The auguries for some sort of climate-change legislation in the next four years are surely positive. For the first time, both the White House and a substantial majority in Congress agree that atmospheric warming constitutes a serious problem – one that justifies a major investment in carbon-sparing technologies and significant changes in societal behavior.

But getting from here to there will be a far greater challenge than is generally understood. For one thing, there is still considerable uncertainty about which approaches to containing greenhouse gas emissions are likely to be cost-effective and what degree of emissions curtailment will be needed to prevent major damage. For another, success in curbing emissions will require the cooperation of (and perhaps considerable sacrifice from) poor but rapidly developing countries, and it is far from clear that they can be convinced to go along.

At the very least, then, one should expect some major stumbles along the way. At worst, unanticipated frustration could lead to the collapse of containment efforts at a time when further delay would have very serious consequences.

These obstacles do not justify doing nothing – waiting for, say, coastal flooding or catastrophic weather changes to generate a global consensus on the imperative of collective sacrifice. But they should temper expectations about the likely
CLIMATE POLICY

pace of progress, as well as focus our energies on what is possible rather than what is optimal.

CLIMATE CHANGE 101: SCIENCE AND ECONOMICS

Human activity produces greenhouse gas emissions, most notably carbon dioxide, but also methane, nitrous oxide and other gases that are part and parcel of modern economic life. Their rate of accumulation is affected by the rate at which “sinks,” like forests and oceans, recapture the carbon. Without efforts to contain them, greenhouse gas emissions would grow by as much as 90 percent between 2000 and 2030.

The damage from greater emissions (or even the failure to cut emissions sharply) would likely be significant, but unevenly felt. For example, while all low-lying countries would be seriously affected by rises in the sea level, poorer countries like Bangladesh would have a far more difficult time coping than, say, Singapore or the Netherlands.

Furthermore, we cannot rule out catastrophic scenarios. Very unpleasant surprises could include intense heat waves, widespread forest fires, massive disruption of agriculture and changes in currents that dramatically disrupt ocean ecologies.

Economists view the problem in the classic context of the “tragedy of the commons.” Just as pastures are likely to be overgrazed unless there is collective action to limit access, the atmosphere is likely to be abused by excessive emissions unless there is collective action to prevent it. And economists generally agree on some aspects of coping with climate change.

The first is that it is useful to think about the problem in terms of costs and benefits in order to develop strategies that are likely to maximize the expected net benefits from avoiding the consequences of warming. By the same token, it should be understood that, in both political and moral terms, who wins and who loses matters almost as much as the magnitude of the net benefits.

Second, we know enough to be confident that there are net benefits in acting sooner rather than later, provided that most countries eventually agree to limit emissions. That qualification is important by the way: William Nordhaus of Yale estimates that abatement costs would more than triple if half the world’s economies did not participate.

Third, it would be extremely useful to create containment mechanisms that put an explicit price on emissions. This approach would provide financial incentives for both private abatement initiatives and innovation in abatement techniques. Moreover, in contrast to containment programs built around “command-and-control” regulation, a market-based system would encourage the reduction of emissions at the lowest possible cost.

Fourth, there is an important role for government-supported research and development in climate-change strategies. For without government support, the pace of investment in R&D is likely to be too slow.

All that said, economists are divided on other important issues in climate-change policy. Some argue that in choosing how much to invest in climate stabilization today, we should discount expected future benefits at a very low rate. In essence, they argue that we should defer to the interests of future generations, rather than focusing on our own costs and benefits. There is also disagreement about the right way to weigh the cost of the un-

ROBERT HAHN is a senior fellow at the American Enterprise Institute, executive director of the institute’s Center for Regulatory and Market Studies and a visiting senior fellow at the Smith School at Oxford. A more-detailed version of this paper is forthcoming in the Harvard Environmental Law Review.
known risks of a climate-change catastrophe—say, the very rapid rise of sea levels or the collapse of vital ecosystems.

But in spite of such division, it is important not to lose sight of the fact that there is a near-consensus on key questions—notably, on the desirability of acting with all deliberate speed in ways that promote innovation, maximize efficiency and leave open the door to rapid revisions as more becomes known about climate change.

