Institute is an independent research organization that works toward the evolution of an environmentally sustainable and socially just society, in which the needs of all people are met without threatening the health of the natural environment or the well-being of future generations. Through accessible, fact-based analysis of critical global issues, Worldwatch helps to inform people around the world about the complex interactions between people, nature, and economies. Worldwatch focuses on the underlying causes of and practical solutions to the world's problems, in order to inspire people to demand new policies, investment patterns, and lifestyle choices.

Various publications of the Worldwatch Institute[3] have been warning about environmental degradation for decades. Disappearing forests, eroding soils, collapsing fisheries, water shortages, melting glaciers, the disappearance of plant and animal species, and increased global warming are all threats arising from a multidimensional failure to act.

These gross changes must sooner or later produce major societal responses, some of which will have arisen from more than a single cause. Classifying a given response as economic or political in origin is arbitrary, since the "spillover" from one to any or all of the others can be significant. And yet, in spite of the well-publicized warnings, the reactions have generally been mild and largely unresponsive. There are a variety of reasons for this: uncertainties about what choices to make, scientific and ideological disputes, fears about excessive costs especially in a very difficult and dangerous economic crisis, the ease with which "resistance fronts" can delay or thwart action both domestically and internationally, and of course the enormously high stakes involved in choosing badly or not choosing at all.

The lack of any strong actions on the part of governments has created a vacuum into which political activists have moved. Former Vice President Al Gore, for example, has made a notable effort to raise public support for immediate and massive responses to global warming and the associated components of environmental decline. Gore's warnings have been published in a well-known book[4] and in an associated documentary that won an academy award. His contributions were recognized in 2007 by the Nobel Prize.

By shifting his life's work from one political arena to another, Gore attracted world-wide attention to a movement that has at least begun to shift attitudes among the general public. Hardly a day goes by that newspapers and television reports do not feature a story about some aspect of

environmental concern or renewable energy. Advertisements by major corporations now feature claims about their products or policy developments intended to help this cause. It appears that there has been in the last decade at least the beginning of an attitude shift concerning the need to do something about these threats. It must be added, however, that strident warnings have been met by mixed reactions in some circles. Depicting threats in a manner that seems overwhelming and unstoppable without massive policy changes, the results of which are inherently uncertain, may elicit an abreaction, a deeper pessimism about the value of doing anything at all, reinforcing in effect the cognitive conservatism of most individuals who are reluctant to challenge the conventional wisdom or to alter basic views.[5]

As will be shown in detail in the coming chapters, our continued dependence on energy from hydrocarbon fuels – oil, gas, and coal – is the major cause of global warming as levels of carbon dioxide in the atmosphere continue to grow. Though this effect is generally understood, efforts to achieve a viable international agreement to cut emissions have foundered. The Obama administration's commitment to become involved in the negotiations to strengthen the Kyoto agreement "in a robust way," which initially generated a surge of optimism, seems in practice to have retreated somewhat from campaign rhetoric – not surprising, given the pressure of other issues and the complexity of creating a domestic consensus.[6] The issues are, of course, also intimately tied to political and economic considerations: higher oil prices, increasing dependence on potentially unreliable suppliers in potentially unstable areas of the world, increasing economic nationalism and resource nationalism, competition not only between producers and consumers but also between different consumers, increasing inequality and a growing sense of unfairness, and the likelihood of increased conflict within and between states fighting to control resources as paying for oil leaves less money to deal with other pressing domestic needs.

There are other political pressures worth noting, apart from the ability of powerful interest groups to thwart change and apart from the fact that virtually all political systems, especially democratic ones, have great difficulty in taking seriously any long-range plans. To these must be added the current economic crisis, whose effects may be with us for a decade. Further, there are clear temptations to hold closely any technological breakthroughs that do occur, considering them as valued intellectual property to be sold only at a very expensive price. Rather than treat the breakthrough as a public good to be shared, the creator may seek to hoard knowledge and earn the monopoly

rents that may become available. Such behavior is reminiscent of the so-called "beggar thy neighbor" policies of the 1930s, which sought to export problems rather than resolve them cooperatively, reinforced both then and now by the absence of an international institution to facilitate such cooperation, as well as by the absence of strong leadership from the rich and powerful.

