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Economic, Environmental and Security Risks

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OPENING REMARKS:
U.S. ENERGY POLICY GOALS

Strobe Talbott, President, Brookings Institution
William K. Reilly, Co-Chair, National Commission on Energy Policy
Daniel Yergin, Chairman, Cambridge Energy Research Associates

MILLER REPORTING CO., INC.
735 8th STREET, S.E.
WASHINGTON, D.C. 20003-2802
(202) 546-6666

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P R O C E E D I N G S

MR. TALBOTT: [In progress] -- but also on behalf of the two other co-sponsors of today's event, the National Commission on Energy Policy, which is going to be represented during the course of the day by two of its co-chairmen, Bill Reilly and John Holdren, and its executive director, Jason Grumet, and there are going to be some other members of that Commission here during the course of the day.

The other co-sponsor is the American Enterprise Institute represented by its president, Chris DeMuth, and also Bob Hahn who is going to be here, the executive director of the Brookings AEI Joint Center on Regulatory Policy.

The topic of today's event, global challenges to U.S. energy policy, could hardly be more timely. There is unrest in oil-producing states ranging from Iraq to Venezuela. Congress has been unable to pass an energy bill. The price of oil is up dramatically, and there is, of course, widespread concern about global warming and biodiversity loss as connected to energy consumption and extraction.

So we have got the right set of subjects. We are talking about them at the right time, and we certainly have the right assembly of people to address those subjects.

We are going to have during the course of the day five current and former agency administrators and deputy cabinet secretaries, including the Deputy Secretary of Energy, Kyle McSlarrow, who will be here in the early afternoon.

We also have a former Member of Congress, Phil Sharp, who is here this morning, and Bill Reilly mentioned when we saw Phil arrive that he was always one of the most constructive and substantive people that Bill dealt with in the United States Congress. So we are very glad to have him here.

We have five presidents and directors of thinktanks or research institutions from around town.

We also have over a dozen scholars, including eight from Brookings, and I want to express a word of thanks to two of those in particular, Nigel Purvis and David Sandalow, who are helping to build this institution's capacity in environmental studies to wit this is the first of three conferences we at Brookings are going to be having on the general subject of the environment between now and June.

Nigel and Paul Bledsoe of the Energy Commission conceived of this conference, and many thanks to them and to Josh Busby for all the hard work that went into preparation for today.

The event is going to be simulcast live on the Brookings website and will be viewable for the next year.

So, with that, I think we should get started. Our first two speakers are Bill Reilly, former Administrator of the Environmental Protection Agency and current chairman of the World Wildlife Fund, and then Dan Yergin, president of Cambridge Energy Research Associates, an Pulitzer Prize-winning author, a Brookings trustee, and an old and very dear friend of mine.

Bill, would you please get us started.

MR. REILLY: Thank you, Strobe.

It is very nice to be in a nearly full room on the subject of energy policy. One of the discouraging realities of the times is the degree to which distractions have precluded serious attention I think on the part, certainly, of the broader population and many experts as well to issues of energy and environment and particularly the relationship between the two of them, which is of most concern to me.

I co-chair the National Commission on Energy Policy. We are a bipartisan group of experts developing recommendations to address the major issues facing U.S. energy policy. My co-chairs include John Rowe, chairman and chief executive officer of Excellon Corporation, the large energy company headquartered in Chicago, and the distinguished Harvard professor, John Holdren, former Congressman Phil Sharp.

And I really did say that to Strobe Talbott about Phil. Phil whispered to me, but you dealt with a lot who weren't in Congress. I want to emphasize that I don't consider that compliment, the tallest building in Manhattan, Kansas.

[Laughter.]

MR. REILLY: He is every bit as good as I said to Strobe.

And CIA director, Jim Woolsey. I wonder, is Jim here yet? Jim is speaking later in the day. I happen to pass in my taxi this morning the Saudi Embassy on the way to the meeting, and I am sure that both the Saudis and Jim will take comfort in how close the embassy is to this conference this morning.

Some of you who have read his foreign affairs articles and others will get the point.

[Laughter.]

MR. REILLY: A full list of our group appears in your materials this morning, the program materials.

We are here, I should say, as a commission to listen and to learn from you. We have had several workshops and quite a number of informal consultations with people around this city and around the country issued in these issues.

I am sure that my fellow commissioners here will strive to overcome their natural shyness and diffidence to at least hint about some of their own views, but I do want to make clear that the Commission itself has not at this time taken positions on the salient and controversial issues of the day and doesn't expect to during the political season. We expect to report sometime after the election this year.

The Commission is focused on three central energy challenges: security issues related to energy, including the vulnerability of domestic infrastructure and the increasing U.S. reliance on oil and other fuels from abroad; environmental issues and especially global climate change; ensuring a reliable and affordable supply of energy essential for economic growth and maintaining our quality of life.

One reason the Commission helped organize today's conference is to benefit from the views of outside experts as we begin to write our final recommendations. We expect to release our report in December. So we are not just feeding into the campaigns or the electoral debate, though I would hope that the issues we will discuss today will find their way into the national dialogue during the campaigns.

I should hasten to add that the Commission enjoys the very generous support of the William and Flora Hewlett Foundation, a very substantial major venture

for its president, Paul Brest, former Dean of Stanford Law School, as well as other support from foundations, but the bulk of this support is from Hewlett, which I understand is also a significant benefactor and supporter of Brookings.

You can tell I have spent a certain part of my career raising money, and if they were in the room, I would lay it on with a trowel.

[Laughter.]

MR. REILLY: Well, let me sketch out broadly the formidable array of global challenges facing U.S. energy policy. Each of these issues is a major challenge in and of itself.

First, the United States continues to rely on imported energy. We now import 55 percent of our total for oil from a relatively small group of suppliers. Imports have risen from 37 percent in 1980 and are forecast by the Energy Information Administration to increase to 70 percent by 2025.

Where are these sources? We have been, as a nation and an economy, diversifying, but the Mideast is the largest supplier. We get more than 20 percent of our total oil, both domestic and imported, from there.

This number will rise significantly over the next several decades as other sources become less plentiful.

You need not be a student of world geopolitics to grasp quickly that many of these places have been characterized by a basiotic instability and politically have been unstable, and that the Mideast represents an especially complex challenge, given the threat of terrorism and U.S. military action in the region. You will hear more about that from Jim Woolsey later in the day.

