NEW DIRECTIONS FOR CLIMATE RESEARCH AND TECHNOLOGY INITIATIVES

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April 17, 2002

NEW DIRECTIONS FOR CLIMATE RESEARCH AND TECHNOLOGY INITIATIVES

WEDNESDAY, APRIL 17, 2002

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE,
Washington, DC.

The Committee met, pursuant to call, at 10 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Sherwood L. Boehlert (Chairman of the Committee) presiding.

Chairman BOEHLERT. The hearing will come to order. I want to welcome everyone here today for this important hearing which should help us set the agenda for science and technology research related to global change. This is a critical moment for global change research programs. While in many ways the successes of these programs are unarguable, their future contours have never been more uncertain.

For starters, the U.S. Global Change Research Program, which was created by this Committee in 1990 is undergoing a thorough and needed review by the Administration, and it is being reorganized in ways that may prove significant. At the same time, the Administration has proposed two new research endeavors, both promising, but ill-defined—the Climate Change Research Initiative and the National Climate Change Technology Initiative. The creation of these two new programs indicates a desire to change, or at least to intensify, the focus on the Federal Government's global change science and technology research programs.

Outside the government, the existing program is also being scrutinized and reassessed. Some experts suggest that the science program is focused on the wrong issues entirely, paying too much attention to long-range questions that will always be hard to resolve, while resource managers who raise shorter-range climate questions go begging for answers. Others suggest the need for a heightened attention to a small set of long-range questions, such as the nature of the carbon cycle, and to providing the modeling and observational tools needed to answer them.

Similar issues have been raised about focusing the government's technology programs, which have led to significant incremental technical improvements, but haven't usually been as successful at great leaps forward or market penetration.

So all these research programs are at a crossroad, making this hearing especially timely. What we haven't asked our witnesses today is to weigh in on the specifics of the review or proposals that are currently on the table. Instead, we have asked them, in effect, what they would do if they were put in charge of the science and technology programs. What research goals would they set out and how would they set up an agenda to achieve them? I look forward to hearing thoughtful, provocative, and varied responses.

We will then follow up on today's hearing with a hearing in late May or June to hear from government witnesses to learn exactly how the Administration plans to proceed with a climate program the President laid out in speeches last June and this February and in his proposed budget. Our questions at that hearing, and the answers, too, one would hope, will be informed by the ideas we gather today.

I have to say that the Administration would be wise to listen. So far, it has spent much too much time reorganizing and not enough time thinking through substantive issues. Additional time has been wasted because of a reluctance to begin by reviewing the USGCRP 10-year plan which is required by law and was finally prepared about a year-and-a-half ago.

It has been especially frustrating dealing with the Department of Energy, which, so far, has been either unwilling or unable to tell us how the $40 million proposed by the President of the United States for NCCTI actually would be spent by DOE. I guess we can't even agree whether it should be NCCTI or necktie, but we will let you take your choice.

But that said, the Administration deserves credit for bringing up top-level attention to the science and technology programs, and for asking tough appropriate questions about them. And we all have to remember that these issues aren't easy. Global change research questions, which seek to understand, in effect, earth, fire, air, and water, and to link them systematically, is mind-bogglingly complex. Maybe instead of dismissing a simple matter by saying, it isn't rocket science, we really ought to be saying, it isn't climate science.

Figuring out what—which research questions to pursue isn't easy either, as today's hearing will demonstrate. And, of course, resolving the policy disputes that the research is supposed to inform, is perhaps toughest of all.

But that is beyond what we are here to discuss today. Today, we want to listen on the ideas our experts can provide to ensure that we have a properly focused, effective research portfolio for both the science and technology related to global change. I look forward to the testimony. The Chair is now pleased to recognize Mr. Hall.

[The prepared statement of Mr. Boehlert follows:]

PREPARED STATEMENT OF CHAIRMAN SHERWOOD BOEHLERT

I want to welcome everyone here today for this important hearing, which should I help us set the agenda for science and technology research related to global change.

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For starters, the U.S. Global Change Research Program (USGCRP), which was created by this Committee in 1990, is undergoing a thorough and needed review by the Administration, and it is being reorganized in ways that may prove significant.

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April 16, 2002

Congressman Sherwood L. Boehlert, Chairman
United States House of Representatives,
Committee on Science
Suite 2320
Rayburn House Office Building
Washington, DC 20515-6301

Dear Chairman Boehlert:

Pursuant to your request of April 1, 2002, regarding my testimony to the Committee of April 17, I'm sending this letter to disclose our current financial interests related to direct Federal support.

During the previous three years, we conducted research and demonstration programs supported by the United States Environmental Protection Agency.

The first activity was a cooperative agreement to support the Alternative Clothes Cleaning Demonstration Project, contract assistance number EQ985537-01, in the amount of $150,000 which was found to be complete on February 17, 2000.

The second activity was a cooperative agreement to support analysis of a new financial services product, the Location Efficient Mortgage, under assistance agreement 822440101, which was found to be complete in March of this year. This work was substantially completed two years ago. Our organization was the contracting agent for a research consortium. The cooperative agreement was in the amount of $135,000, and was supplemented by support from the Federal Transit Administration in the amount of $300,000, and the U.S. Department of Energy, Office of Transportation Technologies in the amount of $150,000.

We appreciate the opportunity to present testimony; if you have any questions about this disclosure, please do not hesitate to contact me.

Sincerely,

Scott Bernstein,
President

DISCUSSION

TOP PRIORITIES FOR CLIMATE CHANGE RESEARCH

Chairman BOEHLERT. Thank you. Thank you very much, Mr. Bernstein. I would like to ask each of you to tell me what your top priority item would be for the research agenda of the science or the technology programs and then whether your priority is adequately addressed by the current programs. So Rad—Dr. Byerly, we will start with you. Microphone, please. We want to hear you.

Dr. BYERLY. Thank you. My top priority is connecting to users in research planning. I think Scott talked about doing that, and I think that is a good example of what I was talking about. What we have now is basically people doing the research they want to do, good research, scientifically excellent, advancing our understanding, but it may only accidentally be useful to a user. And I think we should keep doing that. I am not against that. But I think we could spend a little bit of money in connecting the users and planning research to meet their needs instead of planning ways to find the results of existing research and try to bend things around so that the users would use the research that is being done now.

It is a—what we have now are solutions looking for problems, a man with a hammer seeing everything look like a nail, that sort of thing, instead of planning the research to deliver the information that is needed.

Chairman BOEHLERT. Dr. Barron.

Dr. BARRON. Well, I am taking your question as assuming that the science we have is very important, and the thing that we have to add to that is this ability to integrate across these disciplines in order to better serve society. And I think in the strategic plans of the USGCRP, at least the draft that so far the community has been able to look at, and in the outlines for CCRI, this type of integrated focus is there, but the resources are not yet there.

Chairman BOEHLERT. Dr. Miles.

Dr. MILES. Thank you, Mr. Chairman. We have users involved in planning the research at every step. We have learned how to integrate across a wide variety of scientific and social scientific disciplines. We need to be able to cover all climate-sensitive sectors within the region. We cannot do that now with the resources available. Thank you.

Chairman BOEHLERT. Thank you. Dr. Edmonds.

Dr. EDMONDS. Well, in preparing my oral remarks, I asked myself that same question, "What is the thing that I would point to first?" So, in my oral remarks you heard me call out carbon capture and disposal as being a potentially very important technology to add to our portfolio, particularly, enhancing our ability to monitor and measure what is put into reservoirs. So that is the first thing.

The second is the area of biotechnology, which has potential for paying very large dividends, both in the realm of risk management portfolio and climate change, but also in enhancing energy security. So if you will forgive my two-handedness, those are my answers.

