SMART **ENERGY** SOLUTIONS

CLIMATE EXCHANGE

Cool heads tackle our hottest issue

By Marilyn Berlin Snell

Though the United States is the world's top producer of greenhouse gases, only 13 percent of congressional Republicans believe in human-caused global warming (*National Journal*), and 13 percent of Americans have never even heard of the phenomenon (ACNielsen). One might wonder what planet these folks are on. Unfortunately, it's the one we all share.

Last summer James Hansen, director of NASA's Goddard Institute for Space Studies, blamed my profession for this alarming ignorance. Although the stability of the world's

Photographs by Anne Hamersky

CLIMATE BRAIN TRUST: With all the gloom and doom about global warming, it's hard to imagine a conversation on the topic that could both inspire and entertain. And yet that is exactly what *Sierra*'s roundtable elicited from, left to right, Vinod Khosla, Stephen Schneider, Senator Barbara Boxer, Paul Anderson, Al Gore, Carl Pope, Bettina Poirier, and Dan Reicher.

climate system is unequivocally threatened by human activities, the U.S. media has muddied the issue by giving time to "fringe contrarians supported by the fossil-fuel industry," he wrote in the *New York Review of Books.*

As I read Hansen's essay, I began to imagine a conversation that would push beyond climate-change confusion toward solutions. In the margins, I wrote, "industrialist, scientist, politico, venture capitalist" and filled in the names of prominent experts. A few weeks later, *Sierra* invited a handful of these luminaries to a daylong roundtable in San Francisco. Their job would be to come up with a practical agenda for the next Congress that would stabilize the climate. It was a tall order, addressed to busy people. Yet their response was immediate, gracious, and affirmative. There is urgency in the air.

On December 14, 2006, the group gathered at the Sierra Club headquarters. **Paul Anderson,** then chair of Duke Energy (now chair of a Duke spin-off), arrived right on time in a crisp suit and tie, ready to get down to business. Even before they'd finished their morning pastries, he started lobbying the Club's executive director and roundtable moderator, **Carl Pope,** on what was to become the group's most radical recommendation. Venture capitalist **Vinod Khosla** announced—lest anyone get the wrong idea given his presence at the Sierra Club—that he is a pro-business, free-market Republican. As the roundtable progressed, however, Khosla relaxed, taking his shoes off under the table and tucking a foot beneath himself as he laid out his plan to fight poverty and global warming in one fell swoop. **Bettina Poirier,** staff director for Senator **Barbara Boxer** (D-Calif.) and chief counsel for the Environment and Public Works Committee, listened intently. Two other senior advisors from Boxer's office sat on the sidelines, furiously taking notes. The man who bridged the public-private worlds was **Dan Reicher,**

who worked at the Department of Energy during the Clinton era and was, at the time of the roundtable, president of a venture capital firm focused on renewable energy. (He now runs Google's climate and energy initiative.) Stanford University climate scientist **Stephen Schneider** raced to the discussion from down the street, where he'd just given a presentation to hundreds of scientists at the American Geophysical Union's annual meeting. His hair was slightly Einsteinian upon arrival, but his thoughts were anything but disheveled. Having spent more than 25 years explaining why our planet is getting warmer, he was the roundtable's translator and reality check.

In the morning, the group worked behind closed doors. That afternoon, they were joined by Boxer and former vice president **Al Gore** for a public session to announce the conclusions they'd reached. The defining moment came when Anderson suggested that the federal government should assign a cost to carbon emissions—an idea that has been dismissed as political suicide by several past Congresses. But times have changed. How else could one explain the fact that a leader from the energy industry, a special interest many politicians are trying to protect from carbon regulations, is now calling for those very regulations?

My 12-year-old niece, Sophie, a seventh-grader in Phoenix, traveled alone for the first time to be an observer at the gathering. Her last big class report was on this worrisome topic, and it was important for her to see that adults are constructively grappling with climate change. Her presence helped us all remember that we have an obligation to act on behalf of future generations. Time has an ethical dimension, "the fierce urgency of now," as Martin Luther King Jr. called the struggles of his day.

Time also has an economic dimension: Wall Street is finally moving to address global warming because the issue is showing up in the short time frames that make sense to business.

For love or money, the United States must take a leadership role in the fight against global warming. That was our reason for coming together. And by the end of the conversation excerpted below, we had an abundance of agreed-upon ways to move forward. Schneider, not generally known for his optimism on the subject, was elated: "The fact that you could have a panel with this much diversity, and that our biggest radical is a power company executive, shows real progress." ■

ANDERSON: "WE AREN'T GOING TO SOLVE ENVIRONMENTAL PROBLEMS UNLESS WE HAVE A COST TO USING ENERGY THAT'S COMMENSURATE WITH THE DAMAGE IT DOES TO THE PLANET."

Formerly CEO of BHP Billiton—a global coal, metals, and crude-oil mining concern—**Paul Anderson** was, at the time of *Sierra*'s roundtable, chair of Duke Energy, one of the largest U.S. electric utilities. He is now chair of Duke's natural-gas spin-off, Spectra Energy.

ON THE WEB *Watch* Sierra*'s roundtable participants take on the climate crisis at* sierraclub.org/pressroom/events/2006-12-14. *Sophie's observations of the roundtable are available at* sierraclub.org/sierra/kidsview. *Read the report from the Intergovernmental Panel on Climate Change on the most recent data at* www.ipcc.ch/spm2feb07.pdf. *Learn about the Sierra Club's clean energy solutions at* sierraclub.org/roadmap. *And to find out how to enroll your hometown in the fight against global warming, visit* coolcities.us.