We spent about $600 billion a year on energy, $200 billion for oil, of which $120 billion goes overseas and a healthy chunk of that to the Mideast.

Now, oil is fungible, and the Middle East is the vital swing supplier for the world oil economy and a direct source for America's allies in Europe and Japan. Such interests are strategic and can lead, have led, to blood-for-oil decisions.

At the same time, rapidly developing countries, notably China, are consuming more oil and importing from some of the same sources. China has begun its steady rise as a major new consumer of imported oil with huge consequences for world energy demand. India will follow along later.

The market for oil and increasingly natural gas is a global market. In other words, U.S. energy policy will affect and will be affected by the actions and policies of other countries, including our allies.

The Economist has heralded "The End of the Oil Age." Well, tell that to the Chinese or tell is to Los Angeles.

Second, our economy over the last 30 years or so has become much more energy efficient, and that is good news. In 1970, it took almost 19,000 btu's to general a dollar of gross domestic product. In 2001, it was less than 10,000 btu's per dollar, which is a remarkable achievement. So not all the trends in U.S. energy demand and use are negative and discouraging by any means.

Improvements have come over a time when GDP increased more than 160 percent, energy consumption by more than 40 percent. Vehicle miles driven grew by 150 percent, and population grew about 40 percent, but -- and this is critical -- our

primary mode of transportation, automobiles, is still almost totally relying on oil, more and more of that, of course, as I have said, imported oil.

Our very mobility, in other words, depends on consuming oil in growing amounts until such time as we can develop more efficient vehicles or alternative fuels or some combination.

Third, environmental impacts caused by energy use have been substantial, and none are more complex and vexing than the prospect of global climate change.

Finally, U.S. standing in the world is greatly influenced by our energy decisions. The image many abroad have of us is one of gas guzzlers and unilateralists who walked away from international climate change negotiations. Surveys have shown that most of the world believes that the U.S. invaded Iraq primarily for its oil.

Energy is at the heart of each of these stereotypes. The world's perception of our energy habits and actions has consequences far beyond the energy we use per se.

While addressing this array presents an enormous challenge, we need to define the problems and develop realistic policy alternatives, and we need to do so with a healthy does of humility. I expect Dan Yergin will speak much better to this point.

We have all been struggling to get energy policy right for decades. A changing world with many uncertainties has made this a substantial challenge for a lot of very well-informed experts in energy policy.

Without going into too much detail, something my colleague, Phil Sharp, and others will do later, let me suggest a few general approaches which the U.S. and other countries will need to employ to ensure affordable, reliable energy supplies.

First, I think we have a consensus, something close to it at least, on the Commission. We need to make maximum use of market mechanisms. This will be very distressing to Bob Hahn.

I worked with Bob on the Commission's trading program, the Clean Air Act. So I look forward to hearing him today.

The power of markets must be employed to help make efficient decisions about energy use, about investments, and other matters. This means we need to internalize the cost of the externalities and the price of energy to the extent we can; for example, pricing the economic, military, and diplomatic cost of oil reliance.

Markets will -- they must -- play a key role in finding substitutes for oil if appropriate policy incentives are created. Likewise, markets must play a role in fighting climate change by providing incentives to reduce greenhouse gas emissions.

Second, government and industry technology programs must be strengthened. Energy R&D investment, both public and private, has fallen sharply in the last 10 years in Europe, Japan, and the United States. For a $600-billion industry, not much is spent on energy R&D. U.S. Government spending fell from $6 billion in 1978 to $1 billion in 1997, and private expenditures also fell.

None of the long-term issues can be addressed without deploying at least some new energy technologies and developing a generation of additional technologies. This includes not only new sources like biomass, hydrogen, and others. It also means

increasing energy efficiency and finding ways to make current sources like coal more environmentally acceptable.

Third, these problems require a greater level of global cooperation. Climate change, the science of which John Holdren will be discussing shortly, cannot be solved by any one country. Although given our level of greenhouse gas emissions, the United States is positioned to influence the issue far more than any other country today.

Meeting global energy needs to alleviate poverty in the long run is of direct interest to all nations. Reducing the world's dependence on oil can provide benefits to many. I signal, relative to that, the recent article by Fred Bergsten in Foreign Policy magazine.

The United States must take action domestically on many of these issues regardless of international considerations, but America must also participate fully in global solutions if we are to see tangible and lasting results.

To play a significant role in international deliberations affecting climate change, we must have a more credible and effective policy here at home.

That concludes my remarks. Let me now turn to the "Commanding Heights," whose author is here, the outstanding television series on energy which set records for viewership.

I think, Dan, we need to figure a way to reach the country yet again with something like "Commanding Heights" in this era when the issue is receiving far less attention.

He has been one of the major luminaries in the field of energy policy for as long as I have been following these issues, and at the conclusion of Dan's talk, we are going to take a couple of questions and probably not more than that, given the press of the schedule and the need to move on to the next session.

Dan Yergin.

[Applause.]

MR. YERGIN: Thank you very much, Bill. I am really very pleased to be here and certainly want to thank AEI, Brookings, and the National Commission. This is a very timely and important conference and a very outstanding group of speakers. I am also certainly happy to see so many friends and colleagues here in the audience.

Bill has sketched out the overall framework for the discussion and with a focus on energy and environment, and I am going to pick up on, in a sense, part of those themes and focus on the energy and security questions.

I think it is clear to say that energy security is on the agenda today again. We have had disruptions over the last year that have been very significant. We lost more oil from Venezuela when it went down than from the interruption of supplies from Iraq, and certainly, we have a very tight oil market today, witness current prices, and a tight oil market is vulnerable to shocks and perhaps there is great concern about future shocks near term coming from Venezuela again as well as from other regions.

Iraqi production is still plagued by security questions. Regional and social turmoil continues, of course, to unsettle the Middle East, while global terrorism threatens the entire system.

Consumers are seeing higher prices in their home, heating bills, and certainly, right now, as everybody knows who has pulled into a gas station at the gasoline pump, and I think over the next 2 months, at least through Memorial Day, we are going to see a lot of political turmoil in this country about gasoline prices and energy prices.

Also, as Bill signalled -- and we were recently in China together -- we see China trying to develop its own new concept of energy security as it moves so rapidly away from its traditional self-sufficiency.