Chairman BOEHLERT. Mr. Bernstein.

Mr. BERNSTEIN. Since energy consumption happens in places, coming up with a technology that would help us better understand how energy is actually used in places would allow us to organize

rapidly. So I would put the first money on that into accelerating the deployment of end-use, real-time metering in places. If we had that, then people could organize rapidly around it because they can see the benefits.

One chart I went through too quickly ends up aggregating up to a potential of between 600 and $800 million a year savings within a few years in northeastern Illinois alone by the introduction of that. That would do it. If you would link in peoples' mind that attacking a climate as an issue is going to put that much money in their pockets, I think that goes a long way toward getting over the skepticism and the confusion that happens when they read about this. So linking those things as important information makes that possible.

Chairman BOEHLERT. I couldn't agree more. Dr. Barron, what level of funding is needed to accomplish your vision?

Dr. BARRON. You know what I think we should do is begin with some pilot studies—prove that we can do it.

Chairman BOEHLERT. Uh-huh.

Dr. BARRON. And so, for example, there is a growing northeast environment health connection alliance. And what you are discovering is that this investment and observations that we have are helping us decide whether water is ponding and whether or not you should go out there and put a larvicide in a pool to remove mosquitoes that are delivering West Nile virus before they hatch. And then it is not nearly so environmentally benign to use an airborne insecticide.

And the same focus on USGCRP that enables us to use El Niño to anticipate a season in advance, is allowing us to start to anticipate what resources we need and what kind of season for mosquitoes or ticks we might have. And the same science has enabled you to think about the longer term impacts.

Now, my feeling is that if you start investing tens of millions of dollars into pilot studies that prove that we can integrate this and serve the needs of decision-makers, that you will discover that this becomes contagious, that we will have a certain amount of information envy and we will end up with a new model for how we provide information in this country.

Chairman BOEHLERT. Thank you very much. My time is up. Dr.—Mr. Hall.

Mr. HALL. You can call me doctor if you want to.

Chairman BOEHLERT. Dr. Hall.

INTERDISCIPLINARY RESEARCH

Mr. HALL. Thank you, Mr. Chairman. Several of you have noted the importance of enhanced interdisciplinary research. I would like for you to elaborate on that a little. For example, why it is so hard to produce good interdisciplinary research, and who ought to fund it, and does NSF do a good job of funding it and—on climate research. Dr. Byerly, do you want to kick off on that?

Dr. BYERLY. I think you ought to let somebody else go first next time, but I will start here. NSF has difficulty of that, just starting with your last question. I have served on some review committees, reviewing interdisciplinary proposals for the National Science Foundation. And, at least at that time, if it was interdisciplinary between physics and social science, it had to separately pass peer review in the physics community and the social science community. And, of course, if it were truly interdisciplinary, the physicists didn't like it and the social scientists didn't like it. So interdisciplinary projects had a hard time getting through the review system. So it is difficult because of the disciplinary structure of NSF as an agency and the way they run reviews.

But—and I don't want to be Johnny-one-note—well, I guess I do want to be Johnny-one-note here. I think that if you define your research around a problem, you let the disciplines emerge that need to be done to address that problem. If you evaluate the success of the research based on solving the problem, your interdisciplinarity comes out more or less automatically or you don't get renewed in your funding for the next year. So you begin weeding people out.

So it is hard in our system. Universities are organized around disciplines and that is where a lot of this research is done. Professors get their tenure and their promotions by disciplinary research, so it is a big cultural problem doing it. And one way to do it is to try to focus around problems rather than disciplinary research. We need to disciplinary research to advance science, but this program, it seems to me, is a problem program, not a science, or should be a problem program, not a science program.

Mr. HALL. Dr. Barron.

Dr. BARRON. Well, I think it should be both. And I think one of the challenges is, if you just ask people to do it, you start to accumulate a lot of faculty members from different disciplines, and all of a sudden that budget becomes something that is large and significant. And that makes it a challenge for NSF or for some other agencies.

So I think the key there is you really want to target that opportunity. You want to state it as a priority that the—this focus is to bring the physical sciences and the biological sciences and the human dimensions and put the decision-maker right there in the room. It will help drive the science and it will help drive the decisions.

And I think if you have a targeted enterprise with that as its objective, and as soon as you get those people in the room, in this environment health alliance, the number of people that were sitting in that room from CDC, NIH, across the board, decision-makers in the State of Pennsylvania that focus on mosquito control programs, right to the scientists doing the climate prediction, you can discover that it can be really exciting and successful. You have got to get people in the room and you have got to show a commitment that putting people in the room, they are going to end up to be successful.

Mr. HALL. And you have to get them all in the same room.

Dr. BARRON. Well, unfortunately, I think you really do, because we have a lot to learn from each other. I need to watch how that decision-maker acts and how they use that information. So that instead of my taking climate information and, in a sense, throwing it over the transom thinking that it is the most wonderful thing in the world and everybody will realize my latest climate simulation is just great, you have got to see exactly how it is they use that

information so you can start predicting the things that are really useful.

Mr. HALL. Dr. Barron, how long have you been at Penn State?

Dr. BARRON. For 16 years.

Mr. HALL. Well, maybe you can answer a mystery that I have got. After, oh, two flights before the Challenger exploded, we sent up the equipment called electropheresis in space——

Dr. BARRON. Yeah.

Mr. HALL [continuing]. And produced crystals in a weightless environment and——

Dr. BARRON. Uh-huh.

Mr. HALL [continuing]. Came back and landed and bacteria destroyed the effectiveness of them, and they were to go back, but the Challenger exploded and no one went back for a couple of three years. And I got to looking for that equipment and found it at Penn State.

Dr. BARRON. Is that right?

Mr. HALL. I have always wondered which strong senator or which strong Member of Congress got it there. And how it——

Dr. BARRON. I don't know.

Mr. HALL. And what you——

Dr. BARRON. I really don't know.

Mr. HALL. And what you did with it there.

Dr. BARRON. Yeah. I am afraid that is out of my college realm.

Mr. HALL. I have written——

Dr. BARRON. I could certainly ask.

Mr. HALL. I have written to Unsolved Mysteries. They are working on it and—all right. Is my time up? Yes.

Chairman BOEHLERT. Your time is indeed up.

Mr. HALL. Thank you.

Chairman BOEHLERT. Dr. Ehlers.

Mr. EHLERS. Thank you, Mr. Chairman. And, Dr. Byerly, I have a number of questions and comments for you, and not because you are first, but because of what you said. First of all, on your comments on interdisciplinary research, you are right on. And when I prepared a policy statement for this Committee and the House of Representatives several years ago, which was approved by both this Committee and the House, I made that point. That NSF—not only NSF, but the other granting agencies should set up interdisciplinary patterns to—panels to review interdisciplinary research and not send it to two panels, because it is not working that way.

But we have here a topic which is incredibly interdisciplinary. Probably need about six to ten disciplines represented in really analyzing the climate change issues.

THE IMPORTANCE OF ACCURATE PREDICTIONS

First, your comment that accurate predictions do not give policy solutions, which is certainly true. But it isn't important for us to have fairly accurate predictions in order to make good policy decisions?

Dr. BYERLY. Well, I would go back to the Social Security example——

Mr. EHLERS. Yeah.

Dr. BYERLY [continuing]. Because it is pretty straightforward. If we had better demographics, it might change the date a couple of years, but it still doesn't help us. Let me——

Mr. EHLERS. May I just interject? That is a case where we do have accurate information and we can make good predictions. We can't in the climate area.

Dr. BYERLY. Well, the point is that there is a decoupling between a prediction. The prediction just says there is a problem, and what to do about it comes from totally different considerations.

