THE BROOKINGS INSTITUTION

OPPORTUNITY 08:

ENERGY CHALLENGES FOR THE NEXT PRESIDENT

Washington, D.C.

Monday, May 12, 2008

Introduction:

WILLIAM ANTHOLIS
Managing Director
The Brookings Institution

Featured Speaker:

THE HONORABLE LAMAR ALEXANDER, (R-TENN.)
Chairman, Senate Republican Conference

Panelists:

CARLOS PASCUAL
Vice President and Director, Foreign Policy
The Brookings Institution

WILLIAM ANTHOLIS
Managing Director

The Brookings Institution

JASON BORDOFF
Policy Director, The Hamilton Project
The Brookings Institution

JONATHAN ELKIND
Nonresident Senior Fellow
The Brookings Institution

DAVID SANDALOW
Senior Fellow
The Brookings Institution

* * * * *

P R O C E E D I N G S

MR. ANTHOLIS: Welcome to Brookings and to our opportunity 08 Series for those of you who are new to an Opportunity 08 event. Opportunity 08 is Brookings' effort started in 2007 and will extend through the end of the election this year to put forward ideas that the next President should take seriously, if not act on. And one of the top issues that we've – we've addressed issues across the range of public policy issues that we do here at Brookings from domestic and state and local issues to national and international ones.

And one of our priorities has been energy security and climate change and we're thrilled today to pull together another event that

regard and our keynote speech in that event, in today's event is from Senator Lamar Alexander.

Senator Alexander as most of you know chairs the Senate Republican Conference and therefore is a key player in the Senate leadership on the Republican side and he serves on committees overseeing education, clean air, highways, science, appropriation, and the Tennessee valley Authority. Almost all of which if not all are critical in addressing this complex set of challenges. He is the only Tennessean ever popularly elected both Governor and U.S. Senator.

I'll say a few more remarks about Senator Alexander and then we'll have a panel discussion following his comments. He'll take some questions and answers and then we'll do a panel discussion with Brookings experts who have written for the Opportunity 08 Project.

As most of you also know, Senator Alexander has been the U.S. Education Secretary, President of the University of Tennessee and professor at Harvard's Kennedy School of Government. He chaired the National Governor's Association and President Reagan's Commission on the Americans Outdoors. And being an American Outdoor he walked almost a thousand miles or over a thousand miles across Tennessee in his now famous red and black plaid shirt and a useful model for those looking to conserve energy and address global warming. He then once

elected he helped Tennessee become the third largest auto producer and for those that might wonder whether that's contributed to this problem, he is a leader and as he'll talk today has been a leader in calling for advanced technologies to address this set of issues.

He's the first Tennessean elected to consecutive four year terms as Governor. And he started Tennessee's Governor School for Outstanding Students among his many accomplishments. The Senator today will be talking about energy security in the broadest context and his remarks today are part of an effort that's he's worked on in a bipartisan way, true to the Brookings' spirit of not just high quality but also independence and impact. So with that I want to introduce Senator Lamar Alexander.

SENATOR ALEXANDER: Thank you very much. I'm delighted to be invited to Brookings to discuss energy independence. I want to congratulate for the work that Brookings has been doing, the large number of people here. I had breakfast with David Sandalow the other day because I had been reading his book which I think is very useful on this subject. And I'm looking forward in an unSenatorial-syle to staying around and listening and learning to what some of the rest of you have to say after you get through with me here this morning. So thank you for the invitation.

In 1942 President Franklin Roosevelt invited a bipartisan group to the White House for a secret briefing. After it was over he asked the Chairman of the Appropriations Committee of Tennessee and named Kenneth McKellar if he could hide $2 billion in the budget for a secret project to win the war. Senator McKellar said that should be no problem Mr. President, but I just have one question, where in Tennessee do you want me to hide it?

That place turned out to be Oak Ridge, which was one of three secret cities along with Hanford and Los Alamos that led to the Manhattan Project. The purpose of the Manhattan Project was to find a way to split the atom and build a bomb before Germany did so the United State could win World War II. Nearly 200,000 people worked secretly in 30 sites in three countries. President Roosevelt's $2 billion Appropriation hidden in the Appropriations Bill by Senator McKellar would be about $24 billion in today's dollars.

New York Times science reporter William Lawrence said into the bomb's design went millions of man-hours of what is without doubt the most concentrated intellectual effort in history. Last Friday I addressed a group of about 200 scientists and managers at the Oak Ridge National Laboratory and I proposed that the United States should launch a new Manhattan Project. A five-year project to put America firmly on the path to

clean energy independence; instead of ending a war the goal would be clean energy independence so that we can deal with rising gasoline prices, electricity prices, clean air, climate change, and national security for our country first and because other countries in the world have the same urgent needs and therefore will adopt our ideas for the rest of world.

Now by independence I do not mean that the United States would never buy oil from Mexico or Canada or Saudi Arabia. By independence I do mean that the United States could never be held hostage by any other country for our oil supplies. In 1942 many were afraid that the first country to build an atomic bomb could blackmail the rest of the world. Today countries that supply oil can blackmail the rest of the world.

Some people have trouble with the word independence when we talk about energy independence. I think they need to consult a dictionary. Independence doesn't mean that you go out on some desert islands and never talk to anybody. Independence in the dictionary sense means you're not controlled by someone else. So in my discussions with the scientists in Oak Ridge on Friday, they already comfortable with the idea of clean energy and independence and when I talk with people in Tennessee and other places, they're comfortable with the idea, too of not being held hostage. So I think the three world goal, Clean Energy

Independence, is the right goal. It focuses on the environment, that's clean. On energy, that's our subject. And independence, which is the objective here.

A new Manhattan Project is not a new idea, but it's a good idea and it fits the goal of clean energy independence. The Apollo Project to send a man to the moon was a kind of Manhattan Project.

Presidential candidates John McCain and Barack Obama and many other have called for a new Manhattan Project on energy. They just haven't said exactly how to do that. What I'd like to do today and with the address I made in Oak Ridge on Friday is to begin to flesh in what a new Manhattan Project would look like. Newt Gingrich, Howard Dean, Senator Collins, Senator Bond, many have had the idea of a new Manhattan Project; it's time to get busy with what we mean by that. And through the two years of discussions that many of us had with the America Competes Act -- it passed in 2005 which is the blueprint that Congress passed to maintain America's competitiveness in the world -- many suggested during those discussions that we should focus that on energy independence because a focus on energy independence would actually force the kind of investments that we need to maintain our competitiveness in the United States.

The overwhelming challenge in 1942 was that Germany

would build a bomb before we did. The overwhelming challenge today, according to the National Academy of Sciences President Ralph Cicerone in his address two weeks ago to the Academy's annual meeting is to discover ways to satisfy the human demand for and use of energy in an environmentally satisfactory way and an affordable way so that we're not overly dependent on overseas sources.

Most of us know the statistics Cicerone repeated them in his address. We pay $500 billion overseas for oil, that's $1600 for each one of us. Some of it to nations that are hostile to us, some of them that are funding terrorists that are trying to kill us. It's half our trade deficit. It's forcing gasoline prices to $4 a gallon. It's crushing family budgets. And then there are the environmental consequences. If worldwide energy use continues to grow as it has, humans will inject as much CO2 into the air from fossil fuel burning between 2000 and 2030 as they did between 1850 and 2000. There's plenty of coal to help achieve energy independence but there is no commercial way, yet, to capture and store so much carbon from so much coal burning. And we haven't finished the job of controlling sulfur, nitrogen, and mercury emissions.

There are several reasons why I believe the original Manhattan Project model fits the idea of a Manhattan Project for clean energy independence. The original Manhattan Project had to proceed as

fast as possible along several tracks to reach its goal. According to a young engineer at Los Alamos the entire project was being conducted using a shotgun approach. Trying all possible approaches simultaneously without regard to cost to speed to a conclusion. It needs Presidential focus and it needs a bipartisan support in Congress. It needs the kind of centralized gruff leadership that General Lesley Groves of the Army Corps of Engineers gave the first Manhattan Project.

The first Manhattan Project mobilized the brightest scientist of several countries, it drafted some of the major corporations in America like Tennessee Eastman, Union Carbide, others and it was run by the Army that's one reason it succeeded. It needs to break the mold as Dr. Oppenheimer told Los Alamos in 1945 about their work then. Clean energy independence is too revolutionary to consider in the framework of old ideas and both that project and the new one needs to start with a small diverse group of great minds.

There are some lessons, too from the America Competes legislation that I mentioned a little earlier. Remember how it happened. Just three years ago in May 2005 a bipartisan group of us from Congress asked the National Academies to tell the Congress the ten things we need to do to keep our brain power advantage so we could keep our jobs from going overseas. I remember saying to the Academies at that time, most

ideas in Washington, D.C. fail for lack of the idea and if they would just give us the ten things we needed to do that consensus would make it possible for us to succeed. By October, Norm Augustine a member of the National Institute of Engineering had assembled a small group of great minds including Nobel laureates, university presidents. They gave us 20 things to do. And then the Congress worked on it for two years in our usual messy way, but we ended up with legislation that was sponsored by the Republican leader and the Democratic leader. Through a change of political parties, it still was sponsored by the Republican and Democratic leader. Seventy senators co-sponsored and it put us on a path of double funding for the Physical Sciences over the next ten years and do a number of other things.

Some say that an election year is not a good time to try to move in a bipartisan way on such a big project. I can't think of a better time. I mean voters expect Presidential candidates and candidates for Congress to come up with solutions for $4 gasoline, clean air, and climate change, and the National Security implications of all that. John McCain, for example is dedicating this week to such discussion. The people didn't elect us to take a vacation just because there's a Presidential election in November. So we've already tried to combine the idea of the Manhattan Project with the model that we used with America Competes.