As Bill said, if we went back to the 1970's, we would see that we were importing a third of our oil at the time when the crises began. We are really now edging towards 60 percent, and as Bill pointed out, those numbers are going to increase.

This comes at a time when at least we at Cambridge Energy Research Associates look out and see over the next 10 years, world oil demand rising by something on the order of 20 percent. That will happen unless there is real problems in economic growth in the world, and that poses big questions, challenges in terms of supply, big challenges in terms of security.

If I might as a side note say that anybody who is concerned about reducing world poverty and increasing standards of living should recognize that perhaps the biggest single threat to that right now is not what is the amount of money that is spent on foreign aid and so forth, but it is the new protectionism, and if you are looking for something that could be a major setback for

the world economy, that is here and now.

Of course, issues of security, energy security restricted to oil as per the blackout from last August not only in this country, but a series of blackouts around the world pointed out the complexity of the transmission systems that support modern industrial society.

The high natural gas prices, which get even less attention than what is happening in oil, really do point out to the fact that we have a very tight situation, natural gas in this country. I almost am tempted to use the "S" word, "shortage," but we do face a very difficult situation there.

But there are compensating realities, new sources of oil and gas, new technologies for energy production and consumption, new technologies altogether combined with the institutional lessons that have come from previous energy shocks that may help us weather whatever storms are ahead.

Bill talked about the decreasing dollars being spent in energy R&D, but I think we can see we are in a kind of upsurge period in terms of new energy technologies really across the spectrum, and it is something that I tried to follow several years ago.

I chaired a task force for the Department of Energy on energy R&D, and you see it wax and wane, but we are in a period now where there is a lot of commitment coming not only from the public sector, but certainly in a variety of ways from the private sector.

I think also we could say that relations between producers and consumers with some notable exceptions are, for the most part, better than they have been in years past, more based on interdependence and cooperation.

Energy security has also taken on a wider view because it is not just the flow of oil, but it is the security of the entire infrastructure of supply. All of this is accentuated by, in a sense, social and political turmoil combined with this rise in demand that brings us all into focus.

So let me just build a little bit on the framework for thinking about things. America's $11-trillion-plus economy rests on an energy foundation. Oil, natural gas, coal, and nuclear account for about 93 percent of that foundation, and to get the dimensions right, wind and solar, while growing, are less than two-tenths of 1 percent.

Then, on top of that, of course, is that our imports of oil have been rising. The reasons are simple, that demand has been increasing more rapidly than what domestic production can provide, and all of this means that we have a system that is, from time to time, periodically vulnerable to disruptions of one kind or another.

So we are not going to cease importing oil or being dependent upon energy. So our questions become how do we manage such dependence and stabilize supply and how do we ensure that there is sufficient resilience in the system to absorb shocks.

There is no single answer to how the U.S. becomes less vulnerable. I think Bill pointed out something very important that gets lost in the discussion. In fact, on conservation, we have done a lot. There is a lot to do, but we have done a lot.

We use only about half as much oil for every unit of GDP as we did in the 1970's, and a lot of this has been what? It has been the turnover in the capital stock. It has been greater efficiency.

I think stabilizing production, domestic energy production, is also important, and it is particularly acutely brought home by what we are seeing in terms of natural gas.

We are in one of those periods, too. You get these cycles when the world is going to run out of oil, and they started in about 1859 when the first oil well was drilled. In the 1880's, one of the founders of Standard Oil, the successor in fact to John D. Rockefeller, began selling at a very rapid rate his stock in Standard Oil because the engineers had told him that no oil was going to be found outside Pennsylvania. I think he bought it back later, but there is that concern, and it is a very legitimate and important debate.

What I am struck by is that often you get into these periods. After all, it was a fear of shortage of oil after the first world war, which led to taking the three eastern-most provinces of the Turkish empire and putting them together and creating Iraq, one of the big reasons for that.

But what changes is that new areas open up and new technologies, and we see a whole panoply of technologies, what we call DOFF, the digital oil field of the future. Applying those could be major technological breakthroughs. We think it could expand world oil reserves over the next 10 years by about 125 billion barrels. What is that? That is bigger than the current proven reserves of Iraq.

Also, as part of the agenda, of course, is renewables. We see the renewables industry with new vitality. We see particularly with wind, a new commerciality, and of course, longer term, and I would emphasize longer term, hydrogen and the other alternatives.

But that means we are talking those are farther out. The question is what about now, what about the next few years, what about energy security that is critical both for the United States and the rest of the world.

My colleague, Jim Placke, will be talking a little later this morning about some of the particulars of energy security. What I would like to do is just lay out to me what seem to be nine principles of energy security and would be very interested in responses, is this the right list as you all see it, but these are the nine key ones that I think about.

The first one starts with Winston Churchill who converted the British Navy from coal to oil on the eve of the first world war in order to gain speed over the Germany Navy. That led to a problem, no longer reliant on Welsh coal, but rather on Persian oil, and Churchill was challenged on this.

He laid down what I think is still the fundamental principle of energy security. He said, "Safety in oil lies in variety and variety alone. That is diversification," and I think that is the fundamental starting point. We have seen it again, clear with the development of non-OPEC, and the ability to weather the interruption of Iraq, Venezuela, and Nigeria, all at about the same time.

Secondly, I think we have to continue to recognize that there is only one oil market, one that moves about 80 million barrels a day of oil around the world, and U.S. security resides in the stability of that market. It is not practical to consider not being part of that market.

I think the third is the importance of the existence of surge capacity that can replace disrupted supplies. This takes two forms. One is the spare capacity that

some producers will have, and the other is the importance of strategic petroleum reserve in this and other countries. It is an insurance policy against major disruptions and the resulting threat to GDP and, in my view, should not be used as a tool of kind of market management because it will devalue it.

I think a fourth principle to keep in mind is that the oil market is much more flexible than it was in previous years, and that that enables adjustment.

Right now, to give one example, the tight California market. Bill, I think the price out there is $2.19. I think Guy Caruso got beat up a little bit in the hearing the other day. It was part of a hearing on these questions.

Well, right now there are supplies from the East Coast of Canada that are being moved to California to meet that market demand, and I think the lesson Phil Sharp and others will so recognize is that the short-term intervention and controls can be highly counter-productive, hindering the ability to adjust, which is what we have in this flexible market.