Let me give an example of a program that is in the RISA program that Dr. Miles talked about, and that is the Western Water Association, which is located in the center where I am now a resident scholar. They are looking at Western Water and, in part, they have connected with users in the area and they have found out, for example, that Denver—and they were looking at the Denver water region—Denver has a lot of water that goes right through Denver, out onto the prairie where it is used to irrigate farms. Denver also sits on top of a very large aquifer which has several hundred years' water in that aquifer and is untapped.

Now, policy decisions need to be made today about water and, yet, when you look at water, we have got a ton of water in the area. The problem is not a climate-related problem. It is not that we don't have water, that we are going to lose water. The problem is we have made a conscious decision to support small farms by letting the water go out to them. We are essentially irrigating alfalfa with drinking water. We are subsidizing the beef industry, if you will. Now, that was a conscious policy decision.

At some point, the stream flow may be reduced—could potentially be reduced by a climate change. But a prediction is not likely to be nearly as important as the policy decisions of whether we want to continue to support agriculture, whether we want to continue to support the right of city dwellers to irrigate their bluegrass lawns which are not native to that area and don't belong in that area. So we are also—and the city is irrigating lawns with drinking water.

So we have got so many low-cost, low-value uses of water that we are a long ways from really running against a limit on the amount of fresh water that might be affected by climate change. So that is where I say prediction doesn't maybe not help you in that——

Mr. EHLERS. No. I agree. But you can't make good decisions without good data. And so what I am—what I basically say, and I don't want to dispute this point any further, but, simply, I think we have to do both. We have to pursue the long-range science, but we also have to fund the shorter-range problem-solving issues and do both.

ADMINISTRATION COORDINATION OF CLIMATE RESEARCH

Let me get back to the interdisciplinary aspect as it relates to the whole climate program, and I am very concerned about that. This is a very interdisciplinary program in terms of government funding and structure. It is what is called a crosscutting program that gets across a large number of departments. The President's proposal is to integrate this to some extent.

And I have before me the chart that has been developed of how this is going to be managed. I frankly find it confusing with the yellow boxes, the gray boxes, the blue boxes, the green box, etcetera. I understand what they are trying to do, but I am really concerned that the government does not generally do a good job of this. And I have talked about OMB, that they should develop a methodology for governing these interdisciplinary projects.

The President tried to solve homeland security by appointing one individual in charge who has responsibility over broad areas. I hope that works. But I think we may need that type of coordination for the climate change issues, as well. Right now it strikes me as a who is on first situation where you have who is on first, what is on second, etcetera. And it is—the real key is to make certain that people work together and that the funding is appropriate for each area and that the work is coordinated. That is a horrendous problem. And if any of you have any insight on that, I would certainly appreciate it, if you can give a quick response because my time has expired.

Dr. BYERLY. Well, I would just say that one of the keys with that in coordinated management is to make sure that all those Federal agencies really want to be at the table and want to participate. And we can combine both the mission-oriented and the exploratory elements. And I know when we fenced budgets, that went very well, and then it kind of weakened over the process. So the ability to pool resources, but make sure everybody wants to be at the table—that is what counts.

Mr. EHLERS. Yeah. But they also have to stop defending their own turf.

Dr. BYERLY. They do. It is a challenge.

Mr. EHLERS. My time has expired. I——

Chairman BOEHLERT. Mr. Bernstein, you wanted to comment on that?

Mr. BERNSTEIN. Just a quick follow-on to Dr. Ehler's suggestion about OMB. It would be possible, it seems, for OMB to issue guidance on Dr. Byerly's suggestion of having end-user groups involved in setting the priorities, as well as overseeing the quality of the interdisciplinary work. So it ends up actually aimed in some degree in something that the public, that other professions could actually understand. The Federal Government requires all sorts of participating in everything from community planning and occasionally in science and technology programs. There are no quality standards for participation. And unless a central agency like OMB could enforce that, you are not likely to get performance. So that is something that could be done, and I believe they have the authority to do it.

Mr. EHLERS. And it has to be user-oriented. And let me give you a specific example. I think it is a crucially important question—is how do we contain carbon dioxide emissions or a greenhouse gas emission. Methane is almost as bad in totality because it is cross-sectioned so much bigger. We have to do it. If we don't, it just continues as a problem for years. And how do we attack that specific problem? And that is where I think we need a multi-disciplinary interdepartmental approach.

Chairman BOEHLERT. Thank you very much. Your time has expired. Mr. Udall.

DATA MANAGEMENT

Mr. UDALL. Thank you, Mr. Chairman. This discussion has been very interesting and very helpful. I had a question I wanted to direct to Dr. Barron, Dr. Miles, and Dr. Byerly. Maybe we will let Dr. Barron go first, Rad, and take you off the hot seat for a minute or two. Dr. Barron, and, Dr. Miles, you both talked about current difficulties with data management, and we have been talking around this and about this over the last few minutes. What recommendations would you have to improve the data management for all of these various programs? And the second question—are the data sets now accessible and functional for multiple-user groups?

Dr. LARRON. Yeah. I don't think the data sets are fully accessible, and there is a wealth of observations and there is continual pressure to add more. And the pressure is exerted by the fact that we take a successful observation—NASA puts a new instrument up there and it brings wonderful data sets forth and you want to continue that. And so it becomes a challenge to put your arms around the entire data set and to create a comprehensive observing system.

The more we do that gets NASA and NOAA together in the same room, the efforts like NPOES, those things really enable us to do a better job. But we really have to also start to add the data sets that are on the ground as that part of the integration to put the agencies that are involved together. But I would go back to this idea of can you prove that you really can put every single piece of data at someone's fingertips? And I think that if you started to think that this is, first, our national data sets, not just the global ones or regional ones, and prove that we could actually make it accessible to everybody. Right now, they are accessible to the scientific community and you need an intermediary to take it to a step for a whole lot of different users.

But this country is investing a lot of money in information technology and science. And we are really at the point where we can start to use that and say, okay, we are going to make this successful not only to the scientific community, but to a broader set of people.

Mr. UDALL. Dr. Miles.

Dr. MILES. Our experience is that the system, as it exists, is not bad, and that we can get access easily to whatever we need if it exists. And the people who manage the data are quite responsive to such requests. Our problems come with data that we need critically that don't exist, which indicate where there are major gaps in the observation programs of the United States.

For instance, having found out—and it is my group that found out the power of the Pacific Decadal Oscillation—nobody is yet able to predict switches in that from warm phase to cool phase. We think that in order to get there we will have to instrument the North Pacific in the way that we have instrumented the tropical ocean, the equatorial ocean for ENSO. So there is a big hole there.

There is also a hole for our region with respect to coastal ocean and atmospheric, over the ocean, temperatures. Those are not

being collected systematically, and we need those. And finally, there are major gaps nationally in the way we collect information about groundwater. And only areas which have managed programs for groundwater do we monitor. But that is less than 50 percent. So we are more concerned about the big holes in the system.

Mr. UDALL. Doctor, you are saying that we need to collect more data in order to manage it even further. There is——

Dr. MILES. Yeah.

Mr. UDALL. Yeah. Dr. Byerly, do you——

Dr. MILES. To be of use to end users.

Mr. UDALL. Yes. Dr. Byerly.

Dr. BYERLY [continuing]. Still trying to get the microphone on. And in doing so, I think I have been hitting a user involvement. And I just first want to say I agree with Dr. Barron. The program should be both science-directed and user-directed. And that has to do with data sets as well. And I also agree with his idea of a pilot project. On something like this we should definitely start small and learn from it.