I'm spending a little bit of time on process here, that may not be as interesting to people outside Washington but those who know Washington know that process is often policy and it's very important. So I visited with Senator Jeff Bingaman and Senator Domenici and Lisa Murkowski or the senior members of the Energy Committee in the Senate and they are the ones who Senator Bingaman and Domenici worked, made a major effort in the America Competes Act keeping it bipartisan. With me in Oak Ridge on Friday were Congressman Bart Gordon, the Democratic Chairman of the House Science Committee who is also very involved in America Competes and Zack Wamp, a senior appropriator.

So we are off to that kind of a start and my goal is that we could find a way to take the ideas that I'm outlining here and that others have outlined and come to a consensus about it in about the same period of time that we did three years ago with America Competes. That would mean that by October there would be a consensus of ideas, and a group of us in support of the ideas and the new President and the new Congress could go to work.

The National Academies had its own study going on. You at Brookings have been doing a lot of work as well, but the important thing is to get it together, otherwise you know what will happen: Each of us in Congress, more than 500, will say, well, my uncle's got a great idea up in

his attic, let's put $400,000 behind it, and we'll all be going off in a hundred directions and we will still be paying $4 for gasoline, we'll still have a problem with clean air and climate change, and we'll still have a lot of national security problems because we're being held hostage, in effect, by other countries who have the oil.

So how to proceed. When I talked to Senator Bingaman about the idea of a new Manhattan Project, he thought for a moment. He said, "Maybe, maybe this is a little different. Maybe we need many Manhattan projects," and he suggested the recent speech by Chuck Vest, the former M.I.T. president who's head of the National Institute of Engineering, who suggested 14 grand challenges for the 21st century for engineering, three of which had to do with energy.

I think that Senator Bingaman and Chuck Vest are right. Congress doesn't do comprehensive well. We proved that with the Comprehensive Immigration Bill. Step-by-step solutions or different tracks toward a single goal are easier to digress, have fewer surprises, they often cost less, and, of course, the original Manhattan Project proceeded along several tracks toward one goal.

So here are my criteria for choosing the tracks that we should follow: 1) grand consequences; 2) the United States uses 25 percent of all the energy in the world, so interesting solutions for small

problems with small consequences ought to be part of some other project, real scientific breakthroughs.

There are a lot of things we already know how to do. I mean we know how to drill 50 miles off shore in an environmentally clean way for oil and gas. We know how to build new nuclear power plants. We know how to increase fuel efficiency by 40 percent by 2020, which we just did in Congress.

And I think we should be doing all of those things. But the challenges that I'm going to suggest aren't any of the things that we already know how to do. They would be real scientific breakthroughs that we could make or make substantial progress on in the next five years.

Five years? Why five years? Because we need to get moving. I know we can't be energy-independent in five years, but we can be firmly on the path toward energy independence in five years, and we ought to pick and choose among those opportunities that put us there sooner rather than later.

Family budget is a criteria. Our solutions need to fit the family budget. We can come up with grand ideas that double the price of gasoline and double the price of electricity, run all our jobs overseas and put more of us on the welfare line. That's not a big success. The family

budget has to be front and center as we compare options and as we consider cost and consensus.

The Augustine Group working on America Competes left off some very germane topics like excessive litigation because they knew they probably couldn't agree and the Congress couldn't either So they picked 20 things they could agree about and they thought we could, and as a result we were able to agree on most of them.

So here's where I'd like to ask your help, that at Brookings and the National Academies or others who may be working on this, rather than have members of Congress come up with out favorite idea or even ask scientists to set policy yourselves, I think we ought to have a discussion for a few weeks about what ought to be the grand challenges that we focus on for the next five years, and I want to quickly offer seven for consideration, seven grand challenges that the Congress and the Federal Government should take over the next five years so that we will be firmly on a path toward clean energy independence:

One: Make plug-in electric cars and trucks commonplace. Most of you probably remember H. Ross Perot. Most of you have probably forgotten how he made his money. He was in Dallas in the 1960s and he noticed that the banks were, when they shut their doors at 5 o'clock, were also turning off their big new computers.

So Perot went to the banks and said, "May I buy your idle computer time at night?" And the bank said yes. Then he went to states like Tennessee -- this is before I was governor -- and said, "May I manage your Medicaid data?"

And they said yes. And so the banks made a little more money, and the state saved a little money, and Perot made a billion dollars.

Now, what does that have to do with energy independence? The idle nighttime bank computer capacity in the 1960s reminds me of the idle nighttime power plant capacity in the 21st century. This is why: The Tennessee Valley Authority where I'm from, produces about three percent of all the electricity in America. It has seven or eight thousand megawatts.

That's seven or eight nuclear power plants' worth of unused electric capacity most nights that, if we were to make an inventory of the Tennessee Valley and make a list of our largest unused asset, it would probably be seven or eight thousand nuclear power plants' worth of unused electrical capacity at night. That's an enormously valuable asset.

Second: Beginning in 2010 Nissan, Toyota, General Motors, and Ford will sell electric cars that can be plugged into wall sockets. Fed Ex based in Memphis is already using electric hybrid delivery trucks. TVA could offer -- other utilities are -- smart meters that would allow its nine million customers to plug in their vehicles at night to fill up "on electricity"

for only a few dollars in exchange for the customer agreeing to pay more for electricity used between 4 o'clock and 10 o'clock when the grid is especially busy.

Add to that that 60 percent of Americans drive less than 30 miles each day, those Americans could drive a plug-in electric car or truck without using a drop of gasoline. By some estimates there's so much electric capacity in power plants at night that over time -- and this would take a long time -- we could replace three-fourths of our light vehicles with plug-ins. That could reduce our overseas oil bill from $500 billion to $250 billion and do it all without building one new power plant.

In other words, we have the plugs, the cars are coming. All we need is the cord. Is this too good to be true? Haven't United States presidents back to Nixon all promised a revolutionary car? Well, times have changed. Gas is $4, we're mad about sending $500 billion overseas and the consequences that flow from that every year. We're worried about climate change, we're worried about clean air, and we already have one million hybrid cars that consumers have bought and are waiting in line to buy even without the plug-in.

Down the road is the prospect of a hydrogen fuel cell hybrid vehicle with two engines neither of which uses any gasoline. There are obstacles, true. Expensive batteries is a big one. Maybe they'll add,

David Sandalow says, eight to eleven thousand dollars per car, but I rode on the airplane today from Knoxville sitting next to the Director of the Materials Laboratory at Oak Ridge, who was at my speech on Friday. He says within five years with the appropriate amount of research we ought to have 150-watt-hour per kilogram battery that would produce 80 miles on a single electric charge.

Carlos Ghosn has said Nissan plans by 2012 to sell cars that do that without a hybrid battery on electric charge.

Smart metering is not widespread. There will be increased pollution from coal plants at night, that's true, but we know how to get rid of the sulfur, nitrogen, mercury from coal plants, and we should do it anyway. So that may be an area where the Federal Government needs to help, and that leads us to the next grand challenge, one of those from the National Institute of Engineering, and that is to make carbon capture and storage a reality for coal-burning power plants.

There may be other solutions than capturing and putting underground the carbon from coal plants, but, interestingly, the National Resources Defense Council, which is a pretty tough environmental group, has argued to me that after conservation a coal solution is the better solution for clean energy independence because it provides for the growing power needs of the United States, and if we adopt a way of

creating electricity from coal that doesn't produce nitrogen, sulfur, mercury, or carbon in any significant quantities, then the rest of the world will do it as well.

The third suggestion challenge, make solar power cost competitive with power from fossil fuels. This is the second of the National Institute of Engineering's grand challenges. Solar power despite 50 years of trying produces 1/100th of one percent of our electricity. The cost of solar panels averages $25-to-$30,000, and the electricity produced for the most part can't be stored back to the battery issue.

Now there's more promising research, and at least one utility has contracted to build a solar thermal power plant which captures the sunlight using mirrors, turn heat into steam, and stores it underground until the customer needs it. If that turns out to be commercially useful, that will be a major breakthrough.

Four. Safely reprocess and store nuclear waste. Nuclear plants provide 20 percent of America's electricity but 70 percent of our clean electricity: That is no carbon, no sulfur, no nitrogen, no sulfur [sic.] The most important breakthrough needed so that we can build more new nuclear power plants is to find a way to deal with the nuclear waste. A political stalemate has stopped nuclear waste from going to Yucca Mountain in Nevada. We got $15 billion already collected from ratepayers

just sitting in a bank that was supposed to be for that purpose. Recycling could reduce the waste by 90 percent creating less stuff to store, but finding a way to deal with this is important.

The Oak Ridge scientists told me on Friday that a reasonable goal for nuclear power would be to add five or six new plants a year over the next 40 years. That would get up to close to 200 more power plants, but would only get us to about 30 percent of all the electricity that our big economy needs. I think it's very important in discussing clean energy independence that we realize we're not on some desert island, and a single solar panel and a windmill are not going to cut it for the needs of this country. We need large amounts of clean energy. That's one way to do it.

Five. Make advanced biofuels cost competitive with gasoline. There's a big backlash right now toward ethanol from corn because of its effect on food prices, and that reminds us of the great law of unintended consequences when issuing all these grand challenges. But ethanol from cellulosic materials, which could be described as things we grow that we don't eat, show great promise and within the next five years could make a bit difference. So the focus on advanced biofuels would be on crops we don't eat instead of crops we do eat.

