
BE COOL! STAYING OPEN MINDED ABOUT CLIMATE POLICY DEVELOPMENT

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In the competition for the limited attention span that the American polity devotes to environmental issues, there can be no doubt that global climate change is in a category by itself.¹ Regardless of relative position on the political spectrum, the American public and its leaders have come to agree on once controversial elements of the climate narrative. Discussion of the greenhouse effect and its implications were once the boutique musings of environmental policy wonks. No longer. A major motion picture,² an Academy Award,³ a Nobel Prize,⁴ not to mention frequent appearances throughout the popular culture, have elevated climate change to celebrity status.

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1. Cass R. Sunstein, *Of Montreal and Kyoto: A Tale of Two Protocols*, 31 HARV. ENVTL. L. REV. 1, 44-46 (2007) (discussing public opinion regarding climate change). While Sunstein cites survey data showing that the American public opinion does not support drastic action on climate change or any environmental topic for that matter, he does concede that media attention on climate change and its symbols has been gaining momentum throughout the 1990s. *Id.*

2. *An Inconvenient Truth* (Paramount Pictures 2006). Actually, two motion pictures, if you count *The Day After Tomorrow* (20th Century Fox Studios 2004).

3. The Oscars, *Winner: Documentary Feature*, <http://www.oscar.com/oscar/night/winners/?pn=detail&nominee=AnInconvenientTruthDocumentaryFeatureNominee> (last visited Feb. 24, 2007). Former Vice President Albert V. Gore offered the following remarks on accepting the Academy Award, “Thank you. I want to thank Tipper and my family, thank the Academy and everyone on this amazing team. My fellow Americans, people all over the world, we need to solve the climate crisis. It’s not a political issue, it’s a moral issue. We have everything we need to get started, with the possible exception of the will to act, that’s a renewable resource. Let’s renew it.” *Id.*

4. Vice President Gore received a share of the 2007 Nobel Peace Prize for his work on global climate change. His acceptance speech can be viewed and read on his blog posting, *I Am Deeply Honored*, AL GORE, Oct. 12, 2007, http://blog.algore.com/2007/10/i_am_deeply_honored.html.

Now that an emerged consensus advocating action forms the basis of the climate discussion, we need only discuss a principled basis for deciding among proposed policy solutions to address the problem. As Mencken remarked, however, complex problems often have solutions that are “neat, plausible and wrong.”⁵ Unfortunately, given the proven and purported environmental and economic impacts associated with climate policy, the consequences of being wrong are significant. Policy makers are well advised to be at least as careful in joining in any policy consensus as they were in accepting a scientific one.

This essay will examine briefly the common ground of the emerged political consensus to take action on climate change. Then, we will briefly review the current options to address climate change—with a particular emphasis on exploring incentives-based concepts. Next, the essay will address the downside consequences of an improperly calibrated climate change policy. And last, we will conclude with upsides—environmental, energy and economic—of properly addressing the opportunity presented by innovative climate change policy.

I. THE EMERGED CONSENSUS

Not long ago, the climate narrative was dominated by the story that climatic history could be divided into glacial and interglacial periods—ice ages and temperate ages.⁶ The notion was that Earth was nearing the end of its current interglacial period—the one responsible for the development of current human culture. A combination of anthropogenic emissions and activities were hastening the arrival of the next ice age. Concerted international action was needed; at the very least, reexamination of the primacy of economic growth was in order.⁷

Since that time, the climate narrative has changed. The consensus view, as expressed by the United Nation’s

5. H.L. Mencken’s full remark is, “There’s always an easy solution to every human problem—neat, plausible, and wrong.” H.W. LEWIS, *TECHNOLOGICAL RISK* 48 (1990) (citing H.L. Mencken).

6. David S. Chapman & Michael G. Davis, *Global Warming— More Than Hot Air?*, 27 *J. LAND, RESOURCES, & ENVTL. L.* 59, 59-60 (2007). For a general discussion of climactic periods, see *id.* at 59-77.

7. See, e.g., LOWELL PONTE, *THE COOLING* (1976) (quoting climatologist Stephen Schneider on the back cover as stating that this “well-written book” hypothesizing global cooling may support the notion that “massive world-wide actions to hedge against that threat deserve immediate consideration”).

Intergovernmental Panel on Climate Change (IPCC)⁸ and others, is that the Earth is in the grips of a warming trend, or a perceptible increase in the average mean temperature of the atmosphere. As far as the science goes, “the debate on global warming is over.”⁹ Indeed, one study has found that three quarters of all climate studies support the essential principles that carbon dioxide and other greenhouse gases (GHGs) are increasing, that warming is occurring, and that human activity plays a contributing role.¹⁰ Questions regarding the rate of change and the extent to which controls on emissions will help still exist. But, unsurprisingly, most agree that concerted international action is needed; at the very least, reexamination of the primacy of economic growth is in order.¹¹

There is as much hubris in stating that climate science is perfect as there is in stating that it is without merit. It is perhaps most useful to simply say that climate science is robust enough to support the political consensus for action. As a corollary, it is no longer useful to lodge purely scientific arguments as the basis to reject the adoption of proposals designed to reverse or at least ameliorate the consequences of climate change. As Professor Richard Pierce has written, “I now rate the probability that the anthropogenic global warming hypothesis is true at around 90%. . . . It is time to shift most of the public debate from whether anthropogenic global warming is real to what we should do about it.”¹²

There is a central irony behind the recently emerged political consensus: for all the blood, sweat and intellectual tears spilled in the climate debate, was it needed after all? Scholarship and commentary on climate change has come to the fore in roughly the same time

8. Elisabeth Rosenthal & James Kanter, *Alarming UN Report on Climate Change Too Rosy, Many Say*, INT’L HERALD TRIBUNE, Nov. 18, 2007, <http://www.ihf.com/articles/2007/11/18/europe/climate.php?page=2> (stating that “most scientists have been awed by the IPCC’s deliberate work”).

9. Gary Stix, *A Climate Repair Manual*, SCI. AM., Sept. 2006, at 46.

10. Naomi Oreskes, *Beyond the Ivory Tower: The Scientific Consensus on Climate Change*, Science, Dec. 2004, <http://www.sciencemag.org/cgi/content/full/306/5702/1686> (writing that 75 percent of the 928 abstracts listed in the Institute of Scientific Information between 1993 and 2003 that contained “climate change” as a key word either explicitly or implicitly endorsed the consensus viewpoint); see also Daniel J. Grimm, *Global Warming and Market Share Liability: A Proposed Model for Allocating Tort Damages among CO₂ Producers*, 32 COLUM. J. ENVTL. L. 209, 212 (2007).

11. See, e.g., Mary Christina Wood, *Nature’s Trust: A Legal, Political and Moral Frame for Global Warming*, 34 B.C. ENVTL. AFF. L. REV. 577, 587-89 (2007).