But now, to go specifically to data sets, I want to bring up a metaphor that Vanaver Bush uses in his science, the endless frontier, in which he talks about a model of getting science into society in which there is a reservoir of information which, of course, this brings us to data sets. That is where the data sets would be, in that reservoir of information. And on one side, you have the scientists doing their work and unselfishly putting it into the reservoir of information. On the other side, you have society taking information out and using it.

So what I see is that there is no guarantee the right information will be in that reservoir unless there is communication across that reservoir, unless the users talk to the scientists when they are planning their research and say, here is the kind of information we need. There may not be the information in the reservoir. It is just a fine model, except that the model doesn't allow any communication across the reservoir, and that is what I am talking about. So I think that is the—that is what I am getting at with making sure we have the right data sets in the reservoir.

Chairman BOEHLERT. The gentleman's time has expired.

Mr. UDALL. Thank you.

Chairman BOEHLERT. Mr. Gutknecht.

NIST AND JILA FACILITIES IN BOULDER, CO

Mr. GUTKNECHT. Thank you, Mr. Chairman. And, first of all, I want to thank Mark Udall and Vern Ehlers for encouraging me to come out and visit the labs in Boulder and also in Golden, Colorado. It was a very—and I would encourage other members to take advantage and do that some time because I was extremely impressed at the work that we saw.

I do have to offer, though, this observation. When I compare the NIST labs and the JILA facilities and the budgeting, I have to say that it seemed to me that they were getting the short end of the stick relative to our atmospheric funding. The two—and you almost have to see this for yourself—the difference between the facilities. The NIST labs—and I was impressed—virtually every one of them was making liberal use of duct tape to keep some of their experiments together.

Their computer labs were really—you couldn't compare the quality. So, in some respects, it was good relative to what we need to do for the National Institutes of Standards and Technologies and for JILA. But I think, in terms of NOAA, I came back with a somewhat different conclusion.

HOW MUCH HAS THE CLIMATE CHANGED AND WHY?

What I really want to get to the point, though, as we relate to atmospheric research and where we are and where we should be. And I want to thank Dr. Barron for stopping by, and we had a very nice visit in my office yesterday.

It has been somewhat disconcerting to me to listen to the discussion about global climate change. And it is always framed almost as if it is a Henny-Penney, sky-is-falling discussion. And I always try to remind the scientists, and they—and I always start with, I am not a scientist. I don't play one, but I am a curious person. But—and I would like to have you respond to this because the responses I have had to this point, from many of the scientists I have talked to, has been—I will be diplomatic—dismissive. But 21,000 years ago, we had a sheet of ice on most of the State of Minnesota. It was 100 feet thick. In Minnesota, two days ago, it was 95 degrees. So clearly, there has been global warming.

But I think we have to be honest with ourselves in terms of how the global climate has changed through the eons. In fact, we had a scientist here a few months ago who refused to acknowledge that the level of CO_2 in the atmosphere has actually changed since the time of the dinosaurs. He later had to amend his testimony.

But I wonder if you would talk about the whole issue of global climate change—and we can go one at a time—and we can start—perhaps we can start with Mr. Bernstein this round. But, you know, how much has the climate changed in the last 100,000 years? And maybe we are ready for another ice age.

Chairman BOEHLERT. Microphone, please.

Mr. BERNSTEIN. I am not that old, but I do know, for example, I live on a hill in Chicago. It is 20 feet up. And that is how flat Chicago is. And I am only three blocks from Lake Michigan. And it was sort of disconcerting on the most recent Great Lakes research, to find out that my lot may have been under water as recently as 220 years ago. That is a little bit different when you think about it and have to think about something within the last couple of centuries as opposed to 100,000 years.

I have scientists on staff. I am a lapsed engineer turned political scientist myself. We find the data on CO_2 concentrations convincing, and the other data on climate convincing, as well. But even if we didn't, greenhouse gas stabilization has so many risk reductions, economic development benefits, reliability benefits, that—and, you know, not too many insurance policies that we pay for pay for themselves and provide a rate of return. And so it seems to me that thinking about the what do you invest in as you learn things before you get down to the last decimal point is a great way to think about the purposes of science policy.

We don't invest enough in deploying what we know to the broader community, and there is a mistrust of the scientific community on this precisely because of the apparent argument about the basic knowledge. And I think we could do a lot to make this a lot more transparent and to help people understand where some of those statements are coming from.

Dr. EDMONDS. Let me just begin by saying I am not a paleoclimatologist or any kind of climatologist. And so what I have to say can't address your question directly and so I apologize for that failing. When I think about this problem, I rely on those who have studied it with some concentration, and my colleagues, which span a broad spectrum in their opinion of where we stand today. And it ranges all the way from people who have great faith in their work and their predictions to those who might be in the camp that might be called more skeptical.

And so, as an economist, I come back to this as not as an all or nothing problem, and I think your opening remarks speak to this particular point. That is, it isn't an all-or-nothing point. It isn't either the sky is falling or it is not falling. It is rather a risk management problem. And so my testimony today was really about what kinds of scientific research would make sense to put into a risk management portfolio. And that is really how I have come to think about the problem.

Dr. MILES. I spend half my time on the social science side and half my time on the natural science side. I have participated in IPCC. I would say the basic physics are not in doubt. It is pretty clear, and there is widespread agreement, that the earth has warmed over the course of the last thousand years. That if we continue to put CO_2 and other greenhouse gases into the atmosphere, it will warm further over a lag. And that the issues that are in doubt are not whether it has warmed and will warm, but how much, when, and what the impacts will be.

In order to understand impacts, working at the global level doesn't much help, I think. And one has to work at the regional level because the regional variation is so great. And it does not help to define continents as regions because you don't solve your resolution problems that way.

I couldn't agree more with the two previous speakers as far as the social policy is concerned. It is a risk problem. It is a question of how you manage the risk and no-regret strategies seem to me to be the best way of approaching the problem. Thank you.

Dr. BARRON. I would just say very briefly that you are absolutely right, change on this planet is completely and totally normal. It happens on all sorts of time scales. And I think the earth will do just fine in adjusting to it. And it is worth noting that the U.S. Global Change Research Program has, as a portion of its investment, a look at the past so that we can learn lessons from exactly how the earth changed and responded.

The difference here, and the importance of the research element, is now we get to live through part of the change. So we should do everything we can to anticipate it and to understand just how certain or uncertain we are about these predictions. Because then we can use it to our advantage and we can do a much better job of making decisions. So that becomes the key. And I think it is an—

you know, important to take those lessons from earth history and begin to apply them in that way.

Dr. BYERLY. Well, I am not an expert in this field, by any means, but I think you have raised some good points. First, about NIST—had you visited it on a rainy day, you would have seen a great deal of plastic sheeting in use to protect the equipment. So it is even worse on some days.

Second, when this Committee reported out the National Climate Program Act in 1978, and I have worked on that, the primary concern was for global cooling. So things change.

Third—and Dr. Barron can correct me on this—but I believe if you look back over the record for the last many thousands of years, you will see the earth tends to have sort of flipped between a cool and a warm state, and we are currently in a warm state. And so my uniformed concern then is if we are already in a warm state, is there any possibility of sort of having nonlinear effects if we try to keep making things warmer? That maybe things could be—things could happen precipitously perhaps, that we have really no history to guide us on. But that is a pretty uninformed opinion.

BEGINNING MITIGATION EFFORTS

Chairman BOEHLERT. Thank you very much. The gentleman's time has expired. A very good question and thoughtful responses. Ms. Rivers.