Fifth, of course, it is important to build cooperative relations with nations that produce and export energy, understanding the importance to their national revenues, and for them, what counts is security of demand.

Sixth is the importance of the ongoing dialogue and cooperation with other major industrial countries and other consumers, and it is not only the traditional-always CD countries. It is the new globalizers, the countries like China and India.

Seventh, when markets become tight or disruptive, the public's fears rise, and those fears through panic buying can, in extreme, turn into self-fulfilling prophecies. We have seen that before.

Right now, as I say, we are certainly in one of those periods again when it comes to gasoline, and so often, it is hard for people to focus and understanding that it is problems of new regulations, switching regulations, logistics, and, of course, the high price of oil in the crude markets that is driving all of this. I think it is very important, both from the public and private sector, to just try and have good quality information to address this.

Eighth, sometimes we forget it, but a healthy technologically--and I emphasize technologically driven domestic industry is necessary to energy security.

Ninth, fundamental point and I think a fundamental concern of the National Commission is that commitment, that ongoing consistent commitment to R&D and innovation that goes across a broad spectrum and takes into account current and future environmental consideration, and you need a steadiness, not an up-and-down.

Let me say a word about supply. It is interesting to note that, for a long time, it was said Iraq was the second-largest country in terms of reserves. The other day, I saw an article in the newspapers that said third, and it put it after Canada, which by some estimates--by some estimates, it is now the second largest.

It depends how you view the Oil Sands, but with that said, of course, reserves are concentrated in the Middle East, although the Persian Gulf share of world oil production has declined by about 25 percent over the last 20 years as non-OPEC has come into this situation.

But what about the future? What about meeting? How are we going to meet that 20-percent growth in demand?

Well, when we do our numbers, we see the Middle East here, about over this decade increasing somewhat over 7 million barrels a day, but almost even with it, surprisingly, is Russia and the Caspian, reflecting the transformation in the Russian oil industry as well as the development of the Caspian. And somewhat far behind, but not too far behind, is West Africa, another major source of growth of supply.

But, of course, all of those, those are numbers, those are projections, and those of us who do projections know that they get changed by events, and what will be critical is the decisions governments make in terms of what kind of investment environment they have, the decisions that governments make both consciously and inadvertently in terms of the timing of investment. So, a year from now, those numbers may look somewhat different. If you are looking at where is the focus of activity going to be, that is going to be from a global point of view.

And it is being driven by demand. When Bill and I were in China, a couple of months ago, it was very interesting. There was a conference called by the state planning commission, and their issue, their concern was how was China going to manage this transition to being depending upon world markets, having built of so much of what it has done on self-sufficiency, and that it is happening fast.

China is now the third-largest new car market in the world. Last year, 4.4 million cars were sold in China, an increase of 35 percent over 2002. That is where they are in the income stream, electricity demand growing at 15 percent a year, and you found a leadership--I don't know if you carried that away, Bill, but I certainly did--that was almost preoccupied with almost its own notion of an internal energy crisis.

Five or 6 or 7 years ago, if we had read the Foreign Policy, the international affairs magazines, we would have seen people talking about resource wars in Southeast Asia. I think the Chinese have moved in a different direction to try and meet their energy needs through the same kind of global markets that have so benefitted their overall economy.

I want to just talk about two other points. One is a whole new dimension of energy security, which is the development of the liquified natural gas business.

Five years ago, the door seemed to be shut on that industry. The facilities were literally shut. Plans had closed down. Today, we are seeing the emergence of a new global energy business built around natural gas, built around LNG, which will link Asia, Europe, and North America, if not in a single market, in a series of interconnected markets. I think it is leading to kind of a new concept of gas on the move, gas on the high seas that can change directions in response to market questions.

What is driving, what has turned around the gas business to create this? I think there are four things that have happened.

Number one, world gas reserves are as big as oil's, and countries and companies want to figure out how to monetize those, particularly for countries as a source of revenues, but it has been up until now a kind of point-to-point rigid, primarily, Asian business.

You may remember the old ad, the High-Priced Alternative, but no longer. First, costs have come down 30 percent over the last few years. Second is rising demand because natural gas has been the fuel of choice in electric power around the world, not just the United States.

Those of you who follow the U.S. business know that we added 200 megawatts of new capacity in the last 4 or 5 years, almost all of it gas-fired. That is like increasing our total supply of electricity capacity in this country by 25 percent, and this has happened around the world.

Thirdly, governments want to monetize it, and fourth is we have a kind of tight situation in the United States. Our reserve base seems to be we can, more or less, keep it level, but demand is set really to grow.

So we may indeed see a much larger, more flexible global business. There are three big questions. One is finance; how do you pay for it. Secondly is development in the United States, will it go forward in a timely way or not, and the third is what does it means in terms of relations with exporters, creating a new set of mutual interdependence and that will be worked out over time.

The other issue that I just want to mention is this wider dimension of energy security. If you think about it, since the rise of industrial society, the energy system has been a target in warfare.

When the U.S. bombers started attacking the German synthetic fuel plants in the second world war, one of the German generals said at last they have stopped their lunacy and they are doing what counts, but I think from '73 onward, we mainly thought about it in terms of the security of the flow of oil. But now, it is this wider dimension again.

When Osama bin Laden threatens to attack what he calls "the hinges of the American and world economy," he presumably means the critical infrastructures

that run our economies: transportation, communications, IT, finance, and, of course, energy.

Energy is a very big picture in terms of infrastructure. The numbers on every dimension, from pumping stations, gathering plants and terminals, a system to move 11 million barrels a day of oil into the country, 160,000 miles of high-voltage transmission lines, you could go down it.

So this is a focus, and I think people are coming to grips with it, but it is complex because it means private companies. It means Federal Government. It means States and local governments. It means kind of new ways of operating and protecting a system that really wasn't designed to deal with these kind of threats, and I think it is a fruitful question to explore how well we have done, what have we done, what still needs to be done in this area.

I think that there is a question about the cost of it and who pays for it, and I think ultimately, if we are going to build a higher degree of security-into-energy infrastructure, that ultimately will need to be folded into the price of energy. That will be a requirement for enhanced energy security that we require in this new era.

When we look out on energy, both Bill and I and many other people will talk about the trends, which you can see happening. Some things that happen in energy are very clear, and you really can see the trends unfolding. Others come as surprises and only after the fact, and you look at them, you see why they were inevitable, just not clear beforehand.