12. Richard J. Pierce, Jr., *Energy Independence and Global Warming*, 37 ENVTL. L. 595, 597 (2007).

frame as scholarship and commentary on the diminishing supplies of key fossil fuels¹³ and the security risks presented by continuing reliance on foreign sources of supply.¹⁴ All of these trends counsel policy makers to take the same course: diversify our sources of energy and deploy new technologies.¹⁵ In any event, these simultaneous strands of public argument seem to be largely mutually reinforcing—at least on the need for action.

II. OPTIONS CURRENTLY ON THE TABLE

A quick screening of the film *An Inconvenient Truth*¹⁶ yields another truth: the vast majority of the film dwells on the science and consequences of climate change. Very little of the film dwells on solutions, save cursory statements that flash during the closing credits.¹⁷ In that sense, the award-winning film is a reasonable facsimile of the actual state of policy analysis. With the seeming acquiescence of the press, much of the climate discourse in the current Presidential campaign has focused on general statements on the issue; little attention has been paid to the nuances of the policy options.¹⁸

13. See, e.g., M. King Hubbert, *Nuclear Energy and the Fossil Fuels* Mar. 7-9 1956, <http://www.hubbertypeak.com/hubberty/1956/1956.pdf>. Scholarship regarding the “peak oil” hypothesis has been gathering currency roughly since the work of M. King Hubbert in the mid-1950s. The peak theory posits that there exists a rough bell curve in the amount of available crude petroleum and natural gas reserves, and that current production is on the downside of that curve. For recent support, see John Donnelly, *Price Rise and New Deep-water Technology Opened Up Offshore Drilling*, BOSTON GLOBE, Dec. 11, 2005, at A36 (quoting an ExxonMobil exploration official, who stated, “All the easy oil and gas in the world has pretty much been found”). The peak theory may be approaching consensus. See Russell Gold & Ann Davis, *Oil Officials See Limit Looming On Production*, WALL STREET J., Nov. 19, 2007, at A1 (“A growing number of oil-industry chieftains are endorsing an idea long deemed fringe: The world is approaching a practical limit to the number of barrels of crude oil that can be pumped every day. Some predict that, despite the world’s fast-growing thirst for oil, producers could hit that ceiling as soon as 2012.”).

14. See MILTON R. COPULOS, THE NAT’L DEF. COUNSEL FOUND., AMERICA’S ACHILLES HEEL THE HIDDEN COSTS OF IMPORTED OIL 7 (Oct. 2003), available at <http://www.ndcf.org/> (finding in part that “as long as America remains heavily dependent on imported crude, its national security remains jeopardized”).

15. *Id.* at 108.

16. *An Inconvenient Truth*, *supra*, note 2.

17. See *id.*

18. See, e.g., *How Green Is Your Candidate? Interviews and info on the presidential candidates’ environmental positions*, GRIST, Mar. 6, 2008, <http://www.grist.org/feature/2007/07/06/candidates/> (describing early Clinton campaign positions on climate as “vague about solutions” and Obama campaign positions as “largely platitudinous on energy and climate” and noting both have since become more detailed). Initially, the Presidential campaigns were

There are a number of reasons why open and honest discussion of public policy response has been so limited. Perhaps copy and images related to policy just don't touch the popular zeitgeist in the same way as the symbolism of science, from floods to storms to polar bears.¹⁹ Perhaps the adoption of policy is not without costs, and the imposition of costs likely to be reflected in the price of energy may well have regressive impacts on those in society least able to afford it.²⁰ Or perhaps developing credible and cost-effective policy acceptable to the public is just plain hard.²¹

Despite the lack of truly definitive analysis, policy makers—particularly those in Congress—seem most enamored with the concept of an emissions cap coupled with a trading regime.²² Such an

largely symbolic in their discussion of climate change. *Id.* They were less than clear about specific policy proposals, although each has since released more detailed proposals. *Id.* Despite releasing more detailed plans, there has been little public discourse comparing these policies. The media has not forced the issue in any meaningful way. See Kim Zetter, *Al Gore makes impassioned plea to TEDsters*, WIRED.COM, Mar. 3, 2008, <http://blog.wired.com/business/2008/03/al-gore-makes-i.html> (citing data gathered by former Vice President Al Gore on “the number of questions that broadcast media outlets posed to presidential candidates last year [2007] about the climate crisis”). NBC’s top journalists asked 956 questions of the candidates, but only two of them were about the climate crisis. *Id.* ABC journalists asked 844 questions; two of which were about the crisis. *Id.* Fox and CNN also asked two questions on the topic, and CBS had “asked none.” *Id.* In a general sense, failure to discuss specific policy in detail should come as no surprise given the “ebb and flow” of campaign rhetoric. See BRUCE BUCHANAN, *RENEWING PRESIDENTIAL POLITICS: CAMPAIGNS, MEDIA, AND THE PUBLIC INTEREST* 74 (1996) (noting that “‘politics as usual’ will always bid strongly to supplant issue campaigns” in part because the personal and negative components of modern campaigns “usually marginalize the issues discussion by reducing the attention issues get in the media, which is more attracted to the ebbs and flows of political combat than to policy substance”).

19. Sunstein, *supra* note 1, at 46 (discussing the centrality of the need to associate climate change with “a cognitively ‘available’ event [that] . . . might well lead to a substantial increase in concern”).

20. Cass R. Sunstein, *Irreversible and Catastrophic*, 91 CORNELL L. REV. 841, 881-82 (2005-06) (“[A]ny significant effort to curtail global warming would impose significant hardships, especially on poor people, who are least able to bear the relevant cost increases.”).

21. See Daniel Yankelovich, *How Public Opinion Really Works*, FORTUNE, Oct. 5, 1992, available at http://money.cnn.com/magazines/fortune/fortune_archive/1992/10/05/76926/index.htm (“Wrestling with complex issues—abortion, the death penalty, immigration, censorship, environmental protection, homelessness, as well as health care—requires getting in touch with one’s deepest values and often realizing that these may conflict with one another on a particular question. People naturally resist having to compromise or abandon cherished values.”).