Ms. RIVERS. Thank you, Mr. Chair. I want to follow up in that same vein because in the eight years that I have served on this Committee, I have often heard research argued in place of response, and we have almost become—we almost found ourselves in a situation where we have paralysis by analysis and we have had a parade of skeptics come through and say you can't make any movement forward in addressing this issue until we have had all of the questions answered. And until we have all of the questions answered, we really can't know what to do or when to do it or how much money to spend on it.

And I would like to know, to further your comments from a few minutes ago, whether you think we have answered enough questions that we can begin mitigation efforts and be part of the worldwide efforts to impact this problem. And, Mr. Bernstein, you spoke to it already, but I think you have really, you know, hit it.

Mr. BERNSTEIN. Well, I think that we know enough to know that we can reduce greenhouse gases through more efficient use of resources, whether that is in buildings or in transportation, whether it is energy or natural resources. We have arguments about how much of the problem is due to consumption and activity and how much of it is due to larger ecological and human settlement interactions.

However, what is not arguable is the emerging economic measurement of the benefits. And further, what is not arguable is that it seems to work better when you deploy the stuff faster and in a better aligned sort of manner. So that if there was some modicum of research and development devoted to building some intelligence into our systems so that people actually could make decisions, I think we could get ahead. NSF does invest in advancing the science

of geographic information, but it is nobody's job to apply that in the Federal Government at a localized——

Ms. RIVERS. Actually, DOE has that charge.

Mr. BERNSTEIN. Well, I have got to say that they could do better in that particular one. It is hard to find anybody whose job that is to do that full time in DOE or HUD or DOT, where I spend a lot of time on research policy. And it seems to me that if we could put the information where people actually live, we could do better.

One quick illustration. The current R&D programs over there are organized around technologies, around fuels, and around sectors, but people relate best to communities and to places and to the things that they actually do. The current reorganization plan will not improve this situation and so it will be misaligned in a continued sort of basis.

And so I think that if we could organize around the social science of this a little bit more on deployment, we could get a fairer measurement of how well this stuff works across the different places——

Ms. RIVERS. Thank you.

Mr. BERNSTEIN [continuing]. Where we actually live.

Ms. RIVERS. Dr. Edmonds, do you think we know enough that we could begin some mitigation efforts?

Dr. EDMONDS. To answer your question, I think it is useful to realize that the goal of the framework convention on climate change is stabilization of concentrations of——

Ms. RIVERS. Right.

Dr. EDMONDS [continuing]. Greenhouse gases. And if you look at trying to do this in an orderly way, independent of the concentration, emissions growth has to first begin to slow, then peak, and then begin this long-term decline, which goes on indefinitely thereafter. And that is—that pattern is consistent with any concentration. It is consistent with the concentration that would be as low as 350 parts per million, and it is also consistent with 750 parts per million or even 1,000 parts per million.

Science has not yet told us what the appropriate concentration is. And that timing and magnitude of the change that is warranted today really depends on someone taking the knowledge and making a political decision, as to where would we like to end up and how fast should we go about that process.

Ms. RIVERS. Do we have to know ultimately where we want to end up or do we already know enough to know that less is going to be better?

Dr. EDMONDS. If you are going to structure a cost-minimizing strategy for a 100-year problem, it is useful to have some sense of where you would like to be at the end of that transition process. So while the answer is literally, no, you don't have to—you know, you don't have to set the goal, and much of what has occurred in the discussions of emissions mitigation, have really made no reference to the goal, yet, I find it difficult to get around the basic nature of the problem, which is a century-scale problem and one that—at least my work has focused on. What kinds of orderly progression of steps are warranted in dealing with it in the long term?

Ms. RIVERS. But the plan that is before us—the research program that exists now for $1.7 billion, doesn't set an end date for

greenhouse gas stabilization. Does it? Does it say at this year our goal is to be here at this year?

Dr. EDMONDS. Well, as I said, at present, that has—that level has not been defined. It hasn't been defined by either the political process or the scientific community.

Ms. RIVERS. And do you think then you—are you saying we should wait to do anything until we define that?

Dr. EDMONDS. My counsel here this morning has really focused on the investments that one can make in the science that would lay down the foundations to make a transition, which would be consistent with a broad range of determinations.

Ms. RIVERS. Yeah. But what I am asking you to do, and what you are trying not to do, is I am asking you to address the core political question. And what has happened time and time again is the argument has been we should do nothing until we have answered all the questions. And I am asking whether that is a sound position to take.

Dr. EDMONDS. Well, you are asking me to give you a policy prescription——

Ms. RIVERS. No. I am asking you to give me your opinion.

Dr. EDMONDS [continuing]. And I don't know the answer, you know.

Ms. RIVERS. No. I am asking you to give me your opinion as a scientist.

Chairman BOEHLERT. That is right. The Chair is being indulgent with you because we are trying to get an answer too.

Ms. RIVERS. Yeah.

Chairman BOEHLERT. Dr. Edmonds.

Dr. EDMONDS. There are certainly things that can be done to slow the rate of growth of greenhouse gases in the near term, and many of them have to do with accelerating the development and deployment of technologies. In the long term, I think it is absolutely essential to develop a whole new sweep because the change that is ultimately required is so large that it really requires a revolutionary change. And so there are a variety of steps that are consistent with that long-term resolution, but the work that I have done has really focused on what do you have to do to make that big change over the long term.

Chairman BOEHLERT. The gentlelady's time has expired. Mr. Gilchrest.

QUANTIFYING THE HUMAN IMPACT

Mr. GILCHREST. Thank you, Mr. Chairman. Just a few quick questions. But a comment briefly first from a book by Stephen Snyder called Laboratory Earth, in which he states in that book that the climate on Planet Earth has been warming for the last 10,000 years and about—if I remember right, this is about five or six years now—about one centigrade per thousand years, with the exception of the last 200. It has increased dramatically in the last, basically, 100 to 50 years, and the likelihood that CO_2 concentrations will double in the next few decades.

So the question is—and just brief answers because I have got five questions, and I apologize, unless the Chair gives me a half an hour, which I doubt. Is human activity substantial enough, based

on our present knowledge, to have an impact on the natural variation of the climate? Say yes or no.

Dr. BARRON. Yes.

Mr. GILCHREST. Good. What is the change caused by human activity in the structure or the makeup of our atmosphere as a result of that activity? The physics of the atmosphere has been changed then, and what has increased or what has changed as a result of human activity?

Dr. BARRON. You would probably have to create a ranked list from things that you feel are strong and very likely components of adding the greenhouse gases. For example, increase in globally averaged surface temperature undoubtedly results in a global increase in precipitation because you are evaporating more. You have warming at the higher latitudes, snow-covered areas, because you are removing this highly reflective white surfaces. In any climate, it doesn't matter whether you go back 100 million years ago, the last ice ages, the most sensitive areas area at the edges of sea ice and snow. So you begin to see some of those things where the structural changes appear in every model, appear in earth history. You are just looking at a different mechanism.

Mr. GILCHREST. So those structural changes are changing as a result of the input of CO_2, methane, nitrous oxide, as a result of human activity.

Dr. BARRON. They would result from any forcing that would tend to promote a warmer planet. We just happened to know that currently humans are providing a greenhouse forcing. And, therefore, that signal of the characteristics of that warming should be something that is fairly consistent. Like I say, you could go back to an ice age or a warm time period and you would see that same signal, greater sensitivity, higher latitudes, that total water cycle going up and down based on global temperature.

Mr. GILCHREST. So——

Dr. BARRON. There are other things that are much less certain.

Mr. GILCHREST. Is it likely then to have these greenhouse gases, CO_2, in particular, double in the next several decades from where it was just 100 years ago?

Dr. BARRON. A lot of scenarios have a doubling during this century, but not in a decade or so.

Mr. GILCHREST. What was that?