**POLITICAL REALITIES OF CLIMATE CHANGE**

Economists tend to give short shrift to a pair of very thorny issues in the carbon-containment debate. One is that any policy adopted in the push and shove of interest-group politics is likely to be inefficient—very inefficient—in the sense that it will produce far less than the maximum containment bang for a buck. The other is that there is no magic formula for inducing developing countries (notably, India and China) to participate in containment efforts. And without their eventual participation, any agreement would be of limited use—or even be counterproductive, both in the sense that the costs might exceed the benefits and that the failure to bring free riders into the fold would undermine the public credibility of climate policy.

**Anticipating Inefficiency**

Economists have long recognized that there
are trade-offs between cost-effectiveness and participation in a climate agreement. The Kyoto accord, hammered out in the early 1990s, provides a good example. The signatories agreed to reduce carbon emissions in industrialized countries by 5 percent between 2008 and 2012, but demanded no effort from large and growing emitters in the developing world and failed to induce the United States to join. Nordhaus estimates that, if efficiently pursued, the benefits of Kyoto would have exceeded the costs by as much as $750 billion if the United States were a full member. But without cooperation from both the United States and China, the net benefits are likely to be negative.

Decentralized moves within the United States in the wake of the rejection of Kyoto point to another dimension of the difficulties in creating an efficient climate-change policy. Many states have chosen to move ahead on their own.

The Regional Greenhouse Gas Initiative, made up of 10 Northeast and mid-Atlantic states, plans to cap emissions from electric utilities and then encourage emitters to trade allowances on a market. California’s plan aims to reduce emissions to 1990 levels by 2020, using a combination of cap-and-trade and regulatory standards. While commendable in other ways, these differing regulatory efforts in the otherwise-integrated United States economy are likely to give rise to serious inefficiencies when compared with a market-based national plan.

While there is reason to believe that this balkanization will be pre-empted by federal legislation, the national system that emerges will surely be built around efficiency-sapping political compromises. Any serious effort to limit emissions is bound to result in higher electricity-generation costs – and, most likely, in disproportionately higher electricity bills in the regions that are more dependent on coal-fired generation.

By the same token, any serious containment effort is likely to hit the poor disproportionately because they spend a larger share of their income on home heating and gasoline. Hence, there will be powerful pressures on Congress to offset these unwelcome market outcomes with mandates and subsidies that reduce efficiency by reducing incentives to conserve energy or to switch fuels.

Note, too, that, at least in the near-term, some regions will have little reason to support containment efforts. For example, according to the Environmental Protection Agency, warming would lengthen growing seasons for fruit in the Great Lakes region, making agriculture more productive. Regional differences in benefits will likely prove to be less important politically than regional differences in costs, but could work to undermine efforts to create a level playing field in emissions containment.

The interest-group tussle has already begun. The coal lobby is asking for massive economic
assistance to develop clean-coal technologies and is highlighting the potential impact of curbing emissions on coal jobs, while the ethanol lobby is overstating the importance of ethanol as a means of reducing greenhouse gases. This, of course, is how things work in a democracy. But it will plainly make emissions containment more expensive.

Herding Cats

It is conventional wisdom that developing countries need to be part of any approach to emissions containment if it is to be cost-effective. China, which opens an average of two coal-fired power plants a week, is already the world’s leading emitter of carbon. India is the fifth-largest emitter, behind only China, the United States, Russia and Japan. Indeed, by 2030, now-developing economies are expected to account for more than 60 percent of worldwide carbon emissions.

There is a second reason for working hard to bring developing countries into the fold: much of the low-hanging fruit in terms of emissions abatement is in the less-developed world. For example, sparing forested land from clearance for agriculture or urban sprawl is probably one of the cheapest ways of slowing emissions. Yet another reason is that extending the emissions-containment umbrella would deter high-emitting industries – cement, steel and coal-fired utilities come to mind – from going offshore to escape regulation.

Still, absent inducements, most developing countries aren’t likely to perceive it to be in their interest to join the effort. They correctly see that reducing their carbon footprints would raise business costs and thus slow economic growth. And they are not willing to sacrifice growth today for the benefit of future generations, which will probably be better able to afford such costs.

One approach is to go forward without help from developing countries and hope that they will be shamed into joining later on. A more realistic approach requires the prudent application of carrots or sticks, or both.