22. *The Impact of America’s Climate Security Act of 2007 (S. 2191) on the U.S. Economy and on Global Greenhouse Gas Emissions: Hearing Before the S. Comm. on Env’t. and Public Works*, 110th Cong. 5, (2008), available at http://epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=132d40b2-ff1d-4dcc-a58d-022c80aa824d (statement of, Margot Thorning, Ph.D., Senior Vice President and Chief Economist, Amer. Coun. for Capital Formation) [hereinafter “Thorning Statement”]. Thorning claimed the proposition that success of Acid Rain program and start of European trading program have caused many in Congress to

approach would set a hard and declining limit on greenhouse gas emissions from the principal emitting sectors in the economy.²³ Those reducing beyond the cap would generate credits that could be traded to those that cannot quite meet the cap.²⁴

Doubtless, the greatest attraction of cap and trade regimes in the climate change context is the generally accepted success of a cap and trade program in reducing emissions that cause acid rain.²⁵ This line of analysis contends that all policy makers need do is “plus up” the acid rain program adopted under the Clean Air Act Amendments of 1990 in order to produce a ready-made policy response to climate change. Indeed, proponents of stringent caps even claim that because some in industry opposed the acid rain program prior to 1990, and because the program worked, such industry objections to GHG caps should be viewed through a skeptical lens today.²⁶

Despite the great success of earlier trading programs, there is no doubt that correctly calibrating a cap-and-trade program for GHG emissions will be challenging. Yale economist William Nordhaus has raised several specific obstacles to a well-functioning trading program in the climate context, summarized as follows:

Such a program would require nations to make coordinated decisions about emissions baselines that would be difficult or impossible to make. It would create so much uncertainty about the future prices of emissions permits that trade in permits would be severely impaired. A global cap and trade system would also

express support for cap-and-trade program for GHG emissions. *Id.* (citing Ian W.H. Parry & William A. Pizer, *Emissions Trading Versus CO₂ Taxes*, WEATHERVANE, May 2007, <http://www.weathervane.rff.org/Backgrounders/RFF-BCK-TradingvsTaxes.pdf>).

23. Description of cap and trade programs proposed in the current Congress can be found at Larry Parker & Brent D. Yacobucci, *Greenhouse Gas Reduction: Cap-and-Trade Bills in the 110th Congress*, CONG. RES. SERV. REPT. NO. RL33846, at 1 (Jan. 31, 2008), available at <http://www.ncseonline.org/NLE/CRSreports/07Dec/RL33846.pdf> (“In general, these proposals would create market-based greenhouse gas reduction programs along the lines of the trading provisions of the current acid rain reduction program established by the 1990 Clean Air Act Amendments.”).

24. *Id.*

25. Zachary Coile, ‘Cap-and-Trade’ Model Eyed for Cutting Greenhouse Gases, S.F. CHRON., Dec. 3, 2007, at A1, available at <http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/12/03/MNMMTJUS1.DTL>.

26. *Id.* (noting proposals are based on 1990 Acid Rain program). However, comparisons to the 1990 Acid Rain program can be highly problematic. *See id.* (“[A]ny effort to limit greenhouse gases will be an order of magnitude bigger and more costly than the acid rain program. While the acid rain initiative was focused on just one pollutant, sulfur dioxide (nitrogen oxides were later added), the new proposals seek to limit carbon dioxide and five other pollutants. The acid rain program focused on electricity producers, while the new efforts would affect utilities, large manufacturers and the transportation sector as well.”).

produce highly volatile energy prices and be characterized by transactions costs so high they would impair its efficacy. Finally, Nordhaus fears a global cap and trade system would be plagued by pervasive corruption.²⁷

Despite any reservations in the literature, however, there can be little doubt at this point that a trading program for GHG emissions will at least be part of any solution. The architecture of such an approach is familiar to both the regulated community and the public interest community, as well as to government officials likely to implement the program. That said, a “simmering debate” has erupted over the use of carbon tax schemes as an alternative to trading programs. Cap-and-trade policies “set an overall limit—squeezed lower and lower over time—on the amount of”²⁸ GHG emissions, and then allow for trading. By contrast:

A carbon tax reverses the process. The government would impose a tax on carbon output, gradually raising the price of energy produced from fossil fuels to higher and higher levels. The cost of coal would go up the most, because it emits more carbon dioxide for each unit of energy, with the price rising less for products derived from oil like gasoline and jet fuel, and even less for natural gas. The money raised by the tax, ideally, would be used to offset other taxes in ways that could compensate lower-income households and minimize damage to the economy.²⁹

Many economists seem to believe that a carbon tax would be “a superior policy alternative to an emissions-trading regime.”³⁰ This is because of the tax’s ability to enhance administrative effectiveness, efficiency, the right-sizing of incentives, the minimization of corruption, the relative ease of regulatory burden, and so on.³¹ However, even as academic and policy discussion pitting trading regimes against taxes has flourished, trading regimes continue in the ascendancy, if for no other reason than the public’s aversion to tax increases. This appears to be so, even if a trading regime behaves like

27. Pierce, *supra* note 12, at 600-601 (citing William D. Nordhaus, *After Kyoto: Alternative Measures to Control Global Warming*, 96 AM. ECON. REV. 31, 31-34 (2006)).

28. Tom Redburn, *The Real Climate Debate: to Cap or to Tax?*, N.Y. TIMES, Nov. 2, 2007, available at http://www.nytimes.com/2007/11/02/us/politics/04web-redburn.html?_r=1&oref=slogin.

29. *Id.*

30. *Id.*

31. Kenneth P. Green, Stephen F. Hayward, and Kevin A. Hassett, *Climate Change: Caps v. Taxes*, AMER. ENTER. INST. FOR PUB. POL. RESEARCH, ENVTL POLICY OUTLOOK, June 1, 2007, available at http://www.aei.org/include/pub_print.asp?pubID=26286.

a form of tax anyway, with the government collecting revenue from auctioned credits and redistributing the funds as it sees fit.³²

While there is a healthy intellectual exchange on the pros and cons of trading programs and carbon taxes, it appears that these are the only principle tools under discussion. It has been suggested that the use of modern environmental decision-making essentials could yield no other result. Both a cap-and-trade program and a taxation scheme, along with forerunner concepts of traditional command-and-control regulation, share in common the notion that interposition of government will is a superior approach to the creation of positive incentives to induce social change. Ted Nordhaus and Michael Shellenberger have postulated that environmental thinkers have trapped themselves in “the politics of limits” and are still searching for ways to apply existing beliefs in innovation and entrepreneurship to the desire for positive environmental outcomes.³³

Nordhaus and Shellenberger suggest that pollution control strategies alone are insufficient to address as sweeping an international problem as global climate change. Instead, society must stand ready to implement the incentives of the marketplace as a central feature of a comprehensive solution. They write:

[O]vercoming global warming demands something qualitatively different from limiting our contamination of nature. It demands unleashing human power, creating a new economy, and remaking nature as we prepare for the future. And to accomplish all that, the right models come not from raw sewage, acid rain, or the ozone hole but instead from the very thing environmentalists have long imagined to be the driver of pollution in the first place: economic development.³⁴

Any approach to addressing climate change—no matter what the balance of incentives to mandates—must encourage technological innovation fit to the task of transforming society. One observer has noted that, as it currently stands, there is “no magic Tylenol that will cure this temperature rise overnight, because carbon dioxide can

32. Pierce, *supra* note 12, at 601 (“Many politicians and business leaders prefer a cap and trade system to a carbon tax, but those preferences are based on dubious reasoning. Many politicians prefer cap and trade because it allows them to avoid the dreaded ‘t’ word. They either do not realize, or prefer to ignore, the reality that cap and trade imposes a ‘tax’ that is functionally identical to a carbon tax. Either mechanism can be effective only by increasing the price of carbon-dioxide emitting activities by the same large amount.”).