Dr. BARRON. Century.

Mr. GILCHREST. Century.

Dr. BARRON. Over the next century.

Mr. GILCHREST. Okay. So it—CO_2 could double within the next century, even if it is another 100 years——

Dr. BARRON. Right.

Mr. GILCHREST [continuing]. From what it was 100 years ago. Or what the average variable——

Dr. BARRON. Correct.

Mr. GILCHREST [continuing]. Has been over the last 10,000 years.

Dr. BARRON. Right. Correct.

Mr. GILCHREST. And if it does then, CO_2, double from what it was 100 years ago, or the natural variability, what is the cause of that doubling?

Dr. BARRON. The cause of that doubling is a variety of human activities. Certainly, energy consumption is a major contributor of greenhouse gases. Agriculture, through production of cows and cattles, contributes methane. If you have extensive tropical deforestation, anything that is carbon-based and you burn it, then you are adding CO_2, a greenhouse gas, to the atmosphere. So you could take each one of those gases and characterize exactly what the different sources are, and there are significant human sources for many of them.

Mr. GILCHREST. So while the predictability of what—exactly what will happen is—there is still a level or a degree of uncertainty.

Dr. BARRON. Yes. So if you were to take a doubling of CO_2 and you were to take the best climate models from around the world, you would see that some would suggest a warming on the order of a degree, a degree and a half for a doubling of CO_2, degree C, and then you would see the structural difference between tropics—small warming, mid-latitude, high latitudes—higher warming, and then will find also some models that are up there closer to—to 4.8 degrees. The range is five times what the warming has—more than five times—nine times what the warming has been over the last century. We are somewhere——

Mr. GILCHREST. I just want to——

Dr. BARRON. We are somewhere in that range.

Mr. GILCHREST. Because my—the red light just came on.

Dr. BARRON. Yeah.

Mr. GILCHREST. And that was——

Chairman BOEHLERT. You have got one more question to go.

Mr. GILCHREST. I had one quick—thank you, Mr. Chairman.

Chairman BOEHLERT. I have been counting.

Mr. GILCHREST. I know this might seem like it is not only out of left field, but it is out of the ball park. But about 35 years ago I went to Vietnam. There was about 300,000 U.S. soldiers in Vietnam at the time. Every single one of them got malaria pills. Now, I don't think there is any way for a physician to specifically predict how each one of those would react to the malaria parasite.

Dr. BARRON. Right.

Mr. GILCHREST. Every single one of them, by precautionary approach, was given that malaria pill. So I would assume that the prudent precautionary approach, risk-based decisions would be that we would move in—and this is up to us to make a policy to reduce human input of greenhouse gases based on the best available data, because even if it doesn't have some predictable effect, the less fossil fuel that we put into the atmosphere, the best management practices that we produce for agriculture, will have a positive result, both for the climate, the hydrologic cycle, etcetera, etcetera. I guess that was a statement. Sorry. Thank you, Mr. Chairman.

Chairman BOEHLERT. Thank you very much, Mr. Gilchrest. Ms. Jackson Lee.

NO REGRET STRATEGY

Ms. JACKSON LEE. Thank you very much, Mr. Chairman, to both you and the Ranking Member for, again, holding a very pointed and timely hearing. I say that because not only did I personally

bring 90-plus to Washington, D.C., I thought I was helped by climate change as well. I know that this heat today is probably shocking and so I think the hearing is timely.

But also in Texas, as you well know, yesterday, last 24, 48 hours, we had an unusual set of weather circumstances that caused a great deal of damage in the Dallas/Forth Worth area—tornadoes and others that we are seeing coming at unusual times. So this is clearly a very important hearing for—regionally for us in those areas that are subject to seemingly unusual climatic changes.

Though it may not be necessarily connected, Houston also experienced one of the most unusual storms. We are usually used to the word hurricane, but not storm—Tropical Storm Allison, that in less than or about 24 hours, put 30-some inches of rain in our area. And, of course, there are a lot of other variables that went into the tragedies that ultimately occurred, but it certainly was unusual. And so we are seeing a lot of changes that come about that are weather related, but this hearing on climate is very, I think, timely.

I would like to pursue, I think, Dr. Miles, it seems as if you captured some thoughts that I think are important to restate or to expand—the fact that CO_2 is growing, that it is continuing to be part of our environment, that the earth is continuing to warm. It may be the obvious, but you—if I can cite three points—how much, when, and the impact.

And I would like us to explore these points, and I am not precluding the input of your other colleagues there. I would like to expand on the no-regret strategy. Give us some additional insight on how we can move on that strategy, how we can be—I think of no regrets as bold strategies, strategies that need to move expeditiously, but also thoughtfully.

The other is to give me your insight on how poverty—do we have enough research to suggest how poverty, or the more impoverished, are impacted by climate changes or weather changes or the results of what is going on with respect to climate. I think, for example, of my visits to Bangladesh, India, and Pakistan—India, in particular, looking at various enormous conditions—obviously, part of that is population, but looking at enormously difficult conditions. But I also look at the—I am backdoor planner by backdoor training, having served in municipal government, and knowing that on the east side of every community, that is the downwind, that is where the manufacturing, that is where the refineries in my community are, and that is where folk who are living in small bungalows or tenements are located.

So I am very interested in how we can get our hands around being bold in this instance and then poverty. And I will follow up with a question on what we can do to improve the U.S. global research programs that we are looking to improve. But, Dr. Miles, would you share with me, please?

Dr. MILES. Thank you very much. With respect to no-regret strategies, my thinking is that we will very likely double the concentration of greenhouse gases over the course of the next century, as Dr. Barron has pointed out. In the Climate Convention, it has informally been taken that doubling is the standard, that that is where one wants to be. There is no hard evidence to support that

except that we think we can manage quite well under a doubled scenario, and less well under tripling and even less well under quadrupling.

What worries me is that we do not know, and I don't think this committee or any other can expect science to tell you what is the point at which we will trigger very large non-linear effects, like setting in train motion to an ice age or something of the sort. So, therefore, to me, less is better than more. And, as Mr. Bernstein pointed out, a no-regret strategy has so many risk-reduction potentialities built into it that the evidence suggests one ought to proceed in that fashion now. I make that comment with no necessary connection to the Kyoto Protocol. There are a lot of pathways to reduction, and how we choose is a debate we have never had in this country at an official level publicly.

AFFECTS OF CLIMATE CHANGE ON THE ECONOMICALLY DISADVANTAGED

With respect to poverty effects, the Working Group II of IPCC for the 2001 assessment, the one just published, shows quite clearly that the most severely affected communities globally will be the poor ones. In some cases, in the South Pacific, for instance, this means their islands or atolls will disappear. Certainly, Tuvalu is the clearest. Bangladesh will be in very great trouble; so will the Maldives.

In the United States, none of the research so far has made poverty a major focus of its analysis. We have one program just starting in the northeast, based in New York at Columbia, which undertakes a look at urban effects and connections to human health. And that program, in my view, has very great promise.

Ms. JACKSON LEE. Mr. Chairman, would you just allow Mr. Bernstein, whose head was moving up and down—and that does not mean that he is agreeing with me, but——

Chairman BOEHLERT. Is that the Bernstein bobble?

Ms. JACKSON LEE. And this is not for the record, but I would appreciate if he could make a comment. And, Mr. Chairman, I would also say—and I thank Dr. Miles very much—as we move toward markup, I would certainly like to work with the Committee on expanding the poverty research or poverty impact research that we might look into as we look to mark this up and improve this——

Chairman BOEHLERT. That is very thoughtful. Mr. Bernstein, you——

Mr. BERNSTEIN. I will be quick.