I began by quoting a former British prime minister, Winston Churchill on the subject of energy security and would like to end by quoting another. Bill

mentioned the "Commanding Heights." When I talked to Margaret Thatcher for that book, which then became a TV show, she said at the very end of it, after a very long discussion in which I asked very few questions--

[Laughter.]

MR. YERGIN: She said, "Remember Thatcher's law." Not being familiar with that axiom, I hesitantly asked her, "What is 'Thatcher's law'?," and she said, "It is the unexpected happens, and you'd better prepare for it."

[Laughter.]

MR. YERGIN: These days, we are very mindful of surprises, whether in the Middle East, Venezuela, Nigeria, or in places that we are not really thinking about today. Yet, it seems to me that Thatcher's law remains a very good principle, indeed an essential one, to keep in mind both now and in the future when it comes to the critical matter of energy security and the challenge of energy in this 21st century.

Thank you.

[Applause.]

MR. TALBOTT: Thank you, Dan. There is a microphone here right now that it took me a while to find.

The schedule doesn't permit too many questions. We are running a little behind, but a couple--I am going to start them off.

I have two questions for you, Dan. One is what ever happened with respect to our expectations from the early 1990's that gas was going to be the environmentally optimal, plentiful source of supply on into the indefinite future, against

which we programmed so many decisions in the Clean Air Act, in energy policy and the rest.

Unless you take too long with that answer, I will ask a follow-up simple one.

[Laughter.]

MR. TALBOTT: Is it in the economic interest of Russia, which you have said is now an emerging major energy producer, oil producer, to sign the Kyoto and ratify the Kyoto Protocol, and why haven't they, if it is?

MR. YERGIN: On the first question, I think gas was plentiful and cheap, and we had this gas bubble that went on. As they call it in the industry, it became eventually known as the "gas sausage" that went on and on, but as I said, we built 200 gigawatts of new electric capacity, almost all of it fired with gas. Demand built in future demand growth.

But in terms of gas, I think starting around 1999-2000, you started to see the maturity of the gas reserve base combined with the fact that a lot of errors are closed off or very slow or difficult to work in, and demand started to run ahead.

It got hidden by the economic downturn, but it has come back again. So we are, in a sense, in a state natural gas today, but without the geopolitical overlay where we were in the early '70s, where we went from being largely self-sufficient in oil to being importing. Also, we are a continental. It is Canada, the U.S., Mexico. Mexico imports 20 percent of its gas from the United States.

MR. TALBOTT: Which is really appalling.

MR. YERGIN: It is really the nature of the political system.

Your second question, we recently had our CERA conference in Houston, and we had Andrei Illarionov, who is the economic advisor to President Putin, and he gave not one, but two speeches on Kyoto and he was very consistent between the two of them, which was arguing why it was not in Russia's interest to sign it.

MR. TALBOTT: Well, he is well known for that point of view, but it has never been clear that he speaks for more than himself. He hasn't, or has he?

MR. YERGIN: Well, I think we will know after the Russian election. A lot of it has to do, I think, with Russia's bargaining with Europe. I think it is very much caught up in that.

MR. TALBOTT: Thank you.

Questions? All the way in the back.

MR. CURTIS: Thank you very much.

I am Mike Curtis with the Department of Energy.

On your nine principles of energy security, one point that was not on the list is the linkage between poverty and energy security, particularly U.S. energy security.

We were talking about 1.6- to 2 billion people in the world who don't have access to electricity. I am just wondering if you could share some of your thoughts about how poverty, lack of economic opportunity, hatred terrorist acts towards the U.S., and I wonder if you could comment on that. Is that an important issue for these principles that you discussed?

MR. YERGIN: Well, I think poverty described on that scale is a major source of instability of which energy is just part of it.

One of the great tests of globalization is, indeed, what does it do about global poverty.

Also, we have seen in the last few years in the bust in the electric power business that backing off, as Bill knows from a commitment to developing and an ability to develop infrastructure, to bring energy supplies to the poorest people. And that is a conundrum for governments as well as international organizations.

I would also go back, that if you look at the record and you look at the success of East Asia, the single most important thing that seems to--look at the growth you are getting in India now that it has decided to integrate and open itself to the world economy. So I would go back to the concern about what I call the new protectionism right now. It is a really urgent question for development.

MR. TALBOTT: One more? Sir.

MR. HERSHEY: I am Bob Hershey. I am a consultant.

Could you comment on oil from Central Asia, particularly what might happen with the Baku Tbilisi Ceyhan pipeline?

MR. YERGIN: The major pipeline, which I guess is supposed to be finished by the middle of 2005 is the Baku Ceyhan pipeline that some people--you know, there has been a long project to get it done, but the problem from Central Asia right from the days that oil was developed there in the 19th century is that it is not located near the high seas.

I think the development of that pipeline is a big contribution to energy security and energy diversification.

I think that if we look beyond, there are two other pipelines that need to be built. One is a Russian pipeline that will go to Myrmansk, and the other is a Russian pipeline that will go to Asia.

The major bottleneck now, one of the major impediments to development of Russian supply is the pipeline bottleneck, and resolving that is going to be really quite important.

MR. TALBOTT: I think we need to clear the platform for the next session.

Thank you, Dan. This could obviously go on with fascination for quite a long time.

[Applause.]

MR. TALBOTT: The president of the American Enterprise Institute, Chris DeMuth, is here, one of our three co-sponsors.

Chris, I turn it over to you.

THE BROOKINGS INSTITUTION

"GLOBAL CHALLENGES FOR U.S. ENERGY POLICY"

Economic, Environmental and Security Risks

[TRANSCRIPT PREPARED FROM AUDIOTAPE RECORDINGS.]

Friday, March 5, 2004

PANEL 1:
GLOBAL ENERGY DEMAND 2004-2050

Moderator:
Chris DeMuth, President, AEI.

Panelist 1-Scenarios for Global Consumption
Guy Caruso, Administrator Energy Information Administration

Panelist 2-Emerging Distribution of Energy Supply
John Felmy, Senior Economist, American Petroleum Institute

THIS IS AN UNCORRECTED TRANSCRIPT.

MR. DeMUTH: The next session is going to build on Dan and Bill's initial talks and provide background for the coming policy and security discussions by going into further detail on future patterns of energy consumption and supply, with a particular emphasis on technology.