33. TED NORDHAUS AND MICHAEL SHELLENBERGER, *BREAK THROUGH: FROM THE DEATH OF ENVIRONMENTALISM TO THE POLITICS OF POSSIBILITY* 31-40 (Houghton Mifflin 2007).

34. *Id.* at 113.

persist in the atmosphere for up to a few centuries.”³⁵ This, of course, is the central flaw in the products of prior international efforts to address climate change. Left unaddressed at Kyoto was the notion that climate change requires “an energy technology revolution on a global scale” that would facilitate significant reductions in GHG emissions at “acceptable costs.”³⁶ Available experience from international efforts to regulate ozone-depleting substances further underscores the point: it was only at the point that practical technological alternatives were clearly on the horizon that an international treaty limiting chlorofluorocarbons became acceptable.³⁷ As we shall see, proceeding with a regulatory regime before technology is reasonably available is fraught with complications.

III. THE PROBLEM OF “CHOOSING POORLY”

In the film classic *Indiana Jones and the Last Crusade*,³⁸ the villain must choose among various options to identify the Holy Grail. Tantalized by the shiny, jeweled choice, he turns to dust. An aging knight, observing the mess, states wryly, “He chose . . . poorly.”³⁹ Given what’s at stake in the context of global climate change policy, we had better hope for a more salubrious outcome. The consequences of “choosing poorly” are potentially adverse for the environment, the economy, and even public health.

A. Environmental Consequences

In evaluating the environmental consequences of poorly calibrated regulatory schemes to reduce GHG emissions, we must begin by asking what is to be gained if the scheme performs as hoped. Even if the Kyoto Protocol had performed as hoped, climate models indicate that the mechanism may have only delayed the onset of global warming by seven days by the end of this century. Even

35. Wood, *supra* note 11, at 581.

36. Richard E. Benedick, *Avoiding Gridlock on Climate Change*, ISSUES IN SCIENCE AND TECHNOLOGY, Jan. 9, 2007, available at http://www.issues.org/23.2/p_benedick.html.

37. Sunstein, *supra* note 1, at 63-64 (“[T]echnological innovation is highly desirable as a means of reducing the costs of regulation [of greenhouse gases].”). Indeed, Sunstein contends based upon experience with ozone-depleting substances, that “[t]echnological innovation led the world to believe it had less to lose from regulation than it originally feared.” *Id.* at 34.

38. Jeff Boam, *Screenplay to “Indiana Jones and the Last Crusade”* (Paramount Pictures 1989), available at <http://www.scifiscripts.com/scripts/Indiana3.txt>.

39. *Id.*

assuming the United States and Australia had signed on ab initio, effects would only be postponed by five years by the end of this century.⁴⁰ Put another way, the consequences of global warming will continue “even if we stop emitting all greenhouse gases tomorrow.”⁴¹ The importance of these observations is not that they counsel policymakers to do nothing; rather, they suggest that no climate policy⁴² can be expected to gain the benefits of reversing climate change in any complete sense, and that such policies are more defensible if they can be embraced on a “no-regrets” basis.⁴³ A no-regrets policy yields energy, security or environmental benefits, even if climate benefits ultimately prove dubious.

One reason that U.S. climate policy might fail to produce the desired environmental effect is that unilateral action on the part of the United States does not guarantee the participation of developing nations, including China and India.⁴⁴ In particular, China’s extraordinary rate of industrialization⁴⁵ over the last few decades has made its emissions particularly problematic.⁴⁶ By some estimates, China has already overtaken the United States in GHG emissions,

40. Bjorn Lomborg, *Chill Out: Stop Fighting Over Global Warming—Here’s the Smart Way to Attack It*, WASH. POST, Oct. 7, 2007, at B1.

41. NORDHAUS & SHELLINGER, *supra* note 33, at 13. See also Sunstein, *supra* note 1, at 33 (describing “meager effect” of Kyoto Protocol in “reducing anticipated warming”); Chapman & Davis, *supra* note 6, at 72 (stating that even stabilization requires halving emissions).

42. A possible exception to this statement would be the adoption of geoengineering proposals, including iron fertilization, stratospheric sulfur injection, space-based mirrors, and the like. However, “[n]one of these geoengineering solutions . . . is cost effective, and many have other environmental drawbacks.” Chapman & Davis, *supra* note 6, at 71.

43. Joshua W. Busby, *Climate Change and National Security: An Agenda for Action*, COUNCIL ON FOREIGN RELATIONS REPORT NO. 32, Nov. 2007, at 11, available at http://www.cfr.org/content/publications/attachments/ClimateChange_CSR32.pdf (calling on the United States to “prioritize so-called no-regrets policies, those that it would not regret having pursued even if the consequences of climate change prove less severe than feared”).

44. NORDHAUS & SHELLINGER, *supra* note 33, at 12 (“China and India long ago rejected any approach to addressing climate change that would constrain their greenhouse gas emissions or their economic growth.”).

45. Srinivasan, *Regulating the Belching Dragon: Rule of Law, Politics of Enforcement, and Pollution Prevention in Post-Mao Industrial China*, 18 COLO. J. INT’L ENVTL. L. & POL’Y 267, 270 (2007) (noting the “runaway economic growth” growth of China that was four times the growth rates of advanced economies during the 1990s).

46. *Id.* at 271 (noting that the EPA found that more than twenty-five percent of the atmospheric pollution on the U.S. West Coast relates to Chinese production).

and is on track to account for some forty percent of total global GHG emissions by 2020.⁴⁷

The importance of China and other developing nations in assessing the environmental consequences of U.S. policy cannot be overstated. As Pierce has observed, “[a]ny effort that excludes major nations would be an expensive exercise in futility. It would yield more geographic redistributions of emissions than reductions in emissions.”⁴⁸ Sunstein notes that “[f]or the United States, unilateral action to comply with the Kyoto Protocol may well produce no benefits at all”⁴⁹ Such redistribution of productive assets to China could make matters even worse for the environment, given the comparative lack of institutional environmental controls.⁵⁰

Some have argued that the United States must lead by example, potentially drawing recalcitrant nations along in its wake.⁵¹ While this outcome is possible, so is its opposite. Unions for Jobs and the Environment, a group of ten major U.S. labor organizations and a non-governmental observer accredited by the United Nations Framework Convention on Climate Change,⁵² has argued that if environmental advocates “were to succeed in . . . forc[ing] unilateral reductions in the US, without regard to foreign policy, the US would lose an important source of foreign policy leverage; namely, the

47. Geraldine Tyrrell, *Chinese Pollution Control Laws: Moving Towards Sustainable Development?*, 10 ASIA PAC. J. ENVTL. L. 67, 69 (2007); see also Keith Bradsher, *China to Pass U.S. in 2009 in Emissions*, N.Y. TIMES, Nov. 7, 2006, at C1.