Carl Pope: The Sierra Club believes that most of the American public is ready to move on global-warming solutions but is confused about where to go and how. We hope to create an action plan for the next few years.

Vinod Khosla: I'd like to put a question on the table right away. How do we get the average person to adopt within five years what we agree on today? This question of scalability—how to adopt these ideas on a large scale—is critical.

I spend my time thinking about technologies that can be made attractive to businesses and then scaled up. Then I ask, "What government policies can make all this happen?" I'm a free-market Republican, though I've been working a lot with Democrats recently. I don't want more government money to solve the problem. I want to know what government policies will encourage Wall Street investment.

Stephen Schneider: Vinod is a Republican who works with Democrats. I'm a Democrat who works with Republicans. I've had the most successful interactions on this issue with Senator John McCain and with California governor Arnold Schwarzenegger's staff. In fact, I'm proud that in California global warming has not been primarily a partisan issue. It's nice when you face a common threat and you don't make a political show out of it. That's a model I hope will spread to Washington.

Dan Reicher: My framework for a sustainable path is a triangle with three points: policy, technology, and finance. Currently, the policy world doesn't understand the finance world. The technology world is sometimes allergic to the policy world. We have to be able to communicate across those points.

Bettina Poirier: One of the things we can do in the Senate, and particularly with Senator Boxer as chair of the Environment and Public Works Committee, is to bring the spectrum of voices

to the table. We'll have several new subcommittees this year. One will be chaired by Senator Joe Leiberman; its goal is to include the business and consumer perspective and provide private solutions to global warming. We're trying to build those issues directly into our process.

Reicher: Good. What Vinod calls "scalability" I call "deployment." In the energy sector, we literally spend 20 or 30 years developing a technology, and then it takes another 20 or 30 years to get it deployed. Consider energy efficiency. In many respects, efficiency is our cheapest, fastest, and cleanest option. Why is it that an energy source that can be deployed at two to four cents a kilowatt-hour isn't being deployed—when some of the other things we're excited about, like solar, cost ten times as much? If I had to name one area that offers the nation huge opportunities, it's efficiency.

Khosla: Former UC Berkeley efficiency expert Art Rosenfeld says that if the United States were working at the energy-efficiency level of the early 1970s, we would be spending $700 billion a year more on energy alone. This is not a green argument; it's an economic argument.

Paul Anderson: I am very much in concert with this efficiency argument. But first we need to change the strategic imperative of the United States so it's no longer "cheap available energy for all"—an approach that goes back to the 1950s. We decided then that we were going to build a highway system, and we were going to use trucks instead of barges and trains; we were going to build our cities sprawling, and people were going to drive to their jobs instead of live close to them in highrises. Finally, we were going to make sure that certain special interests were never taxed for the total cost of their energy because they have huge political clout.

We aren't going to solve environmental problems unless we actually have a cost to using energy that's commensurate with the damage it does to the planet. That would be a huge turnaround. I have never heard a politician say, "My goal is to make energy more expensive in this country," but if they really want to reduce carbon emissions, that should be their goal. It absolutely has to be their goal.

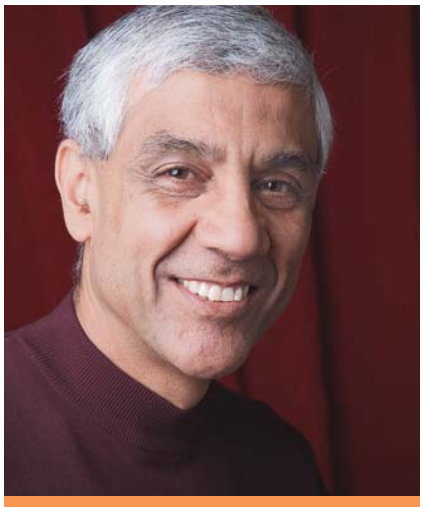
That said, whatever we come up with in terms of solutions has got to avoid a political grab bag like what happened with the sulfur dioxide **cap-and-trade system.** If you were emitting so many tons of SO_2 as of the baseline year, you got X number of allowances. If you cut back on emissions after the baseline year, you could sell your excess allowances to somebody else. This scenario, whether for SO_2 or for carbon, actually creates an incentive to do nothing that reduces your emissions before the system is in place because you might be forgoing a tremendous asset.

Pope: You talk about the need to change strategic imperatives, Paul. The Sierra Club has been a public-policy organization for 115 years, and yet recently our board decided that we should target capital markets, not government. Our strategic imperative is to move capital markets from the past to the future.

But government does have an important role to play, for instance, in modernizing the electricity grid to improve reliability and efficiency and to better accommodate power generation from solar, wind, microturbines, etc. In the United States, consumers pay an extra $150 billion a year because we haven't modernized.

The energy industry is by far the least innovative sector in the American economy, and I'd argue that the reason for this is government. Compare the energy sector's lack of innovation with the steel industry. A steel mill today does not look or work anything like a steel mill of 30 years ago. Nobody is keeping old steel mills alive with special government exemptions. Yet power plants are still being kept alive.

Anderson: I've been in the steel industry and witnessed its disruption, and I've been in the power industry. The big difference is that one is totally independent and the other is centrally planned by government agencies. The steel industry did not change because it wanted to; it changed because people took it out and shot it. In the case of the



Founding CEO of Sun Microsystems, **Vinod Khosla** established Khosla Ventures in 2004 to invest in alternative fuels, affordable housing, and small business loans to the very poor (microfinance). One of his projects, in which Virgin Group founder Sir Richard Branson recently invested $400 million, is developing state-of-the-art ethanol plants.