Two more grand challenges. Make new buildings green buildings. Japan believes it may miss its 2012 Kyoto goals for greenhouse gas reductions primarily because of energy wasted by inefficient buildings. We know most of the technologies to do this. Figuring out how to accelerate their use in a decentralized society is most of this grand challenge.

Someone asked me Friday, "Well, why do you limit it just to new buildings?" Well, we don't have to limit it to new buildings but retroactive is always harder to do, and it seemed to me that if we just found a way to make new buildings green buildings, that would be a significant accomplishment.

And then, finally, provide energy from fusion. Arguably, this doesn't belong on a list that has anything to do with the next five years. This is the idea of recreating on earth the way the sun creates energy and using it for commercial power. It's the third grand challenge of the National Institutes of Engineering, and it's probably a long way away, but the promise of sustaining a controlled fusion reaction for commercial power generation is so fantastic that our five-year goal should be to do everything we can do in five years to reach the long-term goal. And the Congress' failure to approve the President's request for the United States'

continued participation in the international project to do this is embarrassing.

This country of ours is a remarkable place. Even during this economic slowdown, this year we will produce about 30 percent of all the wealth in the world for just the five percent who live here, five percent of all the people in the world who live in the United States. Despite the gathering storm, of concern about America's competitiveness, no other country approaches our brainpower advantage.

The collection of great research universities, we don't just have some of them, we have almost all of them: the collection of great laboratories like Oak Ridge and Los Alamos and others, and the great private sector companies, all of which were brought together in the original Manhattan Project and could be brought together through the right kind of leadership in this one.

These are precisely the ingredients that America needs during the next five years to place ourselves firmly on the path to clean energy independence, and to achieve that independence within a generation, and in doing so to make our jobs more secure, to help balance the family budget, to make our air cleaner and out planet safer and healthier, and to lead the world to do the same.

Thank you.

MR. ANTHOLIS: Thanks, Senator. I thought we'd start out, I'll ask the first question, and we'll open it to the audience.

We, at Brookings as you'd mentioned, and I probably failed to mention up front, started a big energy security here.

SENATOR ALEXANDER: Right.

MR. ANTHOLIS: And you touch on two elements of it: One is the energy security side, foreign dependence on oil, particularly foreign oil, imported oil; the other is the climate change side, and you mentioned climate change quite a lot, and you talk about bipartisan cooperation. In the past Republicans have tended to want to talk about the energy security and Democrats have wanted to talk about the climate change, so do you see those two sides coming together? Do you think over the next five years there's going to be that sort of political convergence to deal with the issue of convergence?

SENATOR ALEXANDER: The answer is yes, and that's a good way to describe the political environment. The Republicans are sort of the party of supply, and the Democrats are the party of demand, I guess, and the Democrats talk more about climate change, and the Republicans talk more about energy independence.

But I think it makes common sense to deal with both. I actually think clean energy independence is the right way to deal with

climate changing clean air because, for example, if we electrify the cars and trucks, our fleet of vehicles in the country, we'll have to use coal. I mean there's not enough electricity in the next 10 or 15 or 20 years to do it otherwise, and if we use coal, we're going to be forced to take the big coal plants that now exist and clean them up, and we're going to be forced to do a crash project for carbon recapture. And if we do a crash project for carbon recapture and we actually succeed in that, that's the single most important thing we could do for climate change around the world because China's building -- most countries are building new coal plants because they're cheap, predictable, they had coal, and they're going to keep building them. So we need to find a way to make them clean.

So I think controlling climate change in clean air is a by-product of clean energy independence. If the word "clean" weren't on the goal, it wouldn't be, but I think the focus is clean energy independence, and that's the way to do it. That will bring the parties together.

MR. ANTHOLIS: That's great. Thank you, Senator.

Questions from the audience? Please, there are microphones. Please tell us who you are and where you're from.

MR. HOFFMAN: I'm Alan Hoffman with the U.S. Department of Energy. Senator, there are a couple of things that you did not mention. I wonder if you'd briefly comment on them. You didn't talk about public

transportation, you didn't talk about other renewables beyond solar -- and there are a whole bunch out there -- and you didn't mention the issue related to water for all of these power plants and the growth of alternative fuels. Those are all important issues that we can get started on in the next five years, I --

SENATOR ALEXANDER: They -- one was other renewables.

MR. HOFFMAN: Public transportation.

SENATOR ALEXANDER: Public transportation.

MR. HOFFMAN: And water.

SENATOR ALEXANDER: Well, as I said, I focused -- my focus were on areas where we needed scientific breakthroughs. Now, in public transportation I think it's more a matter of I think we know what to do; it's just a matter of whether we want to do it or not. I suppose we can invent new trains, but, basically, public transportation, we don't have to invent public transportation any more than we have to invent a nuclear power plant. So I didn't mention a nuclear power plant, I didn't mention public transportation. Clearly, that would help.

On other renewables -- and I was looking for my figures here -- I think one could argue that advance biofuels would be a renewable for fuel. There are other renewables such as wind, geothermal, that could,

but they've gotten such solar, it seemed to me -- it seems to me, personally -- to have the greatest potential for the largest bang for the buck.

So far we've mainly focused on wind which gets a massive subsidy right now. Solar gets almost nothing. We've committed, if we add what we just did in the latest Senate bill, $14 billion over the next 10 years just to wind. So wind gets -- I've got my figures somewhere -- I asked the EIA to do a study of subsidies for various forms of energy, and wind had almost all the subsidy; the other renewables had very little.

But the seven I'm suggesting are just candidates, and your candidates may be better. The question of water, what would you suggest would be the objective over the next five years of water? I could listen to you.

MR. HOFFMAN: Well, if you're going to have thermal power plants, whether they're nuclear or fossil, you're going to need water to cool their exhausts.

SENATOR ALEXANDER: Right.

MR. HOFFMAN: If you're going to grow biomass, you're going to need water to grow biomass in areas where you don't have natural irrigation.

SENATOR ALEXANDER: I see. So what would the objective be?

MR. HOFFMAN: One, to start using whatever water resources we have more efficiently, because we clearly have been taking it for granted in much of the United States, because we've been a water-rich country, but we're running into problems just like the rest of the world. And we also have to learn how to reduce the water demand for power plants, and some of the labs are beginning to work on that.

But you cannot separate water issues from entity issues which we've done in this country for a very long time.

SENATOR ALEXANDER: That's a good point. I think I would, based on that discussion, for example, if we make plug-in hybrids commonplace, that means we've got to deal with advanced batteries, we've got to deal with carbon recapture, we've got to deal with some other things, and you're suggesting we also have to deal with water. So I would suggest dealing with water is a part of one of those objectives might be the way I would do it upon first hearing, but that's very helpful.

Yes, sir? I'm looking for suggestions as much as questions.

MR. KRUPNIC: Yes, this is Alan Krupnic (phonetical) from Resources for the Future.

SENATOR ALEXANDER: Yes, sir.

MR. KRUPNIC: You didn't mention cap-and-trade programs, I don't think. Higher prices for carbon that would occur from such a program would stimulate a lot of the innovation that you talk about but would also stimulate a reduction in demand. It would have a salutary benefits all along the way and maybe compliment some of these challenges that you see, I think, as more engineering based. What's your thoughts about that?

SENATOR ALEXANDER: Well, I have introduced a cap-and-trade program for carbon every since I've been in the Senate for the last five years. Senator Carper and I did it first. Senator Lieberman and I have done that since then. I would limit a cap-and-trade program to power plants because that's a third of the carbon, 40 percent of the greenhouse gases. We know how to measure carbon coming out of smokestacks because we've measured other pollutants coming out of smokestacks.

I'm not for an economy-wide cap-and-trade because for the same reason I mentioned: I don't think we do comprehensive well, and I think it's likely to be more expensive, full of surprises, and will probably fall of its own weight. So I agree that cap-and-trade for power plants would b a useful tactic.

But I think the better objective -- it depends on what your goal is. If your goal is clean energy independence and cap-and-trade may

be one of the tactics you use to get there, or it may be inevitable as a way of making it possible for us to use more coal in electrifying the fleet, if your only goal is climate change, well, then you'd start out with cap-and-trade or something else, of course.

My formula would be cap-and-trade for power plants and a low carbon standard for fuel, and leave everything else alone because most everybody has to pay an electric bill or put gas -- put fuel in their vehicle.

Yes, sir?

MR. KLEINST: Hello, Senator. My name is Martin Kleinst. I'm the Bureau Chief of the German Weekly *Die Zeit*, and coming from Europe I'm amazed, you know, one of the biggest problems here, I think, is energy sufficiency and energy safety, and the reduction of the waste.

You know, it starts from insulating the houses to everything, and that means a big federal program on the federal level, on the state level, and on the local level. You know, subsidies, tax cuts, incentives for people to insulate and to save energy. And I think, you know, when you see the waste of energy every day from the air-conditioning to the heating to how badly buildings are insulated, I think, you know, public buildings and the federal government and the state governments could give it a good example and that will spread out to the individual, individuals.

SENATOR ALEXANDER: I think that's a very good point. The sixth grant challenge I suggested was to make all new buildings green buildings, and the major challenge with that in our very decentralized country -- of course, Germany is a decentralized country as well -- is to find a way to encourage that. It's happening pretty rapidly.

I mean, I was in Kingsport, Tennessee, Saturday night, and the school board has cut its electric bill from $2.1 million a year to $1.6 million a year over the last four years. And the Oak Ridge Lab is about to build some new buildings, and they have all these ideas about energy efficiency.