48. Pierce, *supra* note 12, at 600. See also Unions for Jobs and the Environment, Amicus Brief at 7, *Massachusetts v. Env'tl. Prot. Agency*, 127 S. Ct. 1438 (2007) (No. 05-1120), [hereinafter UJAE Brief] (“GHG emissions from all sources in all nations contribute to an undifferentiated worldwide concentration in the upper atmosphere Therefore, the potential benefit of GHG emission reductions made in the US can be thwarted when emitters in other nations increase or refuse to reduce their emissions.”).

49. Sunstein, *supra* note 1, at 34.

50. See Sitaraman, *supra* note 45, at 335 (citing China’s “lack of strong centralized environmental administration” and its “deep-seated political unwillingness to disrupt economic growth, combined with corruption and local protectionism” that prevents it from enforcing even its own environmental standards).

51. See Andrew C. Revkin, *As China Goes, so Goes Global Warming*, N.Y. TIMES, Dec. 16, 2007, at 4.3 (quoting BinBin Jiang, a research associate in energy and development at Stanford University, who stated, “China is clearly responsible for the largest wedge of emissions in the future, but the United States is still the biggest roadblock. The U.S. is not going to be influential by telling China what to do. It has to lead by example”). See also Zachary Coile, *Emissions Bill Heads to Fight on Senate Floor*, S.F. CHRON., Dec. 6, 2007 (citing U.S. Sen. John Warner, stating, “If we don’t act, China and India will simply hide behind America’s skirts of inaction and take no steps of their own”), available at <http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/12/06/MNIBTP0QH.DTL&hw=boxer&sn=003&sc=787>

52. UJAE Brief, *supra* note 48, at 1-2.

ability to insist on commitments by other nations as a precondition for its own GHG reductions.”⁵³ The Supreme Court has recognized this exact strategy, withholding unilateral action as leverage, as a principled basis for preempting inconsistent state action.⁵⁴ At oral argument in *Massachusetts v. EPA*, Justice Alito raised the concern.⁵⁵

The policy challenge of addressing climate change in many parts of the world includes not just emissions control but also adaptation to the effects of climate change. Even assuming full compliance with environmental controls in developing nations, there still may be heightened impact associated with climate-related damages. A massive investment overseas in regulatory programs could even have the perverse effect of reducing resources available for needed climate adaptation programs⁵⁶ or disease prevention programs.⁵⁷

B. Economic Consequences

Senator Joseph Lieberman (D-CT), one of the principal architects of climate change legislation currently pending before the U.S. Senate, has been refreshingly candid about the impact of his proposed legislation on certain sectors of the economy, noting that the bill would cost “hundreds of billions” of dollars over the next few decades.⁵⁸ Unfortunately, these compliance costs are not borne equally across the U.S. economy. Those in society least able to afford increased prices of energy and manufactured goods will be hurt the most by poorly calibrated carbon caps. In particular, the elderly,

53. *Id.* at 26.

54. See *Crosby v. Nat'l Foreign Trade Council*, 530 U.S. 363, 376 (2000) (finding that forbearance from domestic action constitutes foreign policy because without such forbearance “the President has less to offer and less economic and diplomatic leverage as a consequence”); see also *Am. Ins. Ass'n v. Garamendi* 539 U.S. 396, 427 (2003).

55. Transcript of Oral Argument at 55, *Massachusetts v. Env'tl. Prot. Agency*, 127 S. Ct. 1438 (2007) (Justice Alito references the “view that for the United States to proceed unilaterally would make things worse and therefore they're going to decline to regula[te] for that reason”), available at http://www.supremecourtus.gov/oral_arguments/argument_transcripts/05-1120.pdf.

56. Lomborg, *supra* note 40, at B1 (“If we focus instead on environmental concerns and, for instance, adopt the hefty cuts in carbon emissions many environmental groups promote, this could reduce the rise by about five inches. But cutting emissions comes at a cost: Everybody would be poorer in 2100. With less money around to protect land from the sea, cutting carbon emissions would mean that more dry land would be lost, especially in vulnerable regions such as Micronesia, Tuvalu, Vietnam, Bangladesh and the Maldives.”).

57. *Id.* (“According to scientific models, implementing the Kyoto Protocol for the rest of this century would reduce the malaria risk by just 0.2 percent. On the other hand, we could spend \$3 billion annually—2 percent of the protocol's cost—on mosquito nets and medication and cut malaria incidence almost in half within a decade.”).

58. Thorning Statement, *supra* note 22, at 5.

those living on fixed incomes, and those living at or near the poverty level have a greater proportion of their income dedicated to energy-related expenses, rendering the impact of carbon caps potentially very regressive.⁵⁹ Even when cap-and-trade programs are designed to rebate some portion of proceeds to the poor, most of the cost of the cap is still borne by consumers.⁶⁰ This problem persists even when creative mechanisms are employed to distribute carbon allowances.

The precise economic impacts that can be attributed to a climate change policy vary greatly depending on the details of the legislation and the assumptions made in the economic models employed. For example, there has been no authoritative government analysis of the economic impact of S.2191, legislation introduced by Senator Lieberman and Senator John Warner (R-VA). One analysis conducted by Charles River Associates (CRA) has found that near-term price increases related to the bill's implementation "would be disruptive to the economy, and cause a painful transition."⁶¹ CRA also found a potential increase of some 36 percent to 65 percent in wholesale electricity prices alone, continuing to rise by 2050 to the range of an 80 percent to 125 percent increase.⁶² The bottom line economic assessment: U.S. gross domestic product (GDP) could be lower in 2015 by about \$160 billion to \$250 billion. Eventually, found CRA, the annual loss in GDP attributable to the Lieberman-Warner legislation would increase to the range of \$800 billion to \$1 trillion.⁶³

Large-scale negative economic consequences, regressively borne by American consumers, should give policy makers some pause. For cost of this magnitude also creates the potential for a vicious cycle in which economic consequences tamp down the potential of the economy to stimulate technological innovation. As the National Institute of Standards and Technology found, "the overall health of

59. Sunstein (2006), *supra* note 20, at 881; *see also* Scott Segal, Public Hearing Statement of the Electric Reliability Coordinating Council, Mar. 7, 2006, *available at* <http://www.electricreliability.org/vc.php?cid=81> ("If regulations force utilities to shift from coal to natural gas, the result is predictable. As Catholic Charities of Cleveland has testified that, 'the conversion to natural gas from coal would have a devastating effect on the people of Ohio and our country, particularly the poor and the elderly.'").

59. Thorning Statement, *supra* note 22, at 6.

60. *Id.*

61. *The Impact of America's Climate Security Act of 2007 (S. 2191) on the U.S. Economy and on Global Greenhouse Gas Emissions: Hearing Before the S. Comm. on the Environment and Public Works, 110th Cong. 6 (2008)* (statement of Dr. Anne Smith) [hereinafter "Smith Statement"].

62. *Id.* at 9.