Cap-and-trade system (carbon allowances)

This program would set a mandatory nationwide limit, or cap, on carbon dioxide emissions and create a market in which allowances to emit the gas could be traded. To reduce CO_2, the cap would be set lower than historical emissions and would be reduced over time. Under this system, suppliers or users of fossil fuels (which are the main source of carbon dioxide) would hold the rights, or allowances, for each ton of CO_2 emissions they produce. How well this system would work depends partly on whether the allowances would be bought or distributed free of charge. If they were free, those who have polluted the most could unduly benefit by being given allowances of considerable value—possibly totaling tens of billions to hundreds of billions of dollars (see "grandfather," page 73). Once the allowances were distributed, they could be bought and sold, or traded. Cap-and-trade programs are already being used in the United States to reduce emissions of sulfur dioxide and nitrogen oxides, with varying degrees of success.

Codirector of the Center for Environmental Science and Policy at Stanford University, climatologist **Stephen Schneider** has served as a consultant to federal agencies and White House staff in the Nixon, Carter, Reagan, George H. W. Bush, and Clinton administrations. In 1975, Schneider founded the interdisciplinary journal *Climatic Change*, and since 1997 he has been one of the coordinating lead authors of the Intergovernmental Panel on Climate Change.

power industry, you can't shoot anybody; it's all centrally planned.

Khosla: Beyond steel, other industries have successfully transformed as well. One is telecom. Ten years ago, for example, every single CEO of every major telecom in the world said they would never adopt the Internet as their core network. They would offer it as a service but never adopt. All that has changed. IBM is another example. People thought nobody could touch IBM. When we started Sun Microsystems in 1982, the basic assumption was to be peripheral to or add on to IBM, not to disrupt it. I'm optimistic about changing radically old industries.

Pope: I'm optimistic as well. My premise is that government is preventing that kind of necessary disruption in the energy industry.

Anderson: My solution is very simple and absolutely not new. We need to have a **carbon tax.** Let's call it a carbon fee, like a value-added tax, based on carbon content. This fee would immediately send a signal that there is going to be a cost to carbon—that carbon will *not* be an asset but a liability. It doesn't even matter what the level is. The fee would exempt no one. It would accomplish everything you're looking for—promote new technologies, cause people to change old equipment, switch fuels—and it is the only thing that would have an impact tomorrow.

Schneider: During the **Kyoto Protocol** negotiations, I argued for a carbon tax that involved everybody, including China and India. However, I believed we should recycle the revenue from the tax back to developing countries, even more than they paid in, because you don't subsidize poverty with artificially low prices of commodities that are anti-sustainability. You subsidize it with money, but you target that money toward projects that help advance sustainability. Nobody wanted to talk about that at Kyoto.

If you want to be effective, you have to deal with the people who are hurt either by the climate change or by the policy. Most poor people don't live near their work. It's not because they don't want to but because of housing prices. They don't drive 15-mile-a-gallon cars because they like clunkers. If the price of energy is increased through a carbon fee, we'll need what economists call "equity side payments." If you want to call them a political bribe, fine. For the poor person who has to pay more for gas, I wouldn't offer cash back. I'd give them a voucher for $10,000 to buy a better-than-40-mile-a-gallon car. You could even do it in such a way as to have an internal win—say in Detroit, which would make the fuel-efficient vehicles. You need public-private partnerships.

Reicher: I second the call for a carbon tax. Putting a price on carbon is the motivation we need.

Khosla: If a genie gave me one wish, it would be a price on carbon.

Reicher: Let me offer two smaller ideas. First, I was struck by what the public pension funds in California did a few years ago in deciding to move increasingly serious amounts of money into things green. Collectively, **CalPERS** and **CalSTRS** control over $350 billion. If we could make it work both for the bottom line of the people who manage these pension funds and also respond to the social needs of the people for whom these funds are run, we could do a lot of good.

Second, the National Academy of Sciences met several years ago to address what its research agenda ought to be in terms of climate change and energy. Someone asked what one energy technology can cause a net reduction in atmospheric carbon. It's obviously not coal, oil, or gas. It's not solar or wind, because they're net zero. It's **biomass.** Here's how: The plant, which produced the biomass originally, removes CO_2 from the atmosphere in the photosynthesis process. If we then use biomass to produce energy—electricity or **biofuels**—and, after that, **capture and sequester** the resulting CO_2 from

Carbon tax, carbon fee, carbon cost

A carbon tax is one way to pay for environmental and health costs that aren't yet factored into the cost of power generation while also making cleaner energy more financially competitive.

Kyoto Protocol

The Kyoto Protocol is an amendment to the United Nations Framework Convention on Climate Change, an international treaty that addresses what can be done to reduce global warming. The protocol adds more-powerful and legally binding measures, assigning mandatory targets for the reduction of greenhouse gases.

CalPERS, CalSTRS

The California Public Employees' Retirement System (CalPERS) and the California State Teachers' Retirement System (CalSTRS) are the nation's largest and third-largest pension funds, respectively. Together they have targeted investments of more than $1 billion for environmentally friendly endeavors.

SCHNEIDER: "IT'S NICE WHEN YOU FACE A COMMON THREAT AND YOU DON'T MAKE A POLITICAL SHOW OUT OF IT. THAT'S A MODEL I HOPE WILL SPREAD TO WASHINGTON."

this process, we get a net reduction in atmospheric CO_2. By piggybacking on the sequestration-technology work under way for coal, biomass could become an even more attractive energy source and new investment.

Khosla: And research on carbon sequestration for the oil industry is even more advanced. However, carbon sequestration in oil recovery has nothing to do with carbon sequestration for coal at the global scale we need it.