But you're exactly right. I mean energy -- conservation and energy efficiency is the low-hanging fruit of the clean energy independence. It's the easiest thing to do. The Congress adopted the fuel efficiency standards in the end of last year. Most people are so surprised when constructive things are done by Congress that I don't think we pause and thought about how important that was. I mean that's a 40 percent reduction in fuel efficiency between now and 2020. It's the single most important thing Congress could do about climate change, clean air, or clean energy independence we've just done in a bipartisan way.

So you're exactly right, and whether it's fuel efficiency or green buildings, and I think buildings are the place to focus; if I had to pick one place to focus, I would focus there.

Yes?

MR. TUGWELL: My name is Frank Tugwell I'm with Winrock, International. Your proposal that we recommit this country to nuclear energy didn't include a discussion first of all of the full costs of nuclear energy, and I think it would be useful to have the Energy Information Administration take a look at that, including insurance for power plants.

And, secondly, it didn't include a discussion of the national security issues associated with proliferation. If we commit and other countries commit to nuclear power because it's clean, we could have thousands of nuclear power plants around the world and a trade in plutonium and waste products that would be very, very significant. Many people who are worried about nuclear power don't think that we have a world that's mature enough to be able to handle that trade and that kind of commitment to nuclear power. So I think that's one thing you might want to look at in that discussion.

SENATOR ALEXANDER: Thank you very much for your point, a very good point. As far as the true cost, I've found the federal

subsidies for electric power. This was a year-long study by the Energy Efficiency Administration on per megawatt hour. The federal subsidy for nuclear is $1.59. Compared with wind, for example, it's $23.30 per megawatt hour.

So the nuclear subsidy is pretty -- pretty low. I don't think that includes insurance.

MR. TUGWELL: Well, insurance per megawatt hour wouldn't take it much higher, would it?

SENATOR ALEXANDER: Well, the insurance industry has declined to insure power plants, nuclear power plants, and Congress, therefore, has made that unnecessary.

MR. TUGWELL: Well, I could ask --

SENATOR ALEXANDER: It's called the Price Anderson Act. And I could ask EIA that. And on your proliferation point that you're exactly right. I mean proliferation is a concern of nuclear power

Now, the question is whether we're therefore going to abandon nuclear power or whether we're going to try to control the proliferation concern. And my decision would be to try to control it. We're actually helping Westinghouse, now Toshiba build nuclear plants in China today. So China, India, most countries in the world are thinking of nuclear power. I think the United States has to stay committed to it.

Yes?

MR. COUPATIN: Bob Coupatin , formally with the Department of Energy. I'm probably a voice crying in the wilderness, but it seems to me that the term "energy independence" has been so -- so downgraded and so polluted by political implications that I think it just does not serve a useful purpose.

I would suggest substituting a word like "security." We're all interested in security. It may mean the same thing, but I think independence has been used by all the candidates from Nixon on, and it just does not -- I think, you know, your point about not, you know, being on an island and being isolated is the way that most people think when they think about independence. We fought for independence from the British, and God knows we're not independent anymore. But that's just my take on the word "independence."

SENATOR ALEXANDER: Well, I think you made my point. We fought for independence from the British, and they're now among our best friends. So we just didn't want to be in their apron pocket, and we didn't want to be controlled by them. Independence means that I'm not controlled by you or you're not controlled by me, and most

-- I grant your point. Some agree with you. But if you go to the dictionary and you look at the word "energy" and the word "independence," it means exactly what I think most people would like to see.

MR. ANTHOLIS: (off mike)

SENATOR ALEXANDER: Well, the people -- I'm in sort of a perpetual focus group in my line of work, so the people I talk to about energy independence understand it very well. The 200 scientists at Oak Ridge National Laboratory were very comfortable with it. I asked them a question. I said, "People worry about the word `independence.'" Independence simply means that we don't want to be held hostage by anybody for our energy supplies, and I think most Americans understand that's a good goal.

And, actually, since part of our job is to rally

-- there's a reason why Obama and McCain and all the way back to Nixon have used the words "Manhattan Project" or "energy independence." They want to rally the American people behinds a great cause. And it would be a great cause to make ourselves truly clean energy independent, to clean the air, to have enough energy, and to not be held hostage by any other country for our energy supplies.

And so I think we have to be in the business of persuading half the people we're right, and I'll keep working on my explanation so I

can persuade you and others. You're not the only one who has made that point to me.

Yes?

MR. AMBITHIA: Hi, Lazroth Ambithia from Sweden. I have had two questions: One is that a couple of weeks ago I read a short note in the newspaper saying that you gathered about 40 Republican senators to try to reach a consensus on climate policies, and I am wondering if there is a consensus regarding your plan for the next five years.

The second question would be, what do you expect from a new president regarding an international climate treaty? Do you think it will be possible for the U.S. to sign such a treaty already in December 2009 regarding the short period of time and also regarding the Lieberman-Warner Bill that hasn't passed yet?

And after these two questions, I would also like to encourage your staff that you've -- asking for a solution -- to contact me or the Embassy, because I think Sweden has a lot of knowledge to share when it comes to renewables and energy efficiency.

SENATOR ALEXANDER: Thank you very, very much for your questions. As far as the Republican senators go I said a little earlier, sometimes we Republicans sound like the party of supply. We think that's very important. I mean, we think it makes sense. I do and most

Republicans do think it makes sense to drill -- to give Virginia the opportunity to drill 50 miles offshore where you can't see the rigs in an environmentally clean way and produce a lot of oil and gas, and give Virginia 37-1/2 percent of the revenues which they could then put in the trust fund to build their universities, to nourish their beaches, and to put 12-1/2 percent in the land and water conservation fund which we've been trying to do for 40 years. It's been a federal law for 40 years that we ought to fully fund the Land and Water Conservation Fund up to $900 million from oil and gas drilling.

So we on the Republican side will say if you're not building nuclear power plants or finding a way to use coal plants in addition to conservation, that's what we usually talk about. The purpose for the meeting that I had was to get the various ideas within the Republican conference on climate change.

Senator McCain has been the leader, or one of the leaders in the United States Senate, and he's the nominee of the Republican Party this year. And other Republicans have different proposals on climate change. Senator McCain has an economy-wide cap-and-trade proposal. I have a power plant cap-and-trade proposal plus a low carbon fuel standard for fuel.

Senator Voinovich would prefer to focus just on technology, including raising the money to pay for technology for a crash program for renewables and for carbon recapture.

So what I wanted to do was to -- my job is not to tell all the Republican senators what to be for; it's to make sure we all can say what we're for in compelling ways so we can help our country and be reelected in those two reasons, and I thought we needed some practice on climate change. So we have a very good -- we had a very good session. We must have had 14 senators make their proposals. We don't have a consensus yet within, but we have some good -- we have some good ideas, and you'll be hearing more about them.

Your second question I didn't --

MR. AMBITHIA: A treaty, whether or not you think the next president will have any treaty.

SENATOR ALEXANDER: I think it's possible the next president could sign a treaty, but first I think we have to get our house in order. I mean the steps I would see, Step No. 1 is for the new president -- who I hope will be Senator McCain but it could be Senator Obama or Senator Clinton -- the new president I would like to see launch a new Manhattan Project for clean energy independence and do what a president only can do, which is identify the six, seven, or eight major

objectives within that effort, and then for a bipartisan group of us in Congress to fund that, and then for us to move in a direction that includes dealing responsibly with climate change and clean air.

Once we're on that path, I think it will be easier for our president to consider negotiating and signing a world climate change treaty. Thank you.

(Applause)

MR. ANTHOLIS: I want to thank Senator Alexander for those terrific remarks and this initiative that he's taken.

We going to go right to a panel discussion now that will be moderated by Carlos Pascual, our Vice President and Director for Foreign Policy Studies, who also has been the leader across all of Brookings on our energy security initiative.

Also on the panel are David Sandalow, Senior Fellow here at Brookings; Jason Bordoff, the Research Director or Policy Director at the Hamilton Project; John Elkind, who is a Nonresident Senior Fellow at Brookings, and myself.

MR. PASCUAL: Senator, again thank you very much, and I will get us going on this panel. What we will try to do is have an initial discussion on some of the very important issues that Senator Alexander has already raised with us to try to get into them in a little bit more depth

and open that up to the audience and provide an opportunity for some back and forth debate.

Senator, I want to start by thanking you for your leadership, and this is an issue that really does require a leadership of the highest levels in the Senate, in the Office of the President of the United States. among our international institutions because it's something that is absolutely at the center of the viability of the planet. To the United States it's something which is absolutely central to our economic prosperity, and, as you've indicated, it's also a critical national security concern.

I think it started to come out in some of the questions. This is tough. This is very hard to do. The senator pointed out the Energy Act that was passed and signed by the Congress and signed by the President in December of last year, and in that Act we have to recognize that as much as was done, renewables were essentially excluded, right, except for ethanol. But when we got into issues such as wind and solar, they actually didn't make the cut in terms of actually getting a boost.

Or when we look at the actual impact that would come from the types of actions that were in that legislation, one of the things that that legislation would still allow is for an increase in carbon emissions throughout the economy, yet what we have seen as a result of the scientific reviews that have been done from the intergovernmental panel

on climate change, it's been by 2050 we need to get to a point where annual emissions of carbon are going to have to reduce somewhere on the scale of 50 to 85 percent to avoid increases in temperature on the planet that are going to be irreparably damaging to our ability to function in the kind of life that we know today.

And so we're going to have to look at something which is radically different in the future that requires serious cutbacks, and so it's in that spirit that I want to bring back the discussion. And what I'd like to do is start out with this question of technology and the concept that the senator put out for us of a Manhattan Project and begin by exploring whether or not there in fact is something different that has to be added onto here, because the Manhattan Project was something that produced a weapon that could be used by government.

The Apollo Project produced the technology that was used in space, but here we have technologies that have to be adapted mainstream into the economy, so what is it going to take for that to actually happen?