Ms. JACKSON LEE. Thank you, Mr. Chairman.

Mr. BERNSTEIN. The—there are a couple of poverty effects in addition to Dr. Barron's excellent summary. The cost of continuing to allow very high energy consumption, obviously, affects the poor. Disproportionally you don't have as much money to pay for it. Secondly, to the extent that there is a correspondence between criteria pollutant emissions and carbon emissions, there will be disproportionate effects. And the poor are more susceptible in not because they are genetically different, but they can't afford the medical care to take care of things like asthma, trigger events, and respiratory infections, and they can't afford to climate control their homes as well. And so those programs aren't as available. Most of the high

penetration programs across the country for energy efficiency don't make it to the poor.

You could have a poverty alleviation effect, on the other hand, out of the no-regrets strategy if we targeted the savings in such a way that it would help the poor save money to acquire wealth. There is a program that we participate in, location-efficient mortgages, that takes the savings from people using less transportation and puts it into down payments and other kinds of assistance so that people, in fact, can afford to become homeowners. So, in effect, climate stabilization could provide the savings to attack wealth problems. That is a very, very powerful political and economic message, and we ought to think not just about counting savings, but asking the question then, what could be done with that savings if we reinvested it in a smarter future?

Chairman BOEHLERT. Thank you very much.

Ms. JACKSON LEE. Thank you.

Chairman BOEHLERT. That was a very thoughtful response. Thank you.

Ms. JACKSON LEE. Thank you, Mr. Chairman.

Chairman BOEHLERT. Ms. Morella.

LOCALIZING CLIMATE SCIENCE

Ms. MORELLA. Thank you, Mr. Chairman. And I very much appreciate you calling this important hearing to look at our climate change programs. It is certainly a daunting and very difficult task, and I appreciate your continuing to work on it and give you all the encouragement I can. Thank you, panelists, who presented excellent testimony, including your written testimony which is far more expansive than what you had a chance to say.

So in terms of questioning, Dr. Barron, I think I will start off with you, sir. In your testimony you discuss how regional centers may be able to play a role in localizing climate science and tailoring it to regional needs. A couple of months ago, we had an extensive hearing on this Committee about regionally—a regionally focused program at NOAA called Sea Grant.

Dr. BARRON. Uh-huh.

Ms. MORELLA. Do you envision your ideas in a similar manner or is this not an appropriate analogy?

Dr. BARRON. Okay. Well, Sea Grant, at least from what I understand of the Sea Grant Program, focuses on a lot of different topics that—but with a cohesive theme; coastal oceans, for example. What I would like to do is to develop a program that instead of focusing on individual science elements, the entire crux of it is prove that you can put this diverse scientific community together, the human dimensions, and put the decision-makers in the room. And have your focus not just to be what exists there, but your ability to anticipate the future.

And by that I mean a forecast, short term, a season to a year in advance, and then the long term. And in that case you really discover what that integration is and then how valuable that information that you are attempting, in a sense, to bring the discipline of forecasting to a broader set of environmental issues. So that requires focus and integration on a topic. And that structure, I think, would mean that it would end up to be different than a Sea Grant,

which enables a lot of different specific research projects focused on a particular arena.

Ms. MORELLA. Uh-huh. Well-stated. Do you see this possibility as a demonstration program?

Dr. BARRON. I think a good way to think about it is to begin with some pilot programs. And you may pick different parts of the decision base. You may decide environment and health is a good idea. You may discover that for western states what you really want to focus on is the link to water and water resources. So they could have a different focus.

But what you really want to do is sit there and say, okay, if I look at Maryland, Pennsylvania, northern Virginia, Delaware—if I look at those and I look at all the different data sets people are collecting, and EPA goes here and somebody else for water goes here, can I actually use information, science, and technology to put it all in one place and make it so that you can wander through it, but also a scientist can sit there and wander through it and make it accessible? And can you tune those models so that you are at the resolution where you are looking at the Chesapeake and being able to say credible things about how that system may change? And not just have it be a focus of global warming, but to think about all those different time scales. You are just trying to bring all of this talent to serve society.

Ms. MORELLA. I actually want to ask another question of some other panelists, but you kind of engaged me in terms of what do we do as a Committee then to help to bring that about?

Dr. BARRON. Yes. See, what I hope is that we are sitting there with a very strong U.S. Global Change Research Program that has all of these different elements of observations and enhancing global models. But then we also say, you know, it is time to put some resources into making sure we can integrate all this information and really put it down on the street—really connect with those decision-makers.

So I think it is a matter of looking at the program we have and then saying, okay, we know we have got to do multiple stresses. We know we have got to bring the human dimension in there. We know we have got to connect with agriculture and water resources. Let us also have a component of this problem and our resource base that allows us to take that next step and prove that we can actually do this coupling and integration and tie it to this and have decision-makers right there in the room with you. And I think what we will discover is that it becomes contagious. There will be kind of a data envy there because we will see how wonderful it is to have all that information to be accessible.

DEPLOYMENT RATES AS AN INDICATOR OF SUCCESS

Ms. MORELLA. Thank you. I applaud you. I happen to agree with what you say. Very quickly, I will pose the question. Dr. Edmonds, and, Mr. Bernstein, most of the evaluations of energy technology programs do not exclusively consider deployment rates in their assessment of success. Given the maxim, we are what we measure, should we more exclusively measure deployment rates as an indicator of success? You are going to have to answer quickly, although he is not looking.

Chairman BOEHLERT. I am looking.

Mr. BERNSTEIN. Yes. Yes. We absolutely should. It—we can't know how we are doing unless we have the metrics on that. One way to do that would be to require the agencies responsible to report on this annually with their government performance and results act report. Budgets—time considerations have a way of focusing attention and clarity. And I think that if they had to every year come up with a performance result that related to meeting a deployment goal, then we could get there.

I agree totally with the comments about the need to advance technology, however, we could do a lot more with the technology that is already there. I remember when James Schlessinger held up the first compact fluorescent light bulb prototype. I think it was 26 years ago. The only place in the United States where you have two or more on the shelf at any one time is Home Depot.

I want to suggest that we don't have deployment to the extent that the Federal reports suggest we do. And until people can see this stuff in everyday purchases, get everyday feedback on what it is doing for them, get credited for having done it, get reinforcement on it, we are not going to have the kind of system that acts the way that we are suggesting that it needs to. And I think there has to be commonsense approach to that.

Chairman BOEHLERT. Thank you very much. Mr. Rohrabacher.

Mr. ROHRABACHER. Thank you very much.

Ms. MORELLA. I think Dr. Edmonds agrees. Right. Okay.

Chairman BOEHLERT. Well, wait. Do you—Dr. Edmonds?

Dr. EDMONDS. Yes. I do. I agree. If you are trying to evaluate your performance then you have to be able to measure it.

Ms. MORELLA. Yeah.

Chairman BOEHLERT. Mr. Rohrabacher.

POPULATION DENSITY AND ENERGY CONSUMPTION

Mr. ROHRABACHER. Thank you very much. Mr. Bernstein, you live on a 250-foot hill in Chicago. What was that now?

Mr. BERNSTEIN. Twenty-foot hill.

Mr. ROHRABACHER. A 20-foot hill.

Mr. BERNSTEIN. The only 250-foot hill is the garbage dump on the southeast side.

Mr. ROHRABACHER. Do you live in a house or do you live in an apartment building?

Mr. BERNSTEIN. I live in what is called a two-flat. It is a two-unit apartment building.

Mr. ROHRABACHER. Two-unit apartment building.

Mr. BERNSTEIN. That is correct.