Schneider: Exactly. The oil industry has already pumped CO_2 underground. But oil companies have done it at a level of tens of millions of tons. The amount of CO_2 we need to pump from coal-burning power plants in the next 100 to 200 years, in a business-as-usual scenario, is trillions of tons. You can't scale from 10 million to trillions without an awful lot of research and development to prove it works.

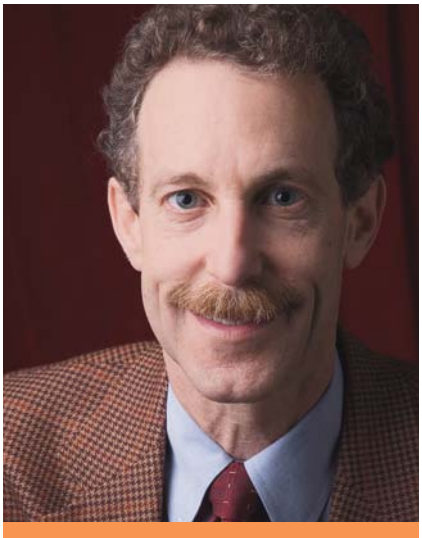
Reicher: We need to be spending more money on sequestration research. But my point is that the biomass world ought to be tagging along, because anything we can do to sequester carbon coming out of a coal plant we can do even better with biomass emissions. Take, for example, the pulp and paper industry. This industry is getting much of its energy in very inefficient ways from its own waste materials. If you could, first, radically increase the efficiency of the pulp and paper industry in powering itself and, second, sequester the carbon emissions, you could have an industry that is actually contributing thousands of megawatts of power to the U.S. electricity grid while at the same time having dramatic impacts on greenhouse-gas emissions. There's an interesting technology-meets-policy-meets-finance idea there.

Khosla: Yes. It's exciting that, when properly produced, biomass **fixes carbon** in the plant while growing, in the roots after harvest, and in the soil during decomposition.

Schneider: I'm a big fan of biomass, but you can't sequester carbon in the soil very long when the temperature gets warm, because then the bacteria that decomposes dead organic matter will work at much higher rates. If it's part of the solution to keep us under a two-degree increase in temperature, we're going to be all right. But if we're going to go high, then all that stored CO_2 is going to come screaming out when it gets warmer. If you warm the soil enough, it switches from being a **sink for CO_2** to being a source, and you only amplify the problem.

Khosla: Let's be fair. Rising temperatures might also increase plant growth, which could decrease CO_2. We don't know the dynamics of that. Further, once you have biomass, it then translates into other uses. You can fire it in coal plants for electricity generation, but probably a better use is to make plastics. That's relatively modest technology. The estimates I'm starting to see for bioplastics are 20 to 50 percent lower costs than petroleum-based plastics as long as oil is at $60 a barrel.

I'd like to make another point about



The assistant secretary of energy for energy efficiency and renewables during the Clinton administration, Dan Reicher is the cofounder and, at the time of *Sierra*'s roundtable, was president of New Energy Capital Corporation, which develops, owns, and operates renewable energy projects in the northeast United States. He now directs Google's climate and energy initiative, which has allocated hundreds of millions of dollars to make green investments and advance policy.

Biomass, biofuel

Biomass is the dry weight of plant or animal-waste matter. Biomass burned to generate electricity includes fast-growing trees such as willow and eucalyptus, waste from pulp mills, and even garden landscaping waste. *Biofuel* is the shorthand term for the kinds of biomass that are used for liquid transportation fuel—like ethanol.

Carbon capture and sequestration

Scientists are working on ways to safely corral the carbon dioxide now spouting from coal plants and other CO_2-emitting industries to keep it from contributing to global warming. They plan to trap the CO_2 and "sequester" it by pumping the gas into the earth, deep into the ocean, or into saline reservoirs.

Fixing carbon, carbon sink

Another form of carbon sequestration is both natural and free. Earth has long stored, or "fixed," carbon dioxide in its fields, forests, and seas, all examples of carbon sinks. In plants, photosynthesis removes CO_2 from the atmosphere, converts it to biomass, and releases oxygen. In oceans, not only do marine plants serve this function, but also the seas themselves act as a kind of pump that transports atmospheric CO_2 from the ocean's surface to deep underwater. In soil, carbon is fixed when chemical reactions convert CO_2 into inorganic carbon compounds like calcium carbonate and magnesium carbonate. When plant matter decomposes, some of the CO_2 released by the process is sequestered as soil organic carbon.

biofuels. I believe that the current U.S. subsidization of **corn ethanol** is a good trend. The corn ethanol process on average reduces greenhouse gases by about 20 percent. **Brazilian ethanol** reduces it dramatically more. A hybrid car improves efficiency by about 20 to 25 percent on average. Getting that efficiency improvement costs consumers between $3,500 and $5,000 more per car because of the extra batteries and drive-train costs. Sugarcane ethanol adds nothing to the cost of a new Brazilian car and reduces greenhouse emissions per mile driven by about 60 to 80 percent!

Unfortunately, politics in this country is such that we buy the cheapest oil from Saudi Arabia and have it compete with perhaps the most expensive ethanol in the world—U.S. ethanol—instead of the much greener ethanol from Brazil. Hopefully that will be corrected.

More important, to me, is that if corn ethanol had not established a marketplace, I would not be investing in **cellulosic ethanol** now. We have four cellulosic ethanol investments in our group, including a wood-cellulosic plant under construction in Georgia that will burn wood waste from the state's pine forests, and one in Louisiana that will use waste from sugarcane to produce ethanol. Several other investments use waste sources but don't fit the traditional definition of "cellulosic." None of that could have happened had the market not been established by corn ethanol.