63. *Id.* at 6.

the U.S. economy will affect the pace of innovation across all industries and technologies. A strong economy increases the pool of capital available for the purchase of new technology and for investment by companies in R&D.”⁶⁴ Unfortunately, the potential for carbon caps to penalize carbon-emitting technologies cannot be seen as a reliable incentive for development of new, cleaner technology. Because carbon caps have the potential to cause power generators simply to switch fuels in the near term—say, from coal to more expensive natural gas—the caps divert capital away from technological innovation and into costly fuels. Margo Thorning describes the result:

Caps on emissions are not likely to promote new technology development because caps will force industry to divert resources to near-term, “end of pipe” solutions rather than promote spending for long-term technology innovations that will enable us to reduce GHGs and increase energy efficiency. An emission trading system will send exactly the wrong signals to investors because it will create uncertainty about the return on new investment.⁶⁵

A loss of innovation is more than just a complication: the development and deployment of new technology for the generation of electricity, transportation, energy efficiency and emissions control are essential prerequisites to addressing global climate change in any meaningful way.⁶⁶

C. Energy Policy Consequences

There are certain immutable facts that any energy policy must take into account for the United States. First, coal-fired electric power represents over half of U.S. electric generating capacity.⁶⁷ No combination of demand-side management and renewable energy will likely be able to replace any substantial portion of that capacity any time in the near future.⁶⁸ Second, policies designed to reduce GHGs

64. NATIONAL RESEARCH COUNCIL, DIVISION ON ENGINEERING AND RESEARCH SCIENCES, COMMITTEE ON FUTURE ENVIRONMENTS, *FUTURE R&D ENVIRONMENTS: A REPORT FOR THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY* 131 (2002).

65. Thorning Statement, *supra* note 22, at 6.

66. *See* Redburn, *supra* note 28; *see also* Thorning Statement, *supra* note 22, at 9 (“Technology development and deployment offers the most efficient and effective way to reduce GHG emissions and a strong economy tends to pull through capital investment faster.”).

67. H. Sterling Burnett, *Coal Power in the Black*, *Texas Public Policy Foundation Commentary*, Dec. 7, 2006, http://www.texaspolicy.com/commentaries_single.php?report_id=1236.

68. Jeffrey W. Moore, *The Potential Law of On-Shore Geologic Sequestration of CO₂ Captured from Coal-Fired Power Plants*, 28 *ENERGY L.J.* 443, 485 (2007) (“Coal is essential to

through inflexible regulatory or tax mechanisms can result in significant fuel-switching away from coal to natural gas or other more expensive energy sources.⁶⁹ Removing coal from the energy mix can directly undermine the reliability and affordability of electricity for consumers and businesses.⁷⁰

One study conducted by researchers at Pennsylvania State University (PSU) has attempted to estimate the rough economic benefits of maintaining coal as a viable part of the fuel diversity of the United States.⁷¹ The PSU team assumed a replacement of coal-fired capacity with more costly alternatives, such as natural gas and a ten percent renewables mix. Even when the positive impacts of investment in gas and renewables is netted out, the study found that by 2015:

- The annual benefit of coal use at currently projected levels is estimated at more than \$1 trillion in gross domestic product (GDP), \$360 billion in additional household income and nearly 7 million jobs.
- In contrast, a 33 percent reduction in coal-fired electric power generation would reduce GDP by \$166 billion, household income by \$64 billion and employment by 1.2 million below what it otherwise would be.

foreseeable energy production, and there are no viable substitutes readily available.”); Burnett, *supra* note 67 (“Coal is a secure energy source, since the United States contains more than a quarter of the world’s recoverable reserves, equaling a 250-year supply at current rates of consumption. As a result, coal-fired power plants generate 52 percent of the electricity in the United States.”).

69. See EUGENE M. TRISKO, NAT’L CTR. FOR POLICY ANALYSIS, BRIEF ANALYSIS NO. 573, ECONOMIC AND PUBLIC HEALTH BENEFITS OF COAL-BASED ENERGY 1 (2006), available at <http://www.ncpa.org/pub/ba/ba573/ba573.pdf> (“[D]omestic and international proposals to reduce greenhouse gas emissions would force utilities to shift electricity production from coal to other sources of generation. For example, the Energy Information Administration (EIA) of the U.S. Department of Energy estimated the climate change plan proposed by Sen. John McCain (R-Ariz.) and Sen. Joseph Lieberman (D-Conn.) in 2004 would reduce coal use by 59 percent to 78 percent.”); Burnett, *supra* note 67 (“[P]roposals to reduce greenhouse gas emissions would force utilities to shift electricity production from coal to other sources of generation.”).

70. See BERNARD L. WEINSTEIN AND TERRY L. CLOWER, OUR ENERGY FUTURE: THE NEED TO EXPAND AND DIVERSIFY TEXAS POWER GENERATION 6 (2007), available at <http://www.unt.edu/cedr/PowerDiversification.pdf> (demonstrating that “fuel diversity . . . [in] generation mix” is necessary to maintain “affordable and reliable electricity to households and business in the years ahead” but noting that in the near term, “base-load coal plants offer the best opportunity to achieve diversification while ensuring reliability and affordability”).

71. TRISKO, *supra* note 69, at 1.

- A 66 percent reduction in coal-fired electric power generation would reduce GDP by \$371 billion, household income by \$142 billion and employment by 2.7 million.⁷²

The negative impacts discussed in the PSU study were not limited to any one particular region of the United States.

D. Public Health Consequences

There are ways, of course, in which improved energy efficiency itself can result in unintended consequences for public health.⁷³ However, to the extent society has already chosen a course to encourage efficiency, these health end-points are either deemed reasonable in pursuit of broader public policy goals or are themselves addressed by other policy choices. Of greater interest here are health end-points that are exacerbated by the choice of climate policy options that could otherwise be avoided by choosing a more sensitively calibrated option.

One endpoint of concern again relates to potential macroeconomic impacts associated with significant fuel switching. In 1979 and 1984, the Joint Economic Committee of the U.S. Congress authorized research by Dr. M. Harvey Brenner at the Johns Hopkins University to demonstrate the relationship between unemployment rates and public health.⁷⁴ That work yielded a strong correlation, showing that each one percent increase in the unemployment rate resulted in a two percent increase in premature death.⁷⁵ In 2005, Brenner updated his work. The Brenner econometric model, applied to economic conditions likely to result from fuel-switching and based upon over 50 years of U.S. health and economic data, yielded significant results. Specifically, he found that “the estimated

72. *Id.*

73. It has been argued that increased efficiency for automobiles may decrease the vehicle size, thus making occupants for susceptible to injury or death in the event of accidents. *See, e.g.*, Thomas Gale Moore, *The Unresolved Conflict Between Auto Safety and Fuel Efficiency*, 1 J. OF REG. & SOC. COSTS 71, 72 (1990). Making your home more energy efficient can trap pollutants inside that can be 100 times higher than ambient air pollution. *See, e.g.*, Morris Carey, *Indoor Pollution Just as Damaging*, CHI. DAILY HERALD, Feb. 8, 2008, available at <http://www.dailyherald.com/story/?id=129918>.