An additional unexpected result might be described as the perverse effect of some seemingly good development. If the demand for oil decreases and its price falls, for example, the incentive to invest in alternative energy is reduced and may lead to a decline in government subsidies that would make it even harder for the alternatives to compete and survive. In effect, policymaking that is a captive of events – this year's recession, next year's boom – is episodic and inconsistent policymaking. There is also the possible effect of another "moral hazard": excessive enthusiasm for this year's quick fix, say carbon capture, may delay or undermine other painful policies that might begin to reduce emissions more quickly.

Given that the products of combustion of hydrocarbons are the major contributors to global warming – which is increasingly the consensus among a large majority of reputable scientists – and if the result is the increasing likelihood that many of the dangers and threats noted above will create global, regional, and national instability, declining standards of living, and (perhaps) a permanent state of crisis, fear, and anxiety, why has it been so difficult to forge common policies to avert such threats? It is not difficult to lay out what a sensible policy package should look like for the US or other nations or indeed for the international community as a whole, but putting those policies into practice has been and may continue to be an entirely different matter. We shall explore some of the reasons for this in the next section.

1.3 The Challenges We Face

We have already alluded to some of the obstacles that impede the development of effective national and international policymaking, to wit:

1 Powerful and rich interest groups have been and still are an obstacle to major reform of the existing energy economy.
2 There are strong divergences of interests between the developed countries and those of the third world, who distrust any notion of moving

away from a development strategy based on rapid industrialization and intensive use of conventional sources of energy.

3 The potential costs are vast and unappealing in a period of economic turmoil and fear.

4 Public opinion is not (yet?) a powerful voice for action and sacrifice.

5 No political system is good at taking long-run needs seriously, that is, paying heavily now to ensure future benefits or to avoid dangers that may not ever develop. The easier option is to "muddle through," to hope that something will turn up, or that someone else will bear the brunt of whatever transpires.

These are perhaps the most frequently cited obstacles to achieving a consensus, both domestically and internationally, on the need to implement – not merely assert the need for – a comprehensive strategy to deal with linked environmental and energy crises. But clearly one needs to try to deepen and extend this analysis beyond the mere recitation of familiar obstacles. There are avenues for persuading governments and their publics of the need to pay now or to sacrifice now in order to achieve uncertain benefits in the future, even the distant future. Summers has noted, for example, that the costs and benefits of a policy in the future are usually given less weight because of the tendency to value benefits today more than tomorrow, and because we believe that we are likely to get $1 worth of goods in the future by spending less than $1 today.[7] He points to a compensating factor however, the moral obligation "most of us have about our obligation to posterity." It should also be pointed out to the reluctant long-term investor that we have no guarantee of greater riches in the future, especially if our fears of global damage are in fact realized because of our neglect of the options available today.

Intergenerational equity has always rested on a kind of tacit norm about distributive justice: each generation accepts informal obligations toward the future because of its own expectations of future reciprocity. In the US this idea has been the basis of the programs for Social Security and Medicare, among others. In an environmental sense, this has implied that each generation can make fair use of land and resources for its own needs but cannot or should not injure future users by unnecessarily undermining or degrading the long-term productivity of that land or those resources. This was captured in the Brundtland Commission's definition[8] of "sustainable development" as development "that meets the needs of the present without compromising the ability of future generations to meet their own needs." This standard underlies our commitment

to preservation of park lands and protected wilderness areas, national policies that have long had broad acceptance and approval in our societies.

These formulations can serve us as guidelines or standards, but individual applications must still address operational questions in practice. How much should we pay now for uncertain future benefits? Who decides how and when to make what investments? Who should bear most of the costs now and enjoy most of the benefits in the future? How "future" is the future, that is, are we thinking 10 years ahead, or a generation – or what? There seems no alternative, at least in democratic societies, to accepting the fact that the decisions will be the uncertain outcomes of the political process, a process in which the needs of future generations will only be one interest among many.