And so, David, I'm going to begin with you, and the Senator kindly gave your book Freedom From Oil very kind mention, and you really grapple with some of these questions. And I want to come back you of whether or not it's realistic to look at some of these technologies and the

adoption of some of these technologies without also at the same time and in parallel tackling some of the very tough policy questions that create the incentive to make them economically viable alternatives.

MR. SANDALOW: Thanks, Carlos, great question, and I want to add my voice of congratulations to Senator Alexander for what in my view is a very, very smart speech here. I mean this is grappling in a very thoughtful and intelligent way with some of the central issues that we're facing. So congratulations, Senator. Thank you very much for the plug for the book.

And I think, to answer your question on technology, Carlos, I would look at that list that Senator Alexander put out. In my view, they include reference to some of the most important. In writing Freedom From Oil, I became focused on plug-in hybrids and plug-in electric vehicle technology which Senator Alexander highlights. And this is, potentially, a transformational technology.

You know, we have plugs it out with recent every home and business defense in the United States. They actually do us very little good in terms of getting off of oil because our cars and trucks can't connect to them. And if this technology can take hold, we are going to change the politics, we are going to change the whole set of security relationships, we're going to have an amazing environmental impact as

well. And just to make a point that is key here, these electric motors are much, much more efficient than the internal combustion engines that we're all used to driving around.

You know, if you think about it, even on a cold winter day, if you turn on the car you've been driving your entire life, drive for a mile or two, that engine gets too hot to touch, and that's waste heat. We had radiator systems that are entirely devised to dissipate waste heat. Electric motors are much, much more efficient, and so the good news is even if we plug one of these cars into a coal plant, we are producing fewer greenhouse gas emissions than running the average U.S. car on oil.

Let me say that again: Even if you plug one of these cars into a coal plant, that's fewer greenhouse emissions than running a regular car on oil. The real win, by the way, if when you plug these cars into renewable energy forces like wind or solar, and then you are literally sailing along on wind in one of these cars, and as our grid becomes greener over time, it's going to have a huge benefit on transport factor.

I also applaud the Senator for his focus on solar power. This is the long-term game changer if you get some engineers to decide to talk about this, but the sun is the ultimate our energy comes from. The most efficient way from an engineering standpoint to get energy for all purposes is to capture energy directly from the sun.

You know, I'm all in favor of wind power. Wind actually mediates solar energy through a variety of other forces. Biofuels mediate it through photosynthesis and growing in plants. Fossil energy mediates solar power through hundreds of millions of years of animals dying and becoming fossilized in the ground, and the long-term solution here is solar.

Let me -- I know Carlos wanted me to talk about policy here. I think. to answer your direct question, a government research effort is important. It's absolutely essential and we need to do it. By the way, I applaud the clean energy independence label. I think it's a good label, I think the way Senator Alexander talks about energy independence is a very good way.

In addition to that, we need to have the rules of the road done right, and the biggest subsidy of all in the Energy Sector right now is that coal plants can use the atmosphere as a free waste dump, and that is an enormous subsidy. And until we correct that and until we correct not just actually coal plants but everybody that is using the atmosphere as a free waste dump for carbon dioxide, we're going to have a massive subsidy going on there. So my own view, I applaud Senator Alexander for his leadership in the power sector in this area.

My own view is that we need to do this economy-wide, that if we don't extend it beyond that, we're going to have other sectors dumping

carbon dioxide free into the atmosphere, and that that is going to ultimately destroy incentive. So, you know, I think there's tremendous momentum towards this, and probably the single most important change we can make in our country is to make sure that the release of carbon into the atmosphere from all sectors is priceless.

MR. PASCUAL: David, that's excellent. I'll take two phrases from that, gain changers, and on those gain changers, in particular the mention of plug-ins and on solar power, but then the other side of that, the flip side of that, is the policy environment that actually makes them viable. And in that sense, then, you also use the phrase "we can't have waste dumps -- you can't allow the environment to use this waste dump at no charge."

So let me pick up at that point and, Jason, I'm going to come to you, and I'm going to ask my other colleagues here as well to feel free to jump in. But I want to get into this question and further about pricing, and you've been doing some work on that, on innovative options, that look at economy-wide issues as well as even questions on insurance.

And when we look through the list of grant challenges that the Senator has put forward and challenged us with here, carbon capture, solar power, nuclear way to advance biofuels, et cetera, I think one of the issues that we have to come back to is how do they become competitive

in an economy looking at the cost of alternative fuels because in the end, unless you actually legislate what fuel he's actually used, people are going to turn to prices as a critical factor.

Can you help us think through that issue of pricing, how critical it is, and how do we get at the pricing issues?

MR. BORDOFF: Sure. I do think it's critical and I also appreciate Senator Alexander's speech. It's a really interesting focus on all of these issues, and, particularly, when you focus, I think, on these concerns from a climate change perspective, I have the same reaction as the gentleman who asked questions from Resources for the Future had which is that a lot of the elements in the seven grant challenges are critically important.

But I think probably the most important thing that we could do is send a carbon pricing all through the economy to both encourage fuel substitution and the use of non-fossil fuel energies, but also to encourage demand reduction and to take account of the fact that people have different preferences. Some people may want to take public transportation to work rather than drive; other people may really want to drive and may want to change their light bulbs or do something else. That's sort of pricing, though, as for the economy I think we'll let people make the choices that maximize their welfare.

Now, I mean, I should be clear. I think a carbon, you know, a carbon price, the market mechanism like a cap-and-trade system or carbon tax does a lot to encourage those to create the right incentives for people to generate non-fossil fuel energies and for people to reduce demands, but there's still a critically important role for well-targeted government regulations and standards, and many of them are the sorts of thing that the Senator laid out.

He talked about R&D, and that's sort of a classic case within the government mark- -- a market failure because private firms often do not recoup the full social benefit of their investment in R&D, so there's a role for government subsidies there. He talked about efficiency standards, especially with things like buildings where they're made to be these principal aging problems, where the people who build buildings are not necessarily those who inhabit them, and there may be a problem there that doesn't lead them to build buildings as efficiently as they might.

Nuclear energy, a whole host of other things where there is an important role for government to make. Also with electricity. You talked about metering, making sure that people can understand their electricity bills. If you send a carbon price signal to me in my house today, I'm not entirely sure how I go about reducing electricity. I don't have a very good

sense about how my electricity bill is determined and which utilities use more electricity than others.

So, but I think the right question to ask on all of those things is not whether these regulations, command and control regulations, are standards or subsidies are good for the environment but whether they reduce the cost of meeting our mission target.

If we set a cap-and-trade system of X-billion tons of carbon dioxide into the atmosphere, whatever science tells us it needs to be, we're going to get X-billion tons of carbon going up into the atmosphere. The question is can government standards and regulations reduce the cost of achieving that goal? And I think in a lot of areas, like I just laid out, the answer is probably yes.

I think we should be cautious about government picking what we think the winning technologies are, solar or anything else. I think ethanol is a good example that government doesn't always pick winners very well, and they're, as you said, the law of unintended consequences. You said sort of the list was -- I think someone asked about renewables and public transportation and said, you know, this was just an initial starting point, and we should have a conversation about how to figure out what the right technologies are.

I think the right way to figure out what that list is, is to use a carbon price signal to let the private sector and individuals figure out what the most-effective way to reduce emissions is rather than expect, you know, people at think tanks and policymakers, many of whom have constituent interests and they expect to grow corn, and others to figure out what the winning technology should be.

SPEAKER: I'd like to jump in on that, if I could.

MR. BORDOFF: Right.

SPEAKER: Because I think that Senator Alexander, framing the issue as impact on family budgets, this is as very important point. Of course, nobody likes spending more for things that are part of their day-to-day requirement. Nonetheless, as we try as a nation to figure out where to go and how to go forward on energy, it's important that we in the think tank community in any event do what is substantially ore difficult for elected officials to do, which is to talk specifically about price. If people do not see an impact in their household budget, they will not alter their behavior.

And none of us likes to change ways that we go about our daily life. The question, though, is how to keep that benchmark that the Senator spoke about, which is impact on household budget while also giving that signal through price. And there are some very interesting

techniques, some of which are done by -- I've written about and analyzed -- by Jason, which he didn't even speak about which get into things like pay-as-you-go insurance for your automobile. Sure, you can make the choice to use that automobile as much as you wish, but that there will be a specific economic impact that will be you.

The critical point is as we respond to these issues, as we pursue the kind of vision that Senator Alexander and his colleagues have been advocating, this need not be something that negatively impact quality of life; on the contrary, this is about positioning ourselves for the long term in a way that preserves that and enhances it.

MR. PASCUAL: That's a good point on the long term and what you need to do to enhance quality of life in the long term. And, of course, politics operates in the short term, and let me use that as a bridge to a question, Bill, for you and take advantage of your position as the Acting Director of the Governance Studies Program and get you into American politics here for a second.

Because one of the areas where we have seen that there has been an immediate political response has been in question of the gas tax holiday. And we've had, virtually, you know, the entire economics community come out and say it's a bad idea, it's actually not going to achieve the intended impact, but it's extremely popular and it resonates

with the public as something that could be done, ironically, and as has been advocated by two presidential candidates who have also taken precept positions on climate change.

And so you might want to comment on the gas tax issue, but there's actually a bigger issue here because if in the end some form of effective national climate change legislation is going to have some pricing mechanism, are we politically capable of getting there? Are we willing to make those tough decisions?

DR. ANTHOLIS: It's the $640 billion question.

MR. PASCUAL: Right.