Reicher: The ability to use all sorts of living things, from crops to forest products, to produce everything from fuel and power to plastics is exciting. Virtually anything we can do with fossil fuels we have the technology, or close to it, to do with biomass.

Khosla: Even more exciting, and this gets into geopolitics, is the use of biomass production to alleviate poverty. I grew up in India and went to college there and understand that we won't solve environmental problems without first solving the global poverty problem. It just won't happen. Biomass production is the only scalable poverty-reduction program in the world because it can increase the value of, and the income per acre of, land. And, unlike an oil well, it's least susceptible to corruption because it's so highly distributed—the very architecture of biomass helps with poverty.

Reicher: It's absolutely right that poverty in the developing world has to be addressed. But let's not forget our own country. More than 30 million U.S. homes are currently eligible for the home-weatherization program, which insulates people's dwellings and can, for a modest investment, reduce home energy use by more than 30 percent. Yet with regard to federal policy, what do we prioritize? We spend $3 billion to $4 billion a year to buy down people's fuel bills. It's a reverse incentive—really a perverse incentive—rather than a positive incentive.

The budget last year for the home-weatherization program was $228 million. We've done 5.5 million homes in the U.S. in the last 30 years, but we have 25 million more that are eligible for federal and state help. By upgrading a home's furnace, sealing leaky ducts, fixing windows, and adding insulation, we can cut energy bills by up to 40 percent. By adding energy-efficient appliances and lighting, the savings are even greater. Replacing a 1970s-vintage refrigerator with a new energy-efficient model will cut an average home electricity bill by 10 to 15 percent.

There may be ways to encourage private-sector investors to make major investments in home weatherization, leveraged by government money, par-

Senator Barbara Boxer's senior policy advisor on global warming, **Bettina Poirier** is also the senator's staff director and chief counsel for the Environment and Public Works Committee.

Corn ethanol

To make ethanol, corn is ground up and combined with enzymes; the resulting cornstarch is then broken down into sugar. After it's been fermented with yeast, the sugary mash is distilled and converted into ethanol. Though corn ethanol burns cleaner than gasoline, corn cultivation relies heavily on petroleum-derived fertilizers and diesel-fueled tractors, and its refining process currently requires large quantities of fossil fuels. In the United States, corn ethanol is commonly combined with 15 percent gasoline to produce the E85 mixture sold at some gas stations.

Brazilian ethanol

Brazil has achieved near energy independence by using sugarcane to produce ethanol. Cane is cheaper than corn to process because it's already sugar and doesn't need converting before distillation. Brazil's farm policies also make its ethanol cheaper: Brazil ended most of its subsidies for the sugar industry in the 1990s, which forced producers to become more efficient.

Cellulosic ethanol

Cellulose, or plant fiber, can be converted into ethanol. Switchgrass, a prairie grass native to the Midwest, is one source of cellulosic ethanol currently under development. It requires far fewer pesticides than corn and soy. But, according to Massachusetts Institute of Technology publication *Technology Review,* cellulosic ethanol is expensive, requiring more-costly equipment and additional processing steps because the conversion of cellulose into sugar is more complicated than for corn. However, reports the magazine, "Research is already improving parts of the process, [and] researchers have created a cocktail of enzymes for converting cellulose into sugar that is a hundred times cheaper than previous methods."

THE POWER OF TRUTH

{EXCERPTED FROM AL GORE'S COMMENTS AT *SIERRA*'S CLIMATE FORUM}

Former U.S. vice president **Al Gore** has been nominated for a Nobel Peace Prize for his work to bring attention to the threat of climate change. His 2006 documentary on global warming, *An Inconvenient Truth,* recently won an Academy Award, and his book on the degradation of democracy, *The Assault on Reason,* will be released in May.

GLOBAL WARMING is, first and foremost, a challenge to the moral imagination. Nothing in our history or experience prepares us for contemplating, much less acting upon, our new relationship to a planet that has been utterly transformed in a short period of time.

Though the population is stabilizing, it has had an effect on our footprint. We've nearly quadrupled the population in less than a hundred years, and that has set the stage for the introduction of technologies that are thousands of times more powerful than any our grandparents had. Along with this, we've had a curious change in philosophy. We think it's OK not to worry about the long-term consequences of our actions.

All the information flowing toward us may be one factor that foreshortens our time horizons, causing us to focus on the near term and instant gratification. So much so, in fact, that when one says, "This will hurt your grandchildren," it's hard to get a response. Recently I read about the newly emerging consensus with regard to the rate of melting of the North Polar ice cap. Under business-as-usual conditions, the ice cap will be completely gone in the summertime within 34 years. First they came for our grandchildren, then they came for our children, and now they're coming for us. This is playing out now.

To build a consensus for change, we have to effectively communicate the danger we face. Yet this is difficult. T. S. Eliot wrote, "Between the motion / And the act / Falls the shadow . . . Between the conception / And the creation . . . Falls the Shadow." We have to cross that shadow.

Three systems are involved: the value, market, and political systems. Our values are formed in different ways, by our culture, faith traditions, families, and communities. We have achieved a great deal of progress in building a consensus that important values are now at risk and we have to act.

Translating that into meaningful change in the market and political systems is the immediate challenge. We've heard from Paul Anderson and others about the importance of putting a price on carbon as a way of assisting the market to make intelligent decisions. That has to be done.