One of the least discussed aspects of the current economic crisis is the level of anxiety and fear that it has generated among citizens at all levels of society, not merely the usual victims, the poor and powerless, but also the (formerly?) rich and confident. Fears about losing jobs, incomes, retirement benefits, a whole standard of living, are pervasive and not irrational. Unfortunately, playing on this fear and anxiety and attempting to manipulate these emotions for political or economic gain (especially through the popular media), exacerbates the problem. In this context, it is essential to cultivate in the public and among government leaders a willingness to think about future obligations and to counter the familiar biases associated with decisionmaking under uncertainty[9] by emphasizing repeatedly that there are options to be considered. The point here is not merely that arguing for inter-generational equity might remove a layer of difficulty and complexity in the negotiating process, but rather that its use could soften in some layers of the population (older, wealthier, influential) an otherwise consuming focus on their personal economic welfare.

It will not suffice to offer a few platitudes about the long-run consequences of excessive selfishness or reciprocal nationalisms; one also needs practical suggestions about how to create a viable negotiating process in such circumstances. We shall discuss this issue in more detail in a subsequent chapter. Here it is sufficient to say that "big bang" negotiations in a global conference setting may be a negotiating bridge too far, guaranteeing only stalemate or pious commitments that are rarely implemented. "Normal" incrementalism is also likely to be inadequate, which implies the need for a deeper, more sustained kind of incrementalism with consensual long-run goals approached by regular steps in a jointly agreed direction.

Another obstacle to the creation of viable international agreement, and one whose significance has not always been understood, is the absence of widely shared knowledge about the causes of a problem and what needs to be done to resolve it. Haas[10] has described this as "consensual knowledge," which is socially constructed, subject to testing and evaluation, and thus different from ideology in facing constant challenges. It has been difficult to establish such knowledge in the present context because of factual complexity and the extended time periods involved. Superimposed on these factors is the occasional dissent from the majority scientific opinions that can be used as reasons or rationalizations to resist action. Note, for example, the statement by three scholars that "the only reliable knowledge is that current understandings of the problem will be obsolete in ten or twenty years."[11] The tendency to pick and choose among different pieces of evidence and to ignore conflicting evidence is also an impediment to agreement. So too is the desire of politicians for certainties in an environment dominated by probabilities and uncertainties.

That knowledge is ambiguous, uncertain, and contested is not, however, an argument for doing nothing. It is, rather, an argument for an even stronger effort to create consensual knowledge especially by creating large panels of widely recognized experts to seek and publicize the best available knowledge and to provide enhanced funding for serious research projects. The success of the Intergovernmental Panel on Climate Change (IPCC), which won a Nobel Prize a few years ago, is illustrative of what can and should be done: its papers were far more authoritative and balanced than contrary efforts either by environmental alarmists or environmental skeptics and were at least helpful in supporting governmental decisions to take relatively strong policy positions on the issues. Of course, it would be easier to achieve consensus about strong commitments to action if one had something like the moon landing project in the US to rally support and engender enthusiasm. That project had reasonably strong consensual knowledge about how to pursue the task, strong leadership and public support, and the vision of a "race" with a determined enemy to justify the effort. Unfortunately, no such conjunction of circumstances exists either domestically or internationally to galvanize a similar outcome with regard to energy or the environment.[12] Some suggest that only an environmental disaster in the developed world would suffice, something akin to the Asian tsunami but hitting say London, or Paris, or Miami. That is, of course, an extraordinarily costly and irresponsible way to engender effective policy responses. Besides, the enormous surge in aid

giving immediately after the tsunami does not appear to have had a lasting effect on either regional governments or international institutions. With few exceptions (mostly in regard to installing better technical sensors) most responders seem to have retreated into business as usual.

Consensus begins at home; that is, the basic obstacle to achieving agreement, which we have already noted at various points, is the play of domestic politics. In effect, the problems we are discussing are sub-system dominant: international organizations, non-governmental organizations (NGO), and any other international entities lack the power and the resources to do much by themselves.[13] There are no clever tactics or stratagems to overcome this problem, but it is worth emphasizing an obvious point: with or without domestic consensus on the issues, strong and determined leadership is the crucial variable that permits a degree of hope in the current situation. Thus the replacement of the resistant Bush–Cheney administration by the Obama–Biden administration *may* allow the US to reassert leadership in the energy and environmental arenas and, finally, to receive a fair and respectful hearing for its policies and positions. But determined action may have to wait upon successful navigation through the current economic crisis.