DR. ANTHOLIS: Which is about, give or take, $100 billion, the size of our energy economy in the United States right, and that part of the economy that would be addressed either through clean energy independence or comprehensive climate change legislation, or whatever comes down.

You know, ironically, today that question is going to be the first one probably put to John McCain when he lays out his climate change speech later this afternoon in Oregon. He was one of the two of the three presidential candidates to favor the energy tax holiday. There actually are one or two economists that say that it's not a crazy idea because it relieves a little from a political standpoint, because it relieves a little bit of

political pressure at a time when gas prices are going over $120 a barrel, and the public outcry in response could do worse damage.

I think that longer term question is the real one, and there are two or three things that will affect the political calculations that the candidates make. Both candidates, whoever comes out of the democratic primary process, and Senator McCain are going to be on the record in favoring action on climate change, and so the debate is largely going to frame over a couple of different things, I think:

1) India and China. Is there a competitiveness hit? Motorists are going to have real legitimate questions. If we are paying for t his stuff now and we're paying for climate action, and we're already in a trade deficit towards China and increasingly towards other countries in the developing world, how can we justify that?

And both candidates are likely, in broad terms, to be in favor of climate change. The Democrats have been a little bit softer and slower on trade these days than Republicans have. Are you willing to do a border permit that essentially puts the price on imported goods that come from countries that don't take climate action to try to even the playing field on competitiveness? That could go against your commitment to the WTO if you're John McCain. How do you feel about that? So you'll see a debate about that, I think, in the run-up to the fall.

You will also see a debate about whether or not we should spend our way out of the problem by investing in the next set of technologies or, essentially, tax our way out of the problem through either a cap-and-trade or carbon tax, which essentially is a tax. It's going to be disguised or discussed as not a tax because I think Americans are so tax-averse, and so you're going to see a little bit of a tension there between the candidates.

I think, lastly, the other thing to keep an eye on is not broad policy but the states where people campaign. The next primary tomorrow is in West Virginia. I've notices in the Washington Post, you know, when they talk about the different states coming up, when it was Pennsylvania, they had the Liberty Bell; when it was Indiana, North Carolina, they had an NCA basketball. For West Virginia they have a lump of coal. And, you know, this is big high stakes politics in a couple of key states where coal is critical to the state's economy. How will people campaign in those states? What will they say in those states?

And it's not just West Virginia. It's also places like Iowa where corn ethanol, whether or not the technology of the future is the technology of today. Are we going to stick with those subsidies? So I think that's where you will see the political battle ground.

MR. PASCUAL: And you can take that lump of coal and put it next to China and India as well because that has been fundamentally fueling their economic growth. And, interestingly, I think, just to give the flip side of this argument and the complexity of it and come back to the question I asked earlier about, can there be an international climate change agreement by the end of December of next year? And here China and India, if we had, you know, two other chairs on the platform, they would be saying, you know, "Look, you guys created this problem. You're the industrialized world. You put the carbon up in the atmosphere, so why in the world should we be paying the cost now of added restrictions on our economic growth if you actually started the problem?"

DR. ANTHOLIS: And then also say look at per capita emissions, not total emissions.

MR. PASCUAL: So we've got a very interesting complex political debate here because in the end we can have that political debate as much as we want to, but we're all going to destroy ourselves if we, in fact, insist on our righteousness and actually can't come to some sort of an understanding.

DR. ANTHOLIS: I think that all three of the candidates are certainly aware that there are broad internationalists that are paying attention to a negotiation that they'll have to be part of in the first year of

their administration, and they all say that they want to reengage in the international community. But up until election day 2008, that's going to have to be a back burner issue for them, and that's the challenge: How do they not cut off in negotiating halfway forward while still getting the votes they need when people are really concerned about competitiveness issues.

MR. SANDALOW: Can I make one quick point?

MR. PASCUAL: Yeah, and then I'm going to come back to you on ethanol since you get into ethanol in your book, so I'm giving you advanced warning.

MR. SANDALOW: I just wanted to make a quick point on the politics of this, which is, you know, as Bill said, the political system seems to have settled on a cap-and-trade system over a carbon tax, largely I suspect because I don't think people fully realize that it has a similar effect of raising energy prices.

There is some question I think, politically, about whether that's helpful to get legislation passed, or whether there may be a benefit to being honest with people about the impact on energy prices that a marketing mechanism will have partly so that we could start to build some support, and, you know, we at the Hamilton Project have written on this about ways to use the revenue that would be created by auctioning off

allowances to try to give refundable tax credits or use the tax code in other ways to try to mitigate the impact, the distributional impact that any sort of carbon pricing would have, because we know that low-income people spend the higher percentage of their income on energy than high-income people, and they'll be particularly hurt.

We've laid out one way -- there are others, obviously -- that you could use lump sum refundable tax credits to try to make everyone in the sector on the distribution, income distribution, roughly as well off as they were before.

MR. PASCUAL: Maybe we can come back to this in the Q&A because the issues are of the cap-and-trade system, how it functions and how you deal with safety valve mechanisms. This, in fact, there are excessive constraints on economic growth that are certain critical to the design of that.

But, David, let me come back to you on the issue of ethanol. In your book, it's an opportunity for diversification, for renewable fuel that you strongly advocated. Recently, we've seen a lot of questions arise about ethanol, what the net impact of it is in terms of actual reductions in carbon emissions, but the food issue has become particularly acute. As we've seen food shortages throughout the world, the impact on food prices, and to be fair there are lots of factors here. Part of it is the rising

price, international price of energy, the cost of that, the impact that that has on the cost of production.

But we've also seen other tendencies, for example, even in Brazil as a result of expanding acreage that's gone into sugar cane production. It's pushed the agriculture more into the Amazon and, as a result of the reduction of the rain forest, that has increased greenhouse gases. So, amazingly, we get Indonesia and Brazil now rising into the top five emitters of GHGs because of reductions of the rain forest.

So, I'm curious, is ethanol one of those examples of a well-intentioned policy that just simply went bad?

MR. SANDALOW: I will answer that question. With your permission, I'd like to comment briefly on the schedule discussion you were having with Bill and Carlos -- Bill and Jason.

Two points: First, you asked, will we see cap-and-trade legislation passed in light of the political problems associated with pulling it together? Yes. I think there is a high likelihood that we will pass cap-and-trade legislation in this country. It will be enacted within the next several years for some of the reasons that we're pointing to. I feel so confident about that I think this is an even money bet that we will see the president of the United States sign legislation to cap carbon dioxide emission in the country by December 31, 2010. And if anybody in the audience disagrees

with me about that, I'll make the even money bet. Come on down afterwards.

SPEAKER: It's a little unfair, though, because Senator Alexander's actually in a place where he could gain the system.

MR. SANDALOW: Well, it wouldn't be right for him to be making bets anyway, so anyone else wants to make the bet, even money, that we will have the president of the United States, whoever that may be, signing this legislation by December 31, 2010.

A more difficult schedule question is the 2009 deadline in the international process for an international agreement. I applaud that deadline because it reflects the sense of urgency that we all should feel about the problem of global warming. The reality of the next U.S. president being able to enter into a major agreement in that time frame is very daunting.

First, I think the next president of the United States should not enter into such an agreement unless legislation of the kind we've been discussing is past. Under our system it's very important that the Congress be full partners, and if passed legislation helps implement an agreement like that.

Second, under our system transitions take awhile, and for under secretary, the assistant secretary to get confirmed can take four or

five months in the new administration, and pulling together a complex policy of the type we're talking about in a short time period is going to be very tough. So I think the 2009 deadlock us a good one because it infuses urgency in this process, but it's going to be very challenging for the next American president to respond to that schedule charge.

On biofuels here the key point. I think what's happening on biofuels underscores the remarkable speed with which popular opinion swings at our country. When I started writing Freedom From Oil three years ago, two and a half years -- but everybody was in favor of ethanol. I mean it was an ethanol euphoria in this country.

Now, as I talk about -- I get, you know, almost a crucially negative or critical comment about ethanol, and we have, you know, magazine covers talking about problems with ethanol. You know, I think, not surprisingly, the truth is somewhere in between. I think that the impact of the biofuels growth on food prices has been wildly overstated in some place. There is an impact to be sure, but what's happening with food prices right now is the result of a complex set of factors, including very significantly the rise in oil prices, including increased demand in, you know, in major developing countries, including some droughts and severe weather conditions in a number of places, and including biofuels.

And I think it's a complex set of factors. I've seen different estimates for the role of biofuels, but the kind of sense that the increase in corn ethanol use in the United States is somehow driving a global increase in food prices is just simply incorrect.

There has been some very important research in the past couple of months. We're typing everybody who pays attention to this issue should look at and look at closely, and I'm actually in the process of working through some of the debates about this research, but it's -- an article published in the Science magazine, a series of discussions have followed on that which makes a key point, and the key point is that when you grow biofuels on land that is used for food or that could be used for food, there will be indirect impacts along the way.

The demand for food probably is not going to go down very much. Demand is pretty -- an inelastic demand for food, by and large, and so if you divert corn, for example, to fuel, somewhere along the chain of events you are going to be taking some land that otherwise would have been used for food and turning it into fuel production, and that's going to have greenhouse gas impact.

And that's a very important point to make, and it means that some of the estimates, I think, on the positive greenhouse gas impacts the biofuels are probably not right from prior years.

But the complex set of issues that I think, what we really need is more, a lot more attention to research on these greenhouse gas impact issues for biofuels so that we know what we're doing on corn.

SPEAKER: I want to jump in on that point, Carlos, if I may, because I think that David is pointing at something that I'd like to emphasize a little bit more, which is the way this kind of whiplash-inducing discussion in the last several years on ethanol should not be something that causes us to conclude that, thinking differently, thinking about what our choices are ahead in a strategic fashion is something we should shy away from.