The presenters are Guy Caruso of the Energy Information Administration and John Felmy of the American Petroleum Institute, fresh from their starring roles on CBS News last night where they were concerned with rather shorter-range and more specific energy questions than they will be addressing this morning.

Guy Caruso has a long and distinguished career in Federal Government service. He was a senior international energy economist at the CIA and has been for many years at the Department of Energy. President Busy named him the Administrator of the Energy Information Administration in February of 2002.

He has also directed important energy security study projects for the Center for Strategic and International Studies and for the United States Energy Association.

John Felmy began his involvement in the energy sector as a laborer and side-room helper on the Tidewater oil pipeline, the world's first oil pipeline, in Pennsylvania. After a few years of that, he decided he would prefer a desk job into the business and so pursued a college degree and his doctorate in economics at the University of Maryland.

He has held a variety of consulting positions in energy economics. He has been at the American Petroleum Institute for 6 years and has for several years now been the API's chief economist and director of policy analysis and statistics.

We will start with Guy and then go onto John, both our PowerPoint guys. I am going to sit out in the audience, so I can watch the show. After both presentations, the three of us will sit up on stage, have a little conversation among ourselves, and then move to questions and a general discussion.

Guy?

DR. CARUSO: Thank you, Chris, and I thank AEI and Brookings for this invitation at this very important conference. I couldn't help but think as Dan was listing his nine factors how important it is to think in the longer term.

For example, this session is, I think, entitled the outlook to 2050. So John Felmy and I got together, and I decided I would do the part to 2025 and John would do the part after 2025.

Right, John?

[Laughter.]

DR. CARUSO: You can't get fired for stuff that far out.

Yesterday, there was testimony before Senate Energy on what was supposed to be the long-term outlook to 2025, but the key topic was next week's gasoline price. And Mr. Reilly pointed out how gasoline prices in San

Francisco these days are about $2.30. So it is really, as you know, an important political issue.

This morning, I will try to stick with at least my part of it, our long-term outlook which we publish annually for both the U.S.--the Annual Energy Outlook--and then in the global sense, we also put out an international Energy Outlook which comes out in the springtime. So the numbers you will see on the international side are now almost a year old.

I think the key point--and I think Dan said it well--isn't so much the specific numbers. It is the trends, and I think there is general agreement about that because the actual numbers certainly will turn out to be different because the assumptions are so difficult to really be precise about, certainly projecting GDP growth 25 years or population growth or what is going to happen in China. It will be very different than we think right now.

Nevertheless, I think these macroeconomic modeling approaches are really useful for us to be able to at least think of these energy issues that Mr. Reilly pointed out in his opening remarks and Dan elaborated on with respect to security. We do need that kind of systematic thinking, and I think that is really the way I would like to present these numbers today.

The big picture for the U.S. is, indeed, one of growing import dependency, not only for oil, which is the one that we focus on so much, but as Dan pointed out, growing import dependency on natural gas. And I will talk about that in more detail, but a pretty robust growth in energy over the next 25 years, about a 1.5-percent growth, but with domestic petroleum having peaked in the early '70s.

According to some analysts, the natural gas may have begun a peak of its own, even as we speak. We are a bit more optimistic about that, though. We will discuss that, but nevertheless, we will be importing more natural gas in the form of LNG.

In terms of the fossil fuel components, Dan mentioned that 90-or-so percent of our demand is met by them. This just shows that very clearly. Petroleum continues to be the dominant fuel, about 40 percent of our energy market.

Gas, again, was the fastest-growing component in the last 12 to 14 years. Whether that will continue or not is very much up for grabs now because of the increase in price. We now have a bit slower rate of growth for natural gas than we did even a year ago.

You can see that blue line, which was going up pretty steadily, now kinks down a bit and actually comes back to meet coal. That is one of the consequences of higher natural gas prices that we actually in this referenced case, which means policies are frozen and rules and regulations and legislation as of September last year, which, of course, means no carbon restrictions. This could change dramatically with policy changes.

Other areas of interest when one looks at where is the energy going to come from, in our long-term view, we see nuclear growing in terms of its actual production of electricity, but no new nuclear plants being built under current economics, mainly because the capital cost still remains much higher than even natural gas and coal. And the total life cycle costs, even with $5 gas,

still does not bring new nukes into play without either a subsidization or a reduction in cost.

The main gainer from the higher natural gas price in the electric sectors, electric power sector, is coal, if you strictly go by the model results.

Then, renewables, which we certainly encourage by tax--in some cases, tax credits--do grow the fastest, but from a very low base and remain somewhere in that 9-percent share level by non-hydro-renewables by 2025.

On the production side, coal continues to be our largest domestic resource and clearly will continue grow and grow even more than we thought a year ago, given higher natural gas prices.

Petroleum has a little bit of an uplift in the early part of this decade because we had found some fairly large new fields in very deep water in the Gulf of Mexico, and that will stem the decline a bit, but then it resumes again by 2010. The others, I have already referred to.

Here is the point. I think the chart illustrates the point that Dan made, and that is that we are using energy more effectively, efficiently, whatever your terminology. He used the term 50 percent of what it--per a unit of GDP is what it is at the time of the Arab oil embargo. This shows that.

We had a very steep decline in the early part of that post-embargo period. It has kind of leveled off now to where we are improving at the rate of about 1.5 percent per year in terms of our use of energy per dollar of GDP. In a $11-trillion economy, about 7 to 8 percent of that is energy, but that means that with a 3-percent GDP growth projection, which we use, our energy demand growth is 1.5 percent.

Of that 1.5-percent improvement per unit of GDP, our studies--and I think there are others such as MIT that have looked into how do you disaggregate that improvement between energy efficiency or structural strange--in our view, it is about two-thirds of that improvement in the use of energy per unit of GDP is due to structural change, and that is, we move away from a heavy industry, away from the energy-intensive parts of our economy toward a more service-oriented economy. That accounts for a large part of that change, and about one-third of it is I think what we would call energy efficiency through technological development.

Our long-term outlook assumes that that kind of pace of technological development will continue over the next 25 years, and this is the area where there is a considerable amount of uncertainty, as Dan mentioned. Significant breakthroughs in technology can make major differences in that relationship between energy use and GDP.