For 14 years, I've proposed that we ought to reduce employment-based taxes down to nearly zero and replace them dollar for dollar with pollution-based taxes, principally on CO_2. Think about it: We live in an outsourcing world where competition with low-wage-based developing countries is fierce. We are handicapping ourselves by piling on top of our single biggest disadvantage—our high-wage structure—the full cost of our health, education, and welfare systems, which come in the form of employment-based taxes. These taxes are killing our ability to compete. Why not give employers and employees a break and encourage more jobs while discouraging the destruction of the planet?

With regard to our political system, it now devalues knowledge and facts. It didn't used to. What was special about the America we were born into was that it still embodied the highest values of the Enlightenment. We grew up in a world where truth mattered, and when new ideas came from people like Stephen Schneider, Dan Reicher, Paul Anderson, and Vinod Khosla, the merit of the ideas was judged against the rule of reason. Our political system, never perfect, nevertheless paid more attention to such things.

The political system doesn't act that way anymore. As in the feudal era, wealth and power now regularly trump knowledge, facts, and reason. The diminished role of reason in the public marketplace of ideas has an impact—from the auto industry to the upcoming presidential campaigns. The joke about the auto industry is that after the Clean Air Act was amended in 1970, every Japanese auto company hired 100 new engineers, and every U.S. company hired 100 new lawyers. It's not too far from the truth, unfortunately.

I have a political idea that is scalable, to use an important concept properly underscored and highlighted by the Sierra Club's roundtable. We ought to have a mass movement around a carbon freeze; it's scalable from the individual level to the company, community, state, and national level.

Gandhi used the word *satyagraha,* or "truth force." In American politics, there have been soaring moments throughout our history when the truth has swept aside entrenched power. In the darkest hours of our Civil War, Abraham Lincoln said, "We must disenthrall ourselves, and then we shall save our country." We need once again to disenthrall ourselves.

▸ ON THE WEB *The San Francisco–based Alliance for Climate Protection is a new initiative from Al Gore. He calls it "an effort of mass persuasion" to motivate the public, develop political consensus, and implement solutions. Visit* allianceforclimateprotection.org.

After working with the Peace Corps in India, and turns with Zero Population Growth and the League of Conservation Voters, **Carl Pope** came to the Sierra Club in 1973. Co-author of *Strategic Ignorance*, which the *New York Review of Books* called "splendidly fierce," Pope has been the Club's executive director since 1992.

ticularly if we can aggregate thousands of homes into financeable packages. If we can figure out a public-private investment approach, we can radically increase the number of homes we weatherize each year and the resulting climatic and economic benefits.

Poirier: Senator Boxer has focused on the extent to which government incentives can drive the markets and work efficiently. Are there other places where a role for government is helpful in getting over barrier-to-entry humps?

Anderson: Utilities are a natural to weatherize homes in this kind of public-private partnership. Yet most utilities are rewarded for producing more energy and building more plants. In most states, there is no reward for the people who can actually create efficiency. If a utility were to come up with a plan to cut energy use by 20 percent and was willing to give half of the benefit to the customers and half of the benefit to its shareholders, the state public utility commissions would say, "That's a great plan, but it's going to go 100 percent to the customers." And so the utility decides to build another power plant instead.

Pope: Whether at the city, state, or federal level, government should be required to factor in the lifetime costs and benefits of its investments in the energy field.

I recently heard a great story about Chicago, where one of the largest line items in the school budget is utilities. Mayor Richard M. Daley decided that the city could afford the up-front costs of retrofitting its public schools with energy-efficient windows so as to save money down the line in utility bills. He also ensured that the contracts for the majority of the construction labor would go to Chicago residents.

Schools are a wonderful example of the long-term benefits of building green. Energy-efficient schools reduce emissions from power plants by using less energy. And improved indoor air quality, lighting, and temperature have been found to improve both school attendance and test scores.

Khosla: We also need long-term policy from Washington so we can make 15-year investment decisions in these areas. We don't mind losing. In the technology venture-capital world, we know we lose half the time, maybe 70 percent of the time. But when we lose, we lose our initial investment. When we win, we make 50 times our money. The math works. We just need to make sure we do enough crazy projects.

Policies should encourage investment because we are close enough in technological terms to make coal, oil, and petroleum-based plastics obsolete and to have efficiency breakthroughs. The investor needs long-term stability on policy even more than having the most attractive policy.

Reicher: I agree. Wind industry investment year by year over the last ten years was up and down—all driven by whether the industry thought tax credits were going to be extended by Congress, which tends to only authorize them for a year or two. On-again, off-again tax credits have killed the acceleration we could have seen with renewable technologies.

Schneider: I had an interesting experience with Australia's government; I recently spent six months there. I'm not responsible for this title, but I was the Adelaide thinker in residence. After long discussions with government

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officials and business heads, the premier of South Australia announced a target of a 60 percent cut in emissions by 2050. I advised the premier to start smart. I borrowed from California, which is the lowest-CO_2-emitting state per capita, what I call the 7-11 solution: Legally mandate energy-efficiency standards—better windows, lights, refrigerators, air conditioners, and automobile performance standards—that pay for themselves in less than 11 years. This would be roughly equivalent to a 7 percent return on investment—as good as or better than the standard mortgage interest rate. You can't make it voluntary. Some business executive argued that "we're not a culture of mandatory," and I said, "Then you're not a culture of sustainability."

Pope: Yet at the federal level, we have an energy policy in which oil, coal, and uranium producers matter, not consumers. Congress approaches energy policy as a regional zero-sum game—who gets to scratch whose back.