Mr. ROHRABACHER. All right. It seemed that your testimony was mainly aimed at peoples' standard of living who live in single-family homes in the suburbs. And perhaps it would be better if you lived in a—to be consistent, a huge building with lots of people in it then, rather than just a building with two homes in it.

Mr. BERNSTEIN. Well, no. I happen to live in a very high-density, but mixed-income community——

Mr. ROHRABACHER. Uh-huh.

Mr. BERNSTEIN [continuing]. Near the lakefront in Chicago. It is the kind of anomaly that we are good at there. So there is——

Mr. ROHRABACHER. Okay.

Mr. BERNSTEIN.—30,000 people a square mile and it is about as densely populated as——

Mr. ROHRABACHER. But it doesn't sound like the specific spot that you chose is quite as densely populated because you only have two families in the dwelling that you live in. But let me just say, I couldn't disagree with you more on that particular point. I think it is wonderful that Americans, in particular, live in their own homes. I think it is—I think suburbs are great and I think people owning their own homes is a terrific thing. It is—and I think that we have a high standard of living that is grand. And it is something we should be proud of. I couldn't disagree with you more on that.

But I couldn't agree with you more that we should be developing the technology and improving on the meter technology, in particular, so people who live in those homes can become part of the solution to producing electricity and to—and managing their electricity and their energy use in a way. And, by the way, I say that not because I believe in any of this——

Chairman BOEHLERT. Now, be delicate.

Mr. ROHRABACHER [continuing]. Stuff about——

Chairman BOEHLERT. Be delicate.

Mr. ROHRABACHER [continuing]. About global warming, but because I happen to believe that some of the points made about energy conservation have a lot to do with public health, which is important to me, and fundamental economics, which are important to our country. For example, how much energy we are going to import and how much of our national wealth is directed toward energy rather than other type of needs. So I agree with you wholeheartedly on that conclusion, that we should be advancing our ability to judge how much energy is being used. So——

Mr. BERNSTEIN. Congressman, I couldn't agree with you more on the goal of home ownership. We promote it. The statistics show that half of it is happening in densely populated areas and half of it is happening in not so densely populated areas. People do have these choices. The only thing I would suspect we may disagree on is who has to pay for those external costs that are imposed because of the low efficiency in the less densely populated ones. This is a science hearing. I was only suggesting——

Mr. ROHRABACHER. Yeah.

Mr. BERNSTEIN [continuing]. That we take an honest look at where these——

Mr. ROHRABACHER. Well, that is——

Mr. BERNSTEIN [continuing]. Are actually coming from.

CARBON EMISSIONS FROM NATURAL SOURCES

Mr. ROHRABACHER. Yeah. Well, we ought to make it to make the science and technology better to both measure it and produce energy more efficiently—I am with you. In terms of—I would like to remind Dr. Miles that if the earth has been warming, which you stated, for the last 1,000 years, the effect—it must not be industrialization that has caused the global warming. But the question I have for Dr. Byerly is, Dr. Byerly, would you say that industrial-

ization, or let us say, the internal combustion engine is—produces more greenhouse gas than rotting trees in jungles?

Dr. BYERLY. I think the difference is that rotting trees have taken the carbon out of the atmosphere——

Mr. ROHRABACHER. First.

Dr. BYERLY [continuing]. First, and then they put it back in so there is no net change.

Mr. ROHRABACHER. Uh-huh.

Dr. BYERLY. That is, of course, also true with things that produce fossil fuels. But the fossil fuels are—the carbon was taken out millions of years ago, so——

Mr. ROHRABACHER. Right.

Dr. BYERLY [continuing]. It is really kind of out of the time frame.

Mr. ROHRABACHER. But in—unless someone disagrees with me on the panel, rotting trees in jungles and the termites that go with them, etcetera, etcetera, produce a huge amount of greenhouse gas, if one is concerned about greenhouse gas, as compared to the internal combustion engine or some of these other type of things. So if you are going to really want to get to the greenhouse gas, you bulldoze the jungles and then replant those trees with young trees, which is, of course, a ridiculous suggestion, which, of course, is why I think this whole focus on greenhouse gas is ridiculous.

NATURAL CLIMATE CHANGE

But one note before we—because I am losing my time here—we—and over the last 1,000 years, which we mentioned has been getting warmer, has there ever been a time in that last, let us say, 100,000 years since the ice age, where we have indications that the temperature has actually increased at a faster rate than the one-degree warmer that it has been in the last 100 years? Oh, no, no. I just need you to answer that question——

Dr. BYERLY. Oh.

Mr. ROHRABACHER [continuing]. And not what is important—is—has there been a time in this last 100,000 years since the end of that ice age, that scientists can suggest that there actually was an increase in the temperature that is greater than what we have had in the last 100 years? There has never been a—we could never tell that there has been a one-degree raise in temperature over a 100-year period over these last 100,000 years.

My guess is that there is evidence to suggest that. Maybe we just need to communicate it. But all I know, after all the hearings I have been through on global warming, they suggest in the last 100 years we have had—I guess, measured at night in the northern hemisphere, a one-degree change in temperature, a rise in temperature. But nobody can say that didn't happen in the past, before industrialization, during the time when they—when the glaciers were receding.

Dr. BARRON. There is substantial evidence that there are abrupt climate changes in the past.

Mr. ROHRABACHER. There you go.

Dr. BARRON. And my feeling is, is that that is the reason why I am interested in anticipating the future and I want to look at the program holistically——

Mr. ROHRABACHER. Right.

Dr. BARRON [continuing]. Because I think it would be just as valuable for us to anticipate a natural change that was a jump like that as it would be one forced by human activity.

Mr. ROHRABACHER. Sure. Well, absolutely.

Dr. BARRON. Same science, same physics.

Mr. ROHRABACHER. As long as it is not being used to justify bulldozing people out of their homes or bulldozing the—all the jungles of the world.

Dr. BARRON. Yeah.

Chairman BOEHLERT. Well, we haven't got the bulldozers ready yet. But thank you very much, Mr. Rohrabacher. It always a pleasure to have you share some of your theories with us on this very important subject. And I want to thank all the witnesses for being resources for the Committee. And it has been—we have had a thoughtful hearing and we have had some good exchanges and we may follow up with a few questions that we would ask that you would respond to in writing in a timely manner as we go forward. Dr. Ehlers has a concluding word.

CLIMATIC OSCILLATION

Mr. EHLERS. Just a comment on something that I think is often misunderstood. And that is that the earth is a natural ecosystem which oscillates, sometimes with fair regularity from one position to another. For example, no ice age to ice ages and back again, with considerable regularity.

It is—what is different about what is going on now is that we are near the peak of one of the oscillations and we, with human activity, are changing the behavior of the oscillatory system. The real scientific question is, is there a positive or a negative feedback going on here? In other words, can it lead to a runaway situation or will the earth, in fact, the feedback take care of it—the earth will absorb the excess carbon and there will be a minimum of that effect, other than just a temperature increase or climate change in various areas. And I think it is very important to understand that.

The other factor that is important is that whatever changes take place now, as Dr. Barron was saying, whether they are natural or human cause, can have an incredible effect on the human race and water levels. Ocean water levels rising 20 feet would have a dramatic effect. Going down 20 feet would have a dramatic effect. That has happened many times in past ages. We didn't worry about it. We weren't there. But it had tremendous effect on animals, plants, and so forth. And we have to keep that in sight. We are talking about small variations in a major system and we just don't know what the impact is going to be.

Chairman BOEHLERT. As Mark Nagrodski used to say, you have had the last word.

Mr. EHLERS. Thank you.

Chairman BOEHLERT. Thank you all very much. This hearing is adjourned.

[Whereupon, at 12 p.m., the Committee was adjourned.]