We have no choice but to grapple with these issues. There will be, as everybody famously says, no silver bullet. To me what this argues in favor of is emphasizing first and foremost demand side reductions, energy efficiency improvements, and the Senator mentioned the building and transportation sectors as two examples there. But the more that there is clarity about energy efficiency as the starting point for our energy policy going forward, the better off we are regardless.

We will need new technologies, there is no question. We will need to sort through the trade-offs exactly in the way that David is saying. We should not internalize the experience of the last couple of years on biofuels as counseling that we just stand pat. We can't afford to do that.

MR. PASCUAL: Right. No, I think that's a good point. I think it also, though, comes back to one of the points Jason was raising and the phrase that you used, David, as well, the waste dump phrase, which is in the end we've got to come back and understand what the impact is of any of these technological options vis-à-vis the amount of carbon which is being put out in that waste dump.

And so, are we being responsible in the prices to being charged, and when you look at the cost of production, in the end is it a good investment to actually make, given the impact that we're looking for? And so this is one of the reasons, I think, that the price issue becomes such an important one, because it helps us to make a judgment about whether or not something is actually a good technology, "good" in quotation marks to be able to pursue.

The irony that we get here, of course, is that the Republican side constant -- you know, prices are a basic market mechanism that have generally been utilized to determine whether or not something is a good investment. And the Democratic side, prices have been used as a positive factor in thinking about how to control or reduce emissions on climate change that when you bring them back together into a climate change policy, you get these populace instincts that keep bringing you back to alternatives that focus either more on the subsidy side or focus

more on setting some form of standards rather than actually allowing the pricing mechanism to be the principal driver of what the technological options might be. And it's an irony of the situation that we find ourselves in right now.

But let me just use this to put to the two of you one more question, then I'll go back to the audience.

I think it would be interesting if you could just say a couple of words about the insurance scheme that you've been working on and developing, because I think it's a creative, innovative approach that provides an effective policy complement to the kind of technological option the Senator has been looking for.

And, Bill, I don't know if you want to jump into the carbon capturing storage question, but again, a tremendously important technology but major issues associated with its development, particularly not just on price but also on liabilities and how to, in fact, actually more it from something which is a good experiment to something which might actually become viable and work.

Would you want to start on insurance?

DR. ANTHOLIS: Sure. This is a paper that is available on the Brookings Website in draft form that I wrote with Pascal Noel , who is also with the Hamilton Project, and will be formally released in July that

pay-as-you-drive auto insurance is not -- I can't take credit for the idea, it's sort of been out there in a few different forms here and there for a few decades, although I think we've sort of taken the analysis a bit further and also, I just wanted to give attention to it, because I don't think it's something that sort of enough people in the policy world knew about.

I came across it in the context of thinking about climate change policies and how to reduce emissions, in this case from driving. So, I mean just very quickly, the problem is for the most part today you pay for auto insurance in a lump sum amount per year regardless of how many miles you drive. There are some exceptions to that. Insurance companies may offer a small discount if you drive below a certain number of miles. But for the most part two people -- a risk-adjusted -- two people in the same risk profile, the same age, the same driving history, will pay roughly similar premiums whether you drive 5,000 miles a year or 50,000 miles a year.

We all know -- I think this is true for everyone, it's certainly true for me -- you tend to eat a little bit more at an all-you-can-eat buffet than you do if you pay for things off an ala carte menu. It's no different with auto insurance or with anything else. I think to the extent you don't bear the marginal insurance cost of each extra mile you drive. People may be inclined to drive a bit more, and we just try to run the numbers on

this based on what we know about how people are responsive to higher driving prices, some really higher gas prices, and so our proposal is that you would price auto insurance per mile driven.

So risk-adjusted premiums still. So you may be again, like, depending on whether you're a risky driver or what your age is, all the other risk-prone factors you take into account today your insurance premium would be calculated as eight cents per miles driven, or 12 cents per mile driven. And how you monitor miles driven is an important question, and we can talk about that. I think it's probably one of the main barriers to why insurance wasn't originally priced this way decades ago, but I think we have a technology today to address that.

We again crunch numbers and estimate that if auto insurance were priced this way on average across the country, you'd see a reduction in vehicle miles traveled, around eight percent. It would be higher in some areas like urban areas where auto insurance premiums are higher and lower in other areas.

To put that in perspective, you'd need an equivalent increase in the federal gas tax of a dollar to achieve a similar reduction in the actual miles traveled so that tells you something about how much of an impact this could have on reducing driving and oil consumption. And I think the reason that this may be, hopefully may be politically viable, although there

are other people here who would know better than it, is because it's one of those policies I think are sort of low-hanging fruit, and unlike other attempts by economists and others to price externalities like apartment tax or gas tax or congestion charge, which we saw in New York City recently, you know, failed.

People react adversely to the idea of paying more to drive. This is an idea that actually creates more winners than losers, because we know that a minority of drivers are responsible for the majority of miles driven. So we again crunch the numbers and estimate that around two-thirds of drivers would pay less in auto insurance than we do today if auto insurance were priced this way.

That's true regardless of where you live. If you live in an urban area or a rural area, because again it's a risk-adjusted premium, so the question isn't, do you drive a lot -- people in rural areas obviously drive a lot -- but do you drive more than the average person like you in your area because geography is a key factor in your risk profile?

So, you know, and again I can come to the policy -- I think there are policy things that need to be done to move this forward. The Department of Transportation today has a small pilot project that's helped to get some learning in this regard. I think one of the key reasons it may -- and there is some moves towards this. Progressive auto

insurance is a pilot project going on. They, on the patent business idea, which may be another barrier to other firms doing it, so there's some movement.

I think one of the key barriers is likely that, especially once there's broad adoption of this idea, there may not be much of a private benefit to insurance firms. There is going to be some cost to figuring out how to monitor the miles traveled, putting on little, you know, telemetric GPS type device or something else in vehicles has a cost attached to that.

That may be a rationale because there are very big social benefits from reducing driving by eight percent, and when we put numbers on that, we estimate around $50 billion a year. When you take into account congestion and reduced accidents, and climate change and all the rest, large social benefits but perhaps no private, or little private benefits may justify some government tax credits or some other government role to help encourage firms to offer this and incur the cost necessary to offer this.

MR. PASCUAL: Jason, thanks (inaudible). CCS, Carbon Caption Storage, and some of the risk and live (inaudible) factors that are restraining it.

MR. BORDOFF: Yeah, so the basics if we have either a comprehensive or a utility-based cap-and-trade system where we are

putting a price on each unit of carbon that's emitted into the atmosphere, so if you capture it and store it in the ground, you don't have to pay that price where you can actually have people come to you because you've created a carbon saving.

But the challenge is that you have to guarantee that it's going to stay in there forever. And it's, essentially,. we've created a security as long as we don't have a safety value, we've created a security by these permits. But the securities are only worth what they are if we know that it's going to be gone forever, and, presumably, if you're the holder of that security, you want to make sure that it's going to worth its value. And so that creates an insurance opportunity or liability and problem.

And the challenge is that since we have to move relatively quickly, 20 years in putting together a system that's going to really start dramatically reducing the scope of our carbon emissions, we don't really know yet how secure those carbon emissions are going to be stored underground. We're essentially storing them in geological deposits, and we may not know where the fissures are. We may have lakes popping up all across America that are Perrier lakes because carbon is suddenly coming up through the ground. People don't know that yet.

The fact that a number of big environmental organizations like NRG here are big proponents of this. It's a sign, I think, that the science is moving in the direction of thinking that there are secure places to store this stuff, but it's not completely there. There are a lot of other environmental groups that are quite concerned about it. So it's going to be an interesting debate as we move forward.

MR. PASCUAL: And in terms of developing the technology if you're any particular company that has the technology, my understanding is that part of the problem in actually moving it forward is that right now you as a company bear that risk. And so you don't have the mechanism of sharing it more broadly.

MR. BORDOFF: Right.

MR. PASCUAL: And the liability can be huge.

Let's open it up for questions from the audience, and we'll just start with the gentleman right there.

MR. FLORIANO: Yes, hi. My name is Floriano, and I'm a journalist from Brazil, currently a Congressional Fellow here since the dealing with energy and the environment and trade. I just wanted to present you with a very few figures here on ethanol since that was mentioned here.

Out of the -- well, Brazil and the U.S., they produce together some 70 percent of the world's ethanol. In Brazil, which is a sugar cane base ethanol, you have one percent of the arable land in Brazil used for that. And most of that is produced in San Paulo, a state which is far, far away from the Amazon. The other 40 percent are produced mostly in the Northeast which is also far away from the Amazon.

So, you know, as ethanol is still a very important produce for Brazil and the United States as well, I think we shouldn't lose this perspective. And also when we talk about the Amazon, we should also remember that it's, even after the logging in and burning, it's still more or less roughly the size of Western Europe. So, thank you.

MR. PASCUAL: Thank you for the comment, and we'll -- maybe we'll come back and make a comment on that as we go along.

Other questions? Up here, front?

MR. HOFFMAN: Alan Hoffman, U.S. Department of Energy. In the spirit of full disclosure, I'm in the Office of Energy Efficiency and Renewable Energy, so I want to say something about fossil fuels right now, so you understand where I'm coming from.

There was a very important report put out last July by the National Petroleum Council called The Hard Truth, and Chapter 5 is called Carbon Management. And the thing that was so important, I think,

in that report is that the oil, gas and generally the fossil fuel industries recognize that there needs to be a control on carbon, so they have some certainty as they go forward, and that they were in favor of a carbon cost that they could know about for a long time in the future, and then they can plan accordingly.