On the carrot side, we might lower their abatement costs by offering them carbon-sparing technology for little or nothing. However, without extra cash to implement the technologies – say, technology that increases the efficiency of electric motors – this isn’t likely to be much of an incentive.

But providing cash or capital equipment is also problematic. First, the sums needed could be very large: by one estimate, China could productively invest $550 billion a year in emissions containment. Second, payments might be lost to mismanagement or corruption. Third, paying one country may well lead other countries to demand payments for what they would otherwise have done without the assistance.

One pragmatic approach here would be to allow developing countries to participate in a global trading system on a project-by-project basis. For example, a Japanese carmaker might get credit for preserving a forest in Thailand or switching a Chinese coal-fired power plant to climate-friendlier natural gas. This is the idea behind the United Nations Clean Development Mechanism, which was conceived as a way to help Kyoto signatories reduce their costs of meeting emissions limits.
Note, however, that such aid would be highly susceptible to manipulation. It is impossible to observe the impact of a specific project. Suppose, for example, a forest is saved in one part of Thailand but, as a result, loggers cut down one elsewhere. It can also be difficult to verify that the forest was ever really headed for the sawmill. Such programs are thus likely to have limited utility. They may, however, help developed countries to build an institutional capability for seriously addressing the global greenhouse gas emissions problem down the road.

The alternative to carrots is sticks – perhaps in the form of import tariffs linked to the carbon imprint of goods produced in non-cooperating countries. But there are problems here, too. It may not be easy to measure the relevant carbon emissions. And the bureaucrats who do the measuring may have their own agendas: the U.S. Commerce Department, for example, is already in the habit of vastly overestimating the production costs of foreign-made goods that compete with American ones. Note, too, that importing countries may stand to lose more from reducing trade than they stand to gain from a global climate treaty. Thus the threat of sanctions may not be credible. Last, (but no trivial matter) green sanctions may violate World Trade Organization rules.

Threats of symbolic sanctions – say, excluding the athletes from non-cooperating countries from international competition or barring their diplomats from important roles in international organizations – are other alternatives. Such actions, however, would have costs of their own, using up the symbolic sanctions available to deter other unwanted behavior, like human rights violations.

All told, there is no surefire way to induce cooperation from developing economies as long as they view emissions containment as antithetical to growth. The best hope is that technological advances will soon reduce the conflict between climate-stabilization and growth goals – for example, making it cost-effective to use, say, solar power instead of fossil-fuel generation even when emissions costs aren’t included in the equation. Progress on this front is apt to be a long time coming – and then only come in fits and starts.

**DESIGNING U.S. CLIMATE POLICY**

In light of this analysis, the highest priority for the United States should not be cutting emissions per se, but designing a policy that would encourage a truly global effort in the medium- and long-term. Stripped to basics,
my preferred approach has three components: carbon pricing, new technology and political will.

**Carbon Pricing**

There are three reasons for setting a price for carbon emissions. First, it would show that the United States is serious about curbing its own emissions, thereby stimulating private innovation in carbon-sparing technologies. Pricing carbon would also serve as a down-payment on a far greater commitment if other countries joined in. This is what the European Union has done, pledging to reduce greenhouse gas emissions by an additional 10 percent on top of its targeted 20 percent if other countries join the effort. Third, pricing carbon today would generate experience on how to run a market-based emissions-containment system, creating a framework for a far larger and more expensive containment effort later on.

Economists like to argue about whether a system that directly set emissions prices (think taxes) or one that capped emissions quantities (think market-based allowance-trading programs) is better. Taxes have the advantage of making the costs of addressing climate change – as well as the rewards to reducing emissions – transparent. The tax route may also be less prone to corruption. But for the foreseeable future, any policy anchored on the T-word is anathema. So developing that approach could be a waste of time.
More likely, we are headed for a national emissions-allowance-trading regime similar to the one we already have for curbing industrial emissions of sulfur. A national carbon-trading program should aim to integrate the cost structure of existing regional programs – notably the Regional Greenhouse Gas Initiative and Western Climate Initiative. As a matter of good politics and economics, such a cap-and-trade program would also have a safety valve – a maximum price for emissions permits, created by an open invitation to buy additional permits from the federal government at a predetermined price. The safety valve would act a lot like a tax, but it is more likely to pass a political sniff test.