Khosla: I agree that there isn't a level playing field with regard to energy subsidies, and I'm not a huge fan of incentives, but I've proposed a policy package for biofuels. To give you some rough numbers, with the current course in the next 15 to 20 years, incentives for biofuels would reach at least $80 billion. With the policy package I have proposed, $30 billion.

Poirier: How is yours different?

Khosla: It creates a variable subsidy that is countercyclical with oil. If the price of oil goes down, the biofuel subsidy goes up. Making subsidies variable with oil prices and smaller than they are today will save the federal government a lot of money, and from a capital-formation perspective, it dramatically reduces the risk. If you reduce the subsidy but provide more downside protection, the safety for new capital coming in goes up dramatically.

Pope: So it's better to incentivize capital than to create windfalls?

Reicher: Exactly. There's a huge difference between incentives and tax policy. As soon as you say we're going to give everybody a 20 percent tax break for doing X, then everybody says, "I'm doing X," regardless of what they are really doing.

We're advanced enough in our analyses that we could sit down and have a rational discussion about incentives, mandates, scalability, capital needs, trajectories for climate, and near-term and long-term approaches. We've finally gotten to a moment where all the right parties are motivated, or most of the right parties are motivated. Goldman Sachs is involved in the conversation now, Citigroup, John Hancock Insurance. People are sitting down at the table and are willing to put money into climate-change solutions.

Coming back to Carl's earlier point, forcing the government to consider lifetime energy costs is critical. We wrote an executive order for President Clinton on the federal government's own energy use. And I'll tell you, dealing with the procurement officers of the different agencies on paybacks was extraordinary. We lost, frankly. It was the same old story: We've got to have a two- or three-year payback, and if we don't have that, it can't work.

Schneider: I had exactly that argument in South Australia, and I had to remind the premier that the treasury doesn't run the government, he does, and that if there's some benefit to the society from a 7 percent rather than a 20 percent return on investment—from the reduction of pollution and the kick-starting of industry—then he'd better overrule those guys from business school who think that 20 percent is the right number.

Khosla: In the U.S., Wall Street needs

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A SENATOR'S VOW

{EXCERPTED FROM BARBARA BOXER'S COMMENTS AT *SIERRA*'S CLIMATE FORUM}

I WILL MAKE THIS PLEDGE: We will do something about global warming. It will be good, and it will be bipartisan. A lot of the ideas your roundtable came up with will be carefully considered. You're being strategic and pragmatic, suggesting, for example, that we have to start sending signals to coal companies. We have to start sending signals not to expect to be grandfathered into the old rules, because we can't do business the way we used to, now that we know what we know.

Let's suppose, for a moment, that we prepared for global warming and it didn't happen. The fact is that all the things we can do are good for our country anyway. If we increase our energy independence, it's beneficial—whether from a foreign policy or trade-deficit perspective. Oil importation is responsible for almost half our trade deficit. In addition, pollution would decrease. Indeed, when we look at our families in California, the biggest cause of school absenteeism is asthma. These changes are better for our families and for the economy. We will create jobs. We'll increase competitiveness and export new technologies. Our venture capitalists will love this. Our farmers will be happy. Look at the opportunities in cellulosic fuels.

Finally, I want to thank Al Gore for his work. As a policymaker, I wouldn't be in the position I am today without him. I really think people looked at this issue last November 7 and voted in many areas because of it. I make a commitment to you now that the vice president's work is going to bear fruit.

First elected to the U.S. Senate in 1992, Senator **Barbara Boxer** (D-Calif.) is now chair of the Environment and Public Works Committee.

to start believing that there's a huge risk attendant with being a carbon emitter and that some form of carbon control is inexorable. Let me be blunt: We need to scare business. Even though we can't pick a date for setting a price on carbon, we can start to dramatically increase the internal risk calculation. I'm on a large board, and one of our eight meetings last year was dedicated to risk; we spent a whole day talking about it. You want carbon risk to become a boardroom discussion everywhere.

Anderson: We currently worry about our carbon exposure. We look at every project with and without a cost of carbon, and we take it to the board and say, "Here's your return with a carbon cost; here's your return without a carbon cost."

Reicher: Can you tell us what you assume is the likely carbon cost?

Anderson: No, I don't think I should, but I'll tell you that the firm I headed, BHP Billiton—the largest global mining company in the world—makes the same calculation.

Khosla: I can add the following data: The business assumption is that there is a marginal cost to removing carbon from the air of $40 to $50 a ton.

Anderson: In a cap-and-trade or carbon-allowance system, it will be something less than that. With the carbon tax, it'll probably be even less. The thing is, when the board says, "What's the likelihood there's going to be a cost of carbon?" I tell them that the likelihood in a time frame that will affect the economics of this or that project is probably irrelevant.

Pope: What time frame might affect your decisions?

Anderson: It depends on the project. But here's the issue: You not only have to assume that there's going to be a cost of carbon, you also have to assume the form it will take and how you are going to have to pay it and whether it will be a level playing field. There are so many unknowns.

I would be irresponsible to go to my board and say, "You ought to plan on this course of action and for this level of carbon tax" if I weren't certain that a carbon fee was inexorable.

Poirier: What sends a signal to people in business that carbon should be factored in? You all were saying you have entire meetings on risk. How do we get these issues considered in those meetings in the near term?

Anderson: A statement and a commitment by government that it will not **grandfather** CO_2 emissions. Otherwise, it just becomes a question of whether your lobbyist is better. If you say that we are not going to create an asset out of your pollution under any circumstances, that will flip it.

Khosla: I agree. The one thing government could do in the power sector right now is say that no matter what else happens, we're not going to give up on the grandfathering issue.