And, you know, over a million and a quarter people have downloaded that report already. It's probably over a million and a half by now. I just think it's a terribly important report.

The other thing I want to bring to your attention is with all the enthusiasm for renewables, which I certainly share, we have to worry about two things: One is the storage issue which needs more attention, and the other one is out national grid. We do not have the capability right now of getting all this solar power from the New Mexico desert to the East Coast or even to the West Coast very well, and we need to pay attention to those. Those are the two major barriers to the widespread use of renewable energy, storage and the transmission grid. And it would be nice to make it smart as we go along.

MR. PASCUAL: Do you want to add a question to that, or if you want to just leave it as a comment.

MR. SANDALOW: I'll pick up on one.

MR. PASCUAL: All right. Okay, David, go ahead.

MR. SANDALOW: I just want to pick up on a point Alan made. I mean, I think you're right to point to the need for storage in connection with renewable energy, and people often talk about the intermittency of our renewable

resources like solar and wind being a barrier to their widespread use.

I would point to another type of intermittency with respect to renewables which is the intermittency of federal policy, which is, I think, maybe the bigger barrier than the intermittency of the resource. And we've alluded to this but haven't had a chance to talk about it today. But Congress has not yet renewed the investment tax credit and production tax credit for solar and wind power.

We've been on the one and two-year cycles over the course of the past number of years, and it is absolutely essential in order to build up this industry that we have a renewal of those tax credits, and I hope do it on a longer term basis.

European industry has bone widely ahead of the United States industry in this area, partly because they have policies what they call feed-in tariffs which is a term for guaranteed prices, essentially, that's been much more successful than what the United States is doing. I think we have these enormous subsidies for fossil fuels over the years. We need steady and dependable support for solar and wind power and other

renewables, and if we do that, I think this industry will grow enormously and be a potentially huge engine of job growth over the course of the next couple of decades.

MR. PASCUAL: John, could you add --

MR. ELKIND: Yeah, and this is a very small point, picking up on Alan Hoffman's comment. The need for clarity of the investment environment going forward is, I think, essential, and I think it's very important that you alluded to this.

Not least, we need to acknowledge the fact, and this in a town where epithets about this industry or that industry are very frequent, we need to acknowledge the fact that technology coming out of the energy industry is going to be a big part of our future as well if we're to manage this problem at all successfully. So I think it's important to take stock at a time when we suddenly have three presidential candidates, all of whom are talking about a cap-and-trade future. It's important to take stock of the need that this is going to be something where industry and the public policy community actually has to work together.

SPEAKER: And just one comment that I'll add about deforestation, and just to keep this in perspective, as big a the Amazon is, as our colleague just indicated, right now deforestation is accounting for about 20 percent of greenhouse gas emissions. And so we have to

recognize that this has become as huge issue and a huge problem. And so stopping that practice of deforestation or reversing it is just as important as the other aspects of the emissions abatement that we've been talking about thus fear on this panel.

MR. PASCUAL: And in fairness, but just in fairness, that's not only in Brazil.

SPEAKER: That's not only in Brazil, right.

SPEAKER: It's a (inaudible) all around our globe.

MR. PASCUAL: Right, absolutely. And Indonesia, the two huge places. I mean Brazil and Indonesia are obviously the ones that stand out, but it's something that extends much more broadly.

I'm going to go all the way to the back.

MR. EPPINGER: Charlie Eppinger, soon to be at Brookings but currently with International Resources Group. Picking up on the last point, Carlos, that you and John raised, I think we would be remiss. I hope the Senator, if he's not here, that this gets recorded that we also need to think about in our energy future the one and a half to 1.8, roughly, depending what estimate you look, billion people in the world who have no access to electricity. This picks up on the deforestation because, of course, these people are using scrub brush, whatever residues they have,

which is further accelerating the deforestation problem and obviously contributing to the climate change.

But I would like, for one, to see our foreign policy, and particularly our U.S. assistance policy, pay greater attention to trying to help some of these nations. And I think we can use renewable technologies and others to do that, including giving some jobs back here at home if we can develop some markets.

The second quick point I'd like to make is, you know, most estimates, including the report of the National Petroleum Council, talked about the need for a trillion dollars of investment in energy infrastructure. We need to begin to think what are the greenhouse gas implications of the cement, the steel, and the other products that are going into that, and is there a way to make those production processes more efficient.

And finally, and very quickly, I would like to know any opinion of the panel members on how do we treat the export of American coal in terms of greenhouse gas or putting a carbon tax or a cap-and-trade program?

MR. PASCUAL: Thank you. I'm going to ask if there are any two other quick comments that anybody else would like to make, and then I'll come back to the panel to sum up.

Right over here.

MR. EARLIS: Good morning. Roger Earlis, a Congressional Fellow with Hugh Mobistar's office. Real quickly, I haven't heard much about your thoughts on the pluses and minuses at state energy policy and initiatives, whether it be California and the steaming tension we have right now between the Federal Government and the states, on a whole very positive, or what are those, you know, what are the pluses and minuses?

MR. PASCUAL: That's very helpful. And then just right behind him.

MR. AILES: Thank you. Rick Ailes, Virginia. I just wanted to suggest that maybe a combination approach would be appropriate. In other words, to break the political deadlock, and we are, obviously, going to need more fossil fuel.

In order to get a little bit more production, if the Republicans said to the Democrats we've got a way to reduce conservation now instead of waiting 'til 2020 through a corporate average fuel economy, let's say three or four percent, and would that potentially, you know, break the political deadlock?

I would suggest that ways of doing that would be, obviously, the previously mentioned revenue mutual tax, exempting poor people from the payroll tax, obviously. And even prior to that we're still incentivizing the use of energy. We still have tax deductions to a certain

extent for 6,000 pound vehicles. I think that was brought down from $100,000 down to the current, I think approximately $35,000, and those are not necessary at all.

We also have something that no one has ever talked about in public, I believe, which is travel deductions. We have a standard mileage rate deduction of 50 cents per mile, and all these -- utilities are also deductible, by the way -- and businesses use, I believe, approximately 6 million barrels per day out of the 13 million barrels a day of transportation energy. And it's important to remember that all of that is tax deductible therefore market discounted. So the way to do that is to --

MR. PASCUAL: I'm going to have to jump in and --

MR. AILES: Yeah, sure.

MR. PASCUAL: Those are good comments, and I wish we can go on longer. I'm going to ask my colleague here to just pick up on just one of those topics and add any other comment that you want to make, and we'll close up.

Bill, do you want to start?

DR. ANTHOLIS: Yeah, why don't I start with Charlie Eppinger's question about aid and assistance in developing countries. That is absolutely a 2009, 2010 issue. It's so not a 2008 issue, right. The presidential candidates are not going to want to talk about giving

assistance to India and China to develop and adapt, you know, energy efficient or carbon capture and storage over there, but starting in 2009 people are going to be scrambling all over that because the challenge, once we get past the election, is how to bring India and China into a place where they're willing to talk about climate change in a way that American politicians want to talk about it in the route to international negotiations.

MR. PASCUAL: Jason.

MR. BORDOFF: I know we're wrapping up, so I'll just quickly say, I mean, most of the proposals I've seen for cap-and-trade, you know, depending on where they are in the stream, if they're sort of midstream that's different, but if they're upstream talk about imposing -- having that allowance require- -- emission requirement at the point of extraction of fossil fuels from the ground or importation into the country, and rebates for exportation of fossil fuel or other ways in which it wouldn't be emitted.

So if CCF becomes a reality and you start to put stuff in the ground, you might get rebates for something like that. This raises of the WTO importagement issues that Bill talked about earlier, which are the topic for and, in fact, will be the topic for a whole covering conference which we talk about it for hours alone, so I won't say any more about that.

MR. PASCUAL: In fact, June 5th I think we're having a workshop here at Brookings.

SPEAKER: Ninth. June 9th.

MR. PASCUAL: Ninth, excuse me. June 9th, which will be advertised in our Website for people to have an opportunity to get into that topic in detail.

John?

MR. ELKIND: Just a general comment to try to reframe. I mean, we're talking here, as you said, Carlos, about how to think about radically different approaches to our energy sector. The magic will be to figure out how to do that, and this is a way, in a way of summing up what Jason and others have been talking about. The magic will be to do that in a way that reminds people that there's a simultaneous opportunity for an improvement in quality of life.

SPEAKER: Well, no one's picked on your states question, so let me just say, it's an extremely important point you're making. I don't have time to do it justice. My friend, Ian Voltz who's the Secretary of Environment in the State of Massachusetts, has made the point that states, as a primary delivery vehicle in the United States for a lot of the greenhouse gas productions that are going to be achieved over the next

several years, particularly regulation of public utility companies, or public commissions, that type of thing.

So I think you're making a key point. Watch this issue in Warner-Lieberman and the cap-and-trade bills in particular. There's going to be a lot of discussion of the role of states in cap-and-trade bills in the years ahead.

MR. PASCUAL: I would just close by underscoring both the importance of the Manhattan Project type of urgency that Senator Alexander has brought to this issue, but then the added complexity that this isn't just government taking a technology and applying it; this is something that has to translate into technologies that can be incorporated into how our economy functions, how people live their lives on a day-to-day basis.

And so the incentive structures that are created to make that possible are going to be just as much as part of the package, as critical to the viability of the package as the actual technologies themselves, and that's one of the aspects, I think, that Brookings will continue to focus on as we continue on this dialogue and debate on how to move these issues forward.

Thank you very much for your attention, and for an outstanding discussion we've had over the course of this morning. Thank you.

(Applause)

* * * * *