Several bills introduced in the last two years would create cap-and-trade systems. However, the ones that have gotten the most traction have a serious liability: meeting their targets would be quite expensive. For example, according to the EPA, the Low Carbon Economy Act of 2007 (the Bingaman-Specter Act) would increase electricity bills by 20 percent and raise gasoline prices by 22 cents a gallon by the year 2030. The Climate Security Act of 2008 (the Lieberman-Warner Act) would be an even harder slog: by EPA estimates, it would increase electricity prices by 44 percent by 2030.

If Congress does not act, the Obama administration would assert the broad powers of the Clean Air Act to impose limits on greenhouse emissions. But that would be an awkward route, opening the prospect of mandated reductions that are both very costly and intrusive in daily life. By the same token, President Obama could order federal agencies to use an implicit price for carbon emissions in weighing the net benefits of regulations for everything from appliance efficiency to mass transit construction. But this approach suffers from the fact that it is piecemeal, and would only address new regulations.

One of the problems with the current crop of cap-and-trade legislative proposals is that they might inadvertently push the value of marketable emissions permits above politically acceptable levels in the short run. Hence the value of a safety valve. If, for example, Congress expected the free market price of emissions allowances to settle at about $15 a ton, it might set a safety valve price – the price at which carbon emitters could buy all the permits they wished directly from the government – at $20 a ton.

It would also make sense to guarantee a minimum price in order to reduce uncertainty for investors in emissions-reduction technologies. Perhaps allowance prices would not be allowed to fall below $10, with the government intervening to sustain this minimum by purchasing allowances on the open market. These targets could be changed as the economy adjusts or as we learn more about the societal costs of emissions.

Many of the bills offered (and the proposed administration budget) provide for auctioning some of the allowances, rather than allocating them according to historical emissions rates or interest-group clout. Auctioning would surely have merits, generating revenue that could be used to soften the distributional consequences of higher energy prices or to reduce inefficient taxes. It is far from clear, though, whether Washington would have the self-discipline to spend the auction revenue wisely.

The system I have in mind would steer away from mandated containment standards or renewable-fuel subsidies. Neither is apt to lead to cost-effective innovation in the context of climate change. Standards may be effective in limited situations where the technological solution is reasonably clear – for example, in energy-efficiency codes for new
buildings – but they are unlikely to work well in most contexts. Regulators typically lack the information (or the political independence) needed to set standards appropriately for forcing innovation.

Unfortunately, Congress can’t seem to resist regulation. The Energy Independence and Security Act of 2007 introduced a host of mandates, including higher vehicle fuel-efficiency standards and minimum use of biofuels. And it seems likely that Washington will go in this direction with climate change, laying mandates and subsidies on top of a cap-and-trade system.

Any program with modest coverage could actually increase global greenhouse emissions in the short term, since firms would have incentives to move their carbon-intensive activities to countries that are less regulated or not regulated at all. But, as discussed earlier, the roadblocks to a comprehensive global system are daunting, in large part because of the magnitude of the subsidies needed to entice developing countries to participate. In my view, some perverse consequences constitute a price worth paying to begin building the framework for a successful climate strategy. In particular, we would learn by doing in designing market-based approaches and in testing alternative inducements for bringing reluctant countries into a truly global containment system.

Climate R&D

The second component of my preferred approach is long-term funding for research and development to improve climate-sparing technology. Breakthroughs in technology may prove the key to success in climate-change policy, addressing issues of living with unavoidable warming as well as decoupling economic growth from emissions growth.
Cautious optimism is in order: a National Academy of Sciences analysis of six energy R&D programs found that five of them produced substantial environmental and security benefits as well as direct economic benefits. For example, the hybrid-vehicle-technology R&D program, which will cost $567 million through 2012, is projected to yield $6 billion to $7 billion in economic benefits, reduce carbon emissions by 28 million tons and gasoline use by around 200 million barrels.

The federal government currently spends on the order of $3 billion on climate change R&D, depending on what is counted. The first priority should not be more money for R&D now, but a long-term commitment to funding. Without it, researchers would have strong incentives to stick with low-risk projects with immediate payoffs, rather than engage in riskier projects that could generate huge returns later on.

By the same token, a long-term commitment should include incentives to increase the supply of skills in relevant fields of science and technology. Market incentives alone are not likely to be sufficient, since the lag between making the work financially attractive and training an army of technologists is very long.