It is very difficult to model technological breakthroughs. One can say we are going to continue improving how we use energy or how we produce energy at the same rate we have, and that is a fairly safe assumption. Certainly, it can be a lot faster, or in some sectors, it can be slower. So I think that is the one where if you are looking for what can change a lot, that is the area I would focus on, technology, and I think Dan mentioned that.

Looking at it a little bit more sectorally, the big share of the increase over this forecast is in the transportation sector. As you can see, the blue bar started out in 1970, well below industrial use and by 2025 almost is equal to the industrial use of energy in this country.

That reflects one thing I have already mentioned, the less energy intensive components of our economy and to the well-known love affair with the automobile in this country, and of course, the growing income and the mobility not only have the average car or vehicles per family growing over this period, the vehicle miles traveled per vehicle have also grown. So that has been a major factor, and we see that continuing.

One thing we have seen in recent years--and many of you are very familiar with it--is the actual reduction in the miles-per-gallon average per vehicle due to the shifting preference of our consumer towards SUVs and light trucks. That has made a big difference in the growth of the transportation sector. We do see that slowing down a bit as prices rise and it kind of saturates the market.

In the last, at least, 5 years, efficiency continues to improve in vehicles. However, most of the efficiency has been used up in the desire for higher horsepower per vehicle. So that will, we think, slow down, but nevertheless, it is another area where a major change could occur in the petroleum demand sector because 75 percent of petroleum used in this country is in this transportation sector.

On the world oil scene--

DR. CARUSO: [In progress]--expect the straight line, but for the purposes of modeling it, we use this reference case of about $25 to $27 in real terms over the long term, which means we don't really think $35, West Texas Intermediate, where it is today, or $36 today will be sustainable. It will come

down, but probably not to as low as what we have experienced in the past, which was an average price over the last 22 years of $20 to $22.

However, within that band, we certainly expect volatility because of an industry that is operating, as Dan mentioned, almost at capacity, 80 million barrels a day of production. This month, with only about two of unused capacity, most of that is in Saudi Arabia. Clearly, the expectation is for continued volatility.

The story on domestic reliance or dependence on imports is as well known. Net import is 54 percent last year growing to 70 percent, under these assumptions, the already peaked and declining U.S. domestic oil and the growing demand in the transportation sector for oil. These lead to an outlook where we are consuming 29 million barrels a day and only producing about 11 of all forms of liquids by 2025. So we have imports going from 11 million barrels a day to 20 million barrels a day.

This, again, just shows the point I made earlier that in the petroleum sector, most of that growth is in transportation, 75 percent of that, and within the transportation sector, gasoline. And we do see some increase in the amount of diesel use in vehicles during this period.

The industrial sector grows slightly, and this shows the gasoline versus distillate, being mainly diesel fuel and jet fuel growing steadily. So it is a pretty similar picture that we have seen in the transportation sector and the relationship with gasoline and other liquid fuels.

Here is the gas story that Dan referred to in the U.S., and that is growing demand for gas largely--and you can see the steepness of it from where

that "V" is in the red line, going up through the end of the last decade. Almost exclusively the dash for gas in the electric power sector, 90-percent plus of all the electric power generation added in this country in the '90s was combined-cycle gas turbines, and that is continuing, as Dan mentioned, about 200 gigawatts of new capacity just in the last 4 to 5 years.

That will now slow down because we have overbuilt in the electric sector, and demand isn't keeping pace. We had 23 percent to capacity of electric generation in the last 4 years, and demand has only grown 5 percent. So there is going to be a little bit of a catch-up period, but the other point here is the domestic supply won't keep up with this. We are among the optimists in the resources for gas in this country. We see it continuing to grow. Others think that we are already in an inevitable decline.

The National Petroleum Council published a report in September. It said that where we all agree is that whatever the level of that imports we will require in this country, most of it will be in the form of liquified natural gas in the next decade or two because Canada, which was our main supplier of imports during the '90s, has also run into some decline issues with respect to its western production of gas. Therefore, we don't expect Canadian exports of gas to the U.S. to grow much during this time frame.

So most of the increase as shown in the right chart with the large increase in the green bar and almost nothing in the pipeline from Canada is our best assessment, and that depends very much on some of the issues that Dan pointed out about financing, siting, and the security issue of LNG.

The gas demand side of this equation is shown in the black there, the rapid growth in electric generation as I already mentioned. Because of the higher price of gas that is now in our forecast, that tempers toward the period after 2015 as $5 gas favors new units being coal-fired because of the economics of that and their existing rules, regulations, and legislation.

The industrial sector still grows fairly steadily, and that is an issue I think of very legitimate analytical concern, and that is, how much of this $5-per-thousand-cubic-feet-of-gas price will actually cause permanent loss of manufacturing or industrial sector capability in this country by moving offshore.

The National Petroleum Council had a substantial decline in demand as a result of higher prices. Our model doesn't show quite as much of a decline. We have natural gas demand growing from its 23 trillion cubic feet today to 31 in 2025. Others think it won't be that high because of this "demand destruction" factor. I think that is an area where more work needs to be done. We are not certain that even that high price will cause manufacturers to move offshore.

The supply side of this--another way of showing it, the black bottom part of this--shows traditional sources of Gulf of Mexico, Lower 48 conventional gas, conventionally produced gas, is in decline. I think there is almost complete agreement about that. It is just a question of how steep is that decline.

The NPC study says it is steeper than our estimate here. We think that the new supplies of unconventional gas which is gas produced in tight sands, particularly in the Rocky Mountain areas, coalbed methane, and shale gas

will make up a big part of that decline, but, again, we are among the more optimistic about that resource on a resource basis.

The other big domestic supplier is Alaskan gas. There is an abundant supply of gas in the North Slope of Alaska. We believe a pipeline will be built on the strict economics of that gas cost and transportation cost to getting it to the Lower 48.

If it is left to the economics of the market under our model, that gas comes onstream in 2018. The conference energy bill, which was not passed, but debated and continues to be debated, does have some incentives in it that would move that forward as much as 5 years if a price floor were to be included, which is in the latest version being proposed.

But you can see even with a relatively optimistic view of domestic gas, there will need to be substantial growth in LNG imports. They represent 3 percent of our gas supply this year. This outlook has them going to 15 percent. Among others, CERA has even a more bullish view of where LNG will be in the total gas supply by 2025, and a lot depends on where you think some of those other segments shown in this chart will be.