Reicher: I'm not sure how long it's going to take to get federal carbon legislation passed, signed, and implemented, but I'm optimistic it will happen. Meanwhile, it's important that the states act. They have been great laboratories and implementers. California has acted on carbon; the northeastern and mid-Atlantic states have acted to some extent. There are other ways to get at the problem as well, such as setting standards for renewable electricity, which 23 states have now adopted.

An example: New Energy Capital bought an old wood-fired power plant in Maine and put many millions of dollars into it to cut pollution and increase efficiency. We did this project for one reason: By upgrading we met the Massachusetts requirements for renewable energy credits. We were being paid seven cents a kilowatt-hour for electricity, but with upgrades we will be paid another three or four cents a kilowatt-hour because we can sell the green credits to Massachusetts, which has adopted an aggressive renewable portfolio standard.

Pope: California has passed a bill—and I know it's working because when I go to Wyoming, the governor yells at me about it—that restricts the importation of electricity made by anything dirtier than the state's most efficient natural-gas plant. Would the adoption of these criteria in other states create a ripple in your boardroom, Paul?

Anderson: Anything that will be enduring and create an economic effect will create a ripple. Anything that's a flash in the pan, politically unsustainable, won't.

Reicher: Efficiency standards are another avenue. They have been one of the most effective, least heralded approaches the federal government can take. Some years ago, appliance manufacturers agreed to a consensus standard and thereby avoided litigation and the usual rule-making process. In exchange, they got some money from Congress to work on their appliances. That was a really good bargain.

It isn't controversial like a tax would be. Yet it moves us along. Look at refrigerator, air conditioner, freezer, and furnace standards. Talk about boring technology. But boy, the near-term impacts are extraordinary.

Whether we build from the ground up, state by state, or build candidate by candidate to press in on carbon controls, these efforts will ultimately force boards to realize change is inevitable. They will then start to put time frames around it. Such pressure will also help Washington get done what needs to get done because, at a certain point, folks in industry won't be able to live with the state-by-state patchwork of regulations. That is how we got national

Grandfather

This form of regulatory nepotism grants an exemption to an existing operation when new rules come into force. Right now there are hundreds of coal plants operating in the United States and 150 more in various stages of permitting and construction. Industry wants these new plants to be grandfathered in, i.e., exempted from any laws that restrict carbon dioxide emissions in the future. If the United States moves to a cap-and-trade system, CO_2 from these plants could become an asset, or allowance, that companies could sell on the open market. Senators Barbara Boxer (D-Calif.) and Jeff Bingaman (D-N.Mex.) have warned utilities not to expect new plants to be grandfathered.

appliance-efficiency legislation passed long ago.

Poirier: Are there any other approaches, such as community right-to-know legislation, that could be useful?

Anderson: We need to focus on action versus process. There's no better way to avoid doing something than to study things, gather information, and talk about how we're going to go about doing something. If you're going to take Paris, take Paris.

A hydrogen economy? That's a good discussion over a Scotch. We must avoid peripheral issues or long-term solutions that we don't have to do anything about. This is particularly important with regard to politicians and businesspeople because their watches are limited, and if they can hold the dogs at bay, it'll be somebody else's problem.

Schneider: With regard to the scale at which we must work, let me tell a story. When the Kyoto Protocol came into force in 2005 without Australia or the United States, I got a call from the BBC World Service. The interviewer asked whether I was frustrated that the largest emitter in the world, the United States, had no climate policy as Kyoto came into force.

Her comment was flawed on two counts. First, it's hard to say that Kyoto came into force when there is, in fact, no enforcement. Kyoto is a generation-long, learning-by-doing experiment in how to cooperate. Second, the United States has a lot of climate policy. The Bush administration represents only one part of the government. Nearly 400 cities, in every state plus Washington, D.C., have signed the U.S. Mayors Climate Protection Agreement.

Time-of-use meters

These electricity meters show customers how much energy they are using at any given time in their home. By charging customers more during peak demand periods, utilities hope to reduce electricity consumption between noon and 6 P.M. weekdays. If they succeed, it's a win-win proposition: Customers use off-peak electricity at a lower price, while power companies avoid having to build new plants to meet peak load demands.

Hundreds of corporations also have meaningful climate policy.

All politics is local. That climate-change policy started locally and increasingly includes the corporate world is another example of how change can happen. But we have to have a change nationally as well. Other countries are moving forward—Japan and Europe, for example.

Reicher: Europe has taken advantage of the efficiency opportunities in several ways. First, it decided to charge higher energy prices. Second, there is a much more robust system of **time-of-use metering.** Third, it has more-robust building and renovation codes. Finally, it has a culture that supports energy efficiency. This has happened in economies that are not that different from our own. Why does it happen in Europe and not in the U.S.? Or in California and not in Texas?

Schneider: There's a political and cultural difference as to private rights versus public protection.

Khosla: I don't know what the kids are like in Texas, but my kids are growing up in a world, in California, where inefficiency, the National Rifle Association, and racism evoke the same emotional response; it is very visceral.

Reicher: There are cultural challenges. But we have the technical means available to make real strides. We don't have all the financial structures in place. There are additional policy tools that would help. The trillion-dollar challenge is deployment. If we put the right policies in place, if we continue to advance the technologies and change cultural attitudes, capital *will* be driven into the market.

My last thought is about President Bush. If big industry continues to positively step in, if the big investment and technology firms continue to step up, there is a chance that the president might do something on climate change. The pressure is growing; real controls are being put in place at the state level. Ultimately, the federal government will have to act. ■

MARILYN BERLIN SNELL *is the senior writer for* Sierra.