74. *See* M. HARVEY BRENNER, JOINT ECON. COMM., 94TH CONG., ESTIMATING THE SOCIAL COSTS OF NATIONAL ECONOMIC POLICY: IMPLICATIONS FOR MENTAL AND PHYSICAL HEALTH AND CRIMINAL AGGRESSION (1979); *see also* M. HARVEY BRENNER, JOINT ECON. COMM., 98TH CONG., ESTIMATING THE EFFECTS OF ECONOMIC CHANGE ON NATIONAL HEALTH AND SOCIAL WELL-BEING (1984).

75. *See* BRENNER, ESTIMATING THE SOCIAL COSTS OF NATIONAL ECONOMIC POLICY, *supra* note 74.

additional mortality in the year 2010, based on four different variations of the model, ranges from an additional 170,507 to 368,915 deaths for the displacement of 100% of coal-based generation. The author's moderately conservative estimate is based on an annual change model at 195,308 deaths⁷⁶. Admittedly, the high end of these mortality projections assumes rather substantial fuel-switching.⁷⁷ Utilizing the more conservative Energy Information Administration data taken from an earlier analysis of pending climate legislation resulted in the following conclusion:

Given an estimated potential displacement of 78% of U.S. coal generation based on EIA's study of proposed climate change initiatives, the indicated premature mortality from reduced income and increased unemployment would exceed 150,000 deaths annually, absent direct and effective mitigation programs.⁷⁸

Regardless of where on the spectrum mortality associated with the economic dislocation resulting from climate change policy may fall, policy makers should still endeavor to minimize these impacts—particularly if constructive and effective climate policy still results.

IV. THE OPPORTUNITY

The way to address the challenge of global climate change is by no means to passively adopt a business-as-usual position. “There is an alternate path,” write geophysicists David Chapman and Michael Davis. “We could unleash our engineering, economic, and political entrepreneurs to improve energy conservation and efficiency and move us towards greater use of renewable energy sources.”⁷⁹ The question, of course, is how.

With a political consensus already hardening around trading regimes, it would be foolish not to learn all we can about how to appropriately structure such programs. However, if we are relying on innovation and new technology to eventually provide solutions, it is also wise to ask what combination of policies—and in what order—maximizes the potential return on our policy investment. There is no doubt that the encouragement of new technological development is a critical element in convincing the developing world to adopt new ways of doing things. Our experience with ozone-depleting substances showed that a critical mass of support for an international

76. See TRISKO, *supra* note 69, at 2.

77. *Id.*

78. *Id.*

79. Chapman & Davis, *supra* note 6, at 59.

regime was achieved only after technological innovation had produced tangible results.⁸⁰ Ultimately, the development and diffusion of new technology could even allow developing nations to “skip the carbon intensive, energy-production stage of industrialization.”⁸¹

While the time developing a cap-and-trade program is potentially well spent, it makes sense to first focus on the basket of policy options that might constitute an incentives-based approach to climate change policy. Former Speaker Newt Gingrich (R-GA), in recent debate with Senator John Kerry (D-MA) over global climate change policy, put it this way: “the morning you provide the incentives, it’ll be 50,000 entrepreneurs figuring out how to get the money. The morning you try to do it by regulation, there’ll be 50,000 entrepreneurs hiring a lawyer to fight you. It’s a fundamentally different model.”⁸²

The “fundamentally different model” must take into account the fact that carbon dioxide and other GHG emissions are unlike other pollutants we have faced in the past. The range of activities, economic sectors, lack of ready alternatives, and other factors dictate not a “go-slow” approach, but perhaps a “go-different” approach.⁸³ An incentives-based policy initiative might contain the following measures:

- i. An accurate assessment of GHG emissions in the form of a registry modeled on the best aspects of current state and federal reporting programs;
- ii. A set of reasonable milestones for GHG emission reductions that place the United States on a glide path of stabilization;

80. Sunstein, *supra* note 1, at 34 (“We might find a parallel to the process that led to the Montreal Protocol, as technological innovation led the world to believe that it had less to lose from regulation than it originally feared.”).

81. Chapman & Davis, *supra* note 6, at 59.

82. Senator John Kerry & Former House Speaker Newt Gingrich, Debate at the NYU Brademas Center for the Study of Congress: Global Climate Change and the Environment 15 (April 10, 2007), available at http://www.nyu.edu/brademas/pdf/Kerry-Gingrich_Federal_News_Service_transcript.pdf (transcript).

83. See Control of Emissions from New Highway Vehicles and Engines, 68 Fed. Reg. 52,922, 52,928 (denied Sept. 8, 2003) (“It is hard to imagine any issue in the environmental area having greater ‘economic and political significance’ than regulation of activities that might lead to global climate change. Virtually every sector of the U.S. economy is either directly or indirectly a source of GHG emissions. . . . The production and use of fossil fuel-based energy undergirds almost every aspect of the U.S. economy.”); Wood, *supra* note 11, at 585 (“Transitioning to a carbon-free society is more complicated than our previous experience with CFCs because it involves nearly every sector of society.”).

- iii. The development of a tax incentive policy or policies to encourage the use of, and investment in, near-term technologies that are reasonably available;
- iv. The development of loan guarantees to encourage the use of and investment in longer-term technologies that are not currently off-the-shelf;
- v. The development of public-private partnerships with dedicated funding sources to encourage more basic research in areas critical to addressing the climate challenge;
- vi. The development of policies to enhance the diffusion of new technologies to markets in the developing world;
- vii. Periodic program evaluation designed to monitor the extent to which incentives are creating the basis for substantial progress towards the achievement of GHG emission reduction goals; and
- viii. The development of a regulatory alternative—a cap-and-trade program with adequate cost containment—to phase in, in the event that incentives do not produce the requisite forward momentum.

The last suggested step is indicative of the notion that incentives-based policies and regulatory policies are not inherently inconsistent, provided that they are appropriately phased. No policy maker would willingly run the gauntlet of economic consequences described in this essay if an incentives policy could place the country on a glide path to successful emissions reductions first. While sources of revenue will be needed for an incentives-based policy, directly targeting the encouragement of technology may be far more cost-effective than adopting a cap first and merely hoping for innovation instead of fuel-switching. Even if the United States and other nations committed 0.05 percent of their respective GDPs to investments and incentives for new technology—from new generation to capturing carbon—it would amount to a ten-fold increase in global research and development.⁸⁴ And it would be some seven times cheaper than attempting to fully implement the Kyoto Protocol.⁸⁵

Tax incentives, loan guarantees, bonds, and other strategic government investments, in partnership with private sector actors, can awaken new technological possibilities and can accelerate gains in

84. Lomborg, *supra* note 40, at B1.

85. *Id.*

energy efficiency and emissions control.⁸⁶ Already, policy makers are focusing on concepts like these in order to minimize the consequences of proscriptive regulation described here, while truly addressing climate change.