The environment has rarely been a "front burner" issue for most governments and until recently even the energy issue has only been front and center when there has been a sudden surge in oil prices. As a result, conferences on these issues have tended to be dominated by environmental advocates, industry advocates, environmental scientists, and mid-level government bureaucrats. Thus, for example, in retrospect many officials who participated in negotiating the Kyoto Protocol in 1997 "… now say they see it as weak and naïve about political and economic realities." As a British official said, "In Kyoto, we made a lot of promises to each other, but we hadn't done the domestic politics and that is why Kyoto … has ultimately been so fragile."[14] There are two simple points here: negotiations have to be driven by committed and high-level leadership, especially from the US, and expertise about domestic political constraints is crucial if one wants agreements that will be ratified and implemented. In sum, the obstacles are severe and the tools to deal with them are as yet underdeveloped.

But to acknowledge the problems that face us does not condemn us to surrender to them, and it is the purpose of this book to offer constructive approaches that can mitigate unwelcome effects and even avert them where possible. Our suggestions will focus on both policy and science technology, whichever choice or combination of choices will serve these ends.

Notes and References

1. There is an excellent column about this incident by Thomas L. Friedman, see "Going Cheney on Climate," *New York Times*, December 9, 2009, p. A37.
2. This is not meant to deny that the furor over the leaked e-mails *did* make some difference. Thus, in an environment where public attention is focused on the economy and the skeptics and deniers speak with an inappropriate degree of certainty, a poll in the months after the incident indicated that the share of the public who do not believe climate change is happening increased from 15% to 25% and the percentage who do think it is happening and man-made dropped from 41% to 25%. See "Greener than Thou," *The Economist*, February 13, 2010, p. 61.
3. The diametrically conflicting views of the Worldwatch Institute and the Competitive Enterprise Institute are discussed in William D. Sunderlin, *Ideology, Social Theory, and the Environment* (Lanham, MD: Rowman and Littlefield, Inc., 2004), pp. 178–9.
4. Al Gore, *An Inconvenient Truth* (Emmaus, PA: Rodale, 2006).
5. Andrew C. Revkin, "In Debate on Climate Change, Exaggeration is a Common Pitfall," *New York Times*, February 25, 2009, p. A14.
6. See Elisabeth Rosenthal, "At U.N. Talks on Climate, Plans by the U.S. Raise Qualms," *New York Times*, April 9, 2009, p. A14.
7. Lawrence Summers, "Foreword," in Joseph E. Aldy and Robert N. Stavins, eds, *Architectures for Agreement: Addressing Global Climate Change in the Post-Kyoto World* (Cambridge, UK: Cambridge University Press, 2007), p. xix.
8. Brundtland Commission, Report of the World Commission on Environment and Development, published as *Our Common Future* (Oxford, UK: Oxford University Press, 1987).
9. For comments on the problems of decisionmaking under uncertainty and in an environment of fearfulness, see Daniel Gardner, *The Science of Fear* (New York: Dutton, 2008), p. 39ff.
10. Ernst B. Haas, *When Knowledge is Power: Three Models of Change in International Organizations* (Berkeley, CA: University of California Press, 1990), p. 21.
11. Peter M. Haas, Robert O. Keohane, and Mark A. Levy, "Improving the Effectiveness of International Environmental Institutions," in Peter M. Haas, Robert O. Keohane, and Marc A. Levy, eds, *Institutions for the Earth* (Cambridge, MA: MIT Press, 1993), p. 410.
12. In any case, perhaps the moon landing is an inappropriate analogy because we do not have a single aim in the policy debates on climate change but rather many aims, some of which compete with each other.

13. Peter M. Haas, Robert O. Keohane, and Mark A. Levy, "Improving the Effectiveness of International Environmental Institutions," op. cit., pp. 397–426.
14. Both quotes are from Elisabeth Rosenthal, "Obama's Backing Increases Hopes for Climate Pact," *New York Times*, March 1, 2009, p. 10.