Washington ought to consider a wide array of options to promote R&D, including unusual ones like cash prizes for achieving key goals. We must recognize that positive incentives (subsidies) are complements to negative incentives (putting a price on emissions) – not substitutes for them.

It’s also worth remembering that carbon dioxide is not the only greenhouse gas. In fact, some of the most cost-effective opportunities for containment lie outside carbon. For example, abatement costs for methane and nitrous oxide are generally lower. By one estimate, a broad attack on greenhouse gas emissions, compared to an approach focusing solely on carbon, would cut containment costs by two-thirds. By the same token, it’s worth pursuing R&D in the containment of these other gases.

That said, a big prize in climate research would be a cost-effective means of carbon capture and storage for coal-fired power plants. And there is some reason to believe that current expenditures on that effort are too low. First, the challenge is daunting and the potential payoff far away, discouraging private-sector investment. Second, coal is available in virtually unlimited quantities in friendly countries, suggesting that the societal benefits of figuring out how to use it benignly would be very large.

Another potentially promising avenue for R&D is making nuclear power cheaper and safer. Nuclear power may be the only technology that could compete with fossil fuels in terms of cost without the benefit of major breakthroughs. And while the ancillary issues of waste disposal and the proliferation of nuclear weapons are unlikely to go away, they could be mitigated through changes in plant design and management.

Since a comprehensive emissions-containment strategy is not in sight, it would make sense to plan for adaptation to climate change as well as taking steps to prevent it. The U.S. Climate Change Science Program currently spends on the order of $155 million, nearly
15 percent of its budget, examining the sensitivity and adaptability of human and environmental systems. More should be devoted to this area of research. Just as important, we need to invest more in emergency planning: past experiences ranging from hurricanes to tsunamis show that we are under-prepared for environmental disasters.

The climate R&D portfolio should also have a place for “geo-engineering” – engineering techniques for offsetting the climatic impact of emissions on a large scale. The potential for such technology is there, but so too is the risk of major collateral damage. For example, sulfate particles spewed in volcanic eruptions could serve as a temporary shield against sunlight, cooling the earth much the way particles spewed in volcanic eruptions cool the earth. But we know little about unintended consequences – for example, the potential for acidification of the oceans or ozone-layer depletion.

The Need for Political Leadership
The political problem of moving ahead without the cooperation of some large emitters may not prove as daunting as I have argued. Europe’s apparent willingness to go it alone, and the success of Al Gore’s campaign to mobilize American public opinion, suggest that many are prepared to do more than self-interest would dictate. There is even modest evidence that this view is broadly held. A 2007 MIT survey found that Americans are willing to pay, on average, an additional $21 more a month for electricity to reduce global warming. This implies a willingness to pay of $125 per ton of carbon not emitted.

Much depends on political leadership – the charismatic sort shown by Churchill in carrying Britain through World War II or by Roosevelt in keeping the United States together during the Depression.

WHERE TO GO FROM HERE
I believe that an effective global agreement to curtail greenhouse emissions, no matter how badly many want it, is not in our near-term future. But the reality that interim measures are likely to be messy, inefficient and incomplete is not a good enough reason to procrastinate. America needs to assert leadership here, experimenting with market-based containment plans, pressing an ambitious R&D agenda aimed at reducing the cost of containment and exploring ways to induce major developing economies to join in the effort.

However, since the problems of getting from here to there are undeniably large, it would also make sense to plan now for the consequences of delay or outright failure to stabilize climate gases at an acceptable level. That, of course, includes adaptation to changes in weather patterns, storm severity and sea level. But it also includes the development of geo-engineering technologies for reversing the consequences of the failure to slow emissions in a timely fashion.

Policy analysts also need to come to terms with the reality that many of the policies to address climate change will be highly inefficient. That doesn’t mean we should dither, but it does imply that we should take inefficiency into account in policy design. For example, adaptation may prove to be more efficient than reducing emissions, because adaptation will not typically require global cooperation. The bottom line: we need to think hard about how proposed policies would work in a very messy world.

Al Gore was surely right about the “inconvenient truth” that global warming poses a great threat to the planet. There is no contradiction, however, in acknowledging another inconvenient truth: fixing the problem will demand tenacity and sacrifice, as well as humility about what’s possible and when.