Senator George Voinovich (R-OH) recently delivered the keynote address at a meeting of the National Commission on Energy Policy. He noted that a bipartisan group of Senators was working on a proposal “to encourage the development of new technologies” by use of appropriate tax treatment for companies that develop new technologies, loan guarantees, and international technology transfer reform.⁸⁷ At the same meeting, the Democratic staff director of the Senate Energy and Natural Resources Committee agreed that cap-and-trade legislation may stall for political reasons, thus providing an “ideal situation” for an incentives-based proposal.⁸⁸

Senator Pete Domenici (R-NM) recently announced a new proposal that would set up the “Clean Energy Investment Bank of the United States,” modeled on governmental financial institutions such as the Export-Import Bank of the United States and the Overseas Private Investment Corporation.⁸⁹ The proposal would provide “a variety of financing tools” to encourage investment in renewable energy, carbon capture and sequestration, new nuclear technology and other applications.⁹⁰

Perhaps not unlike climate science itself, creating incentives packages properly calibrated to achieve environmental success is an inexact science. The mechanism described in this essay or the two proposals already under development seem like steps in the right direction. While the total dollar amount needed is difficult to estimate, one analysis has found that a domestic investment of \$15 to \$30 billion a year in clean-energy research and development would stabilize carbon emissions and would also foster appropriate market dynamics that would allow the investments to pay for themselves

86. Thorning Statement, *supra* note 22, at 11-13.

87. Anthony Lacey, *Voinovich Touts ‘Incentives’ As Bipartisan Alternative To Cap-And-Trade*, CARBON CONTROL NEWS, Jan. 24, 2008, http://carboncontrolnews.com/index.php/ccn/show/voinovich_touts_incentives_as_bipartisan_alternative_to_cap_and_trade/.

88. *Id.*

89. Ben Geman, *Domenici Unveils Plans for Federal ‘Clean Energy’ Bank*, ENV'T & ENERGY DAILY, Mar. 3, 2008, <http://www.eenews.net/EEDaily/2008/03/03/5>.

90. *Id.*

thereafter.⁹¹ Another estimate from the Electric Power Research Institute finds that an investment of approximately \$17 billion between now and 2025 would be sufficient to undertake the steps necessary to achieve near-zero emissions (SO₂, NO_x, mercury, particulates, and CO₂) from the use of coal.⁹²

Regardless of which roadmap is chosen, there is ample evidence that a portfolio of public and private investments can target the actual endpoints necessary to stabilize GHG emissions. Rather than sacrificing considerable productive assets in the U.S. economy, a well-designed incentive-based policy can “offer the promise of creating a vibrant new industry capable of driving economic growth for decades to come.”⁹³ And if predictions such as these began a slow divergence from reality, policy makers can always reserve the right to implement a cap-and-trade program or a carbon tax.

V. CONCLUSION

It is not the intention of this essay to paint an unduly pessimistic picture of the challenges ahead for climate change policy development. First, as a society, we are already well along the path of modifying behavior in order to react to a carbon-constrained world. The United States arguably leads the world in reducing the energy intensity of its economy, meaning that less energy is being consumed for each unit of production.⁹⁴ U.S. consumers are purchasing record

91. See NORDHAUS & SHELLINGER, *supra* note 33, at 124; see also Daniel Kammen, *The Rise of Renewable Energy*, SCI. AM., Sept. 2006, at 92 (discussing an analysis produced by the Renewable and Appropriate Energy Laboratory University of California at Berkeley).

92. COAL UTILIZATION RESEARCH COUNCIL, THE CURC-EPRI ROADMAP: CLEANER, AFFORDABLE, MORE EFFICIENT ENERGY FROM COAL 2 (Nov. 2007), http://www.coal.org/UserFiles/File/Roadmap_-_November_2007.pdf (“With successful technology development and increased federal funding, new coal-based power generation technologies can be demonstrated by 2025 that control emissions, including CO₂, while generating electricity at a cost no greater than today’s modern power plants that are not equipped with CO₂ controls.”).

93. NORDHAUS & SHELLINGER, *supra* note 33, at 124.

94. Steven F. Hayward, *The United States and the Environment: Laggard or Leader?*, AEI ENVTL. POL’Y OUTLOOK, No. 1, Feb. 2008, available at http://www.aei.org/publications/pubID.27548/pub_detail.asp (“The consistent improvement in America’s energy efficiency is an untold and underappreciated long-term story. . . . In fact, some evidence suggests the United States is currently outperforming Europe in reducing energy intensity (the amount of energy used per unit of economic output) and greenhouse gases. According to the Department of Energy’s latest annual report on the subject, U.S. greenhouse gas emissions fell by 1.5 percent in 2006, the first time they have fallen in a nonrecessionary year. It is likely that the United States is the only industrialized nation whose greenhouse gas emissions fell in 2006.”).

numbers of hybrid vehicles⁹⁵, energy-efficient appliances, and insulation⁹⁶. Second, this essay does not reject the use of regulatory approaches, trading regimes or carbon taxes. Rather, it recognizes these policy options as part of a complex puzzle. Regulatory approaches should not be undertaken lightly, must be calibrated to avoid the worst predictable consequences, and perhaps should be phased so that incentives-based policies can be tested first. Last, and most importantly, the basis of the American economy and the quality of life dependent upon it are closely tied to the entrepreneurial spirit and innovation of market participants. This essay posits that it is precisely those traits that can recognize global climate change as an opportunity for the opening of new markets for technology in the areas of energy efficiency, electric generation, and emissions control.

95. Daniel Gross, Blue-Collar Prius, NEWSWEEK, Apr. 10, 2008, available at <http://www.newsweek.com/id/131373> (citing Toyota data, "In 2007, a year in which overall vehicle sales fell, hybrid sales rose 44 percent to constitute about 10.6 percent of sales."); *Hybrid Sales Continue To Climb In United States*, WEEKLY DRIVER NEWS SERV., Apr. 8, 2008, available at <http://theweeklydriver.com/articles/715/1/Hybrid-Sales-Continue-To-Climb-In-United-States/Page1.html> ("According to a report by the Green Car Congress in Washington, D.C., sales of hybrids in the U.S. rose 10 percent in March 2008 compared to 2007 sales in the same month.").

96. Over half of Americans currently say they purchase energy-efficient appliances and insulation. Of those that do not engage in these behaviors, 42 percent indicate that they are willing to try such behaviors. Porter Novelli and the Center of Excellence in Climate Change Communication Research, George Mason University, *What Are Americans Thinking and Doing About Global Warming? Results of a National Household Survey* (2008), available at <http://climatechange.gmu.edu/PN%20GMU%20Climate%20Change%20Report.pdf> (see Table 2, number of respondents ranging from 10,099 to 11,758).