If you are less optimistic about domestic gas and you think we are going to have that much demand, then the only alternative is LNG.

There are two things about the price of natural gas analysis. One is that we think that the $5-per-thousand-cubic-feet gas mark that we have seen now for almost 2 years, which is about a 70-percent increase, by the way, over 2002, we think that will come down as a result of two things.

One, LNG can be brought into this country at a lower price, at a lower cost than that, and therefore, we will provide some competition. You can see that sharp after getting as high, above 5. Our price comes back down as you get to 2010 with the building of new LNG facilities.

In our model, 9 to 12 new LNG regassification plants coming onstream between 2007 and 2025, there are four existing plants now. It would be inadequate to meet the kind of demand I showed in the previous chart. So they will all be expanded, but will need a number of other new plants. There are some issues there as to whether they will come on in a timely fashion, and that would change that price curve.

The other thing that would change it is the impact of technology on developing the existing resource base of gas in this country. A more rapid improvement in technology would probably mean lower prices. A slower technology would mean higher prices, but in any case, we see natural gas prices increasing, again, after that 2010, the dip-down period toward 2010. So it goes down and then back up again.

Now let me just quickly put this in the context of the world. On the world side, our view is that we have got rapid growth in energy consumption on a global basis, and to reiterate Dan's point, much of it is in the developing world, much of which is in developing Asia, about a 60-percent growth in total in energy demand on a world basis. Again, much of that is in the fossil fuels, as natural gas is also the favorite fuel in many of the developing countries as they move towards further electrification, but oil in the transportation sector--and Dan mentioned China--where is it going to come from on the security side?

The demand is largely in the developing countries, and we see OPEC growing in its importance in our outlook.

Dan mentioned 10-million-barrel-a-day growth, CERA's outlook for OPEC demand in the next 20 years. We would see at least that in the next 10 years and even more by 2025 with OPEC, I think, in this outlook, about something like 50 million barrels a day out of a total world demand of over 115. That is because, as Dan mentioned, that is where the reserves are, as this chart shows.

The only point on gas in this is that it is not only the U.S. that has made natural gas the fuel of choice. It is many of our friends and allies in OECD and of growing importance in the developing country.

Where are the reserves? The major reserve countries on gas are Iran, Russia, Middle East, and former Soviet Union. The LNG will come from those countries, plus others such as Algeria, Venezuela, Nigeria, and Trinidad.

Mr. Reilly pointed out the critical importance of the relationship between energy and environment, and this kind of outlook with such dominance of fossil fuels means growing carbon emissions. That, of course, is an important issue not only for today's discussions, but for looking at policy questions and dealing with the issues that Dan raised and I think John and I will raise by our fundamental. So I think the summary is fairly clear. I think this will be available to everyone. So I don't have to repeat this.

I know I have taken a little more time than I thought. So thank you, once again, for your attention and, Chris, for your invitation.

[Applause.]

DR. FELMY: Good morning, everyone. Thank you very much for the opportunity to present some of API's views on energy policy. This is a very important event.

The National Commission on Energy Policy is an important organization, and I laud them for moving forward in a very balanced way in terms of developing an energy policy that we think is important and will help American consumers.

Let me start by saying, first of all, I want to thank you for inviting me to speak on something other than gasoline prices.

As Guy mentioned, the price of gasoline in California and Nevada hit records yesterday, were a couple cents away from a record for national averages, and so the number of phone calls that I get on an average increases pretty dramatically right now. So I am happy not to speak to that issue.

What I will do is, first of all, just reiterate some points that both Guy and Dan have made. They pretty much covered most of my slides. So what I will focus on is the policy issues, the concerns that we have, and I will also talk to a couple of what I consider important points, such as climate and regulatory issues that I think are important, as we move forward with developing a rational energy policy.

I put this title up because virtually, once a week, I get a call from some reporter saying, "When are we running out of oil?," and it is usually from some conference or other around the world. My answer as an economist is, firmly, "Never." It is a question of what the price will be.

So, going forward, let's look at where we stand, first of all, in terms of the energy situation, and this is pretty much the same data that Guy has put up, but I have reconfigured it a little bit.

This shows the shares of energy currently used in the U.S. right now, where the dominant share is petroleum. It is going to continue to be that way. Natural gas is second, and it is a fairly constant share over the next 25 years, the same with coal and nuclear.

Renewables continue to be a small share of the total energy supplies, and that is important--and I will break this out in a little more detail--and that is because of their cost. Until we reduce the cost of renewable energy, they are going to continue to play a smaller role and, indeed, a niche role, but an important role.

If we break out renewable energy itself, these are the components that you have in terms of renewables. Unfortunately, I notice that hydropower, which is the largest, the 2.85 percent--dropped off of my Excel spreadsheet. So, at the bottom, you can imagine 2.85 percent.

But if you take a look, hydro is the largest of renewables, followed by wood and waste, both residential and commercial. We have got a large amount of municipal solid waste, MSW.

Ethanol is projected to grow significantly, whether or not we adopt the renewables fuel standards or even just under current policy.

Then, if you look at the darlings of renewable energy, which is wind, solar, and geothermal, those other ones, for the most part, with the exception of ethanol, very few people are advocating increasing dramatically,

not big dams, not a large expansion of wood, but if you look at the sources of renewables that everybody thinks of, you are talking about less than 0.5 percent of our energy.

So, even if you increase that energy source by a thousand percent, you get to 5 percent. So renewables will continue to be a small role until we develop the technology to be able to reduce the cost, and so that is an important message that we have got to look at going forward.

If you look at EIA's forecast by 2025, you can see that, indeed, they do grow as a share, as you can see from the previous two slides, but they still remain a small share. This is about a 52-percent increase over 2025.

So an important point of energy policy has to be we have to take this reality into account. Otherwise, we are being disingenuous with the American public in terms of what can actually supply secure sources of energy, cost-effective and reliable and affordable energy.

Now, this is the world energy consumption chart that is similar to those pie charts that they had, but I just also discovered that I have "2020" instead of "2025," but you can see the message is here. Both for the world and for the U.S., you have the predominant share of energy is going to be supplied by petroleum, natural gas, coal, nuclear, and then you have an important role for renewables as you go forward in terms of what they can play in the world's supply of energy.

This is a slide courtesy of Exxon Mobile that breaks out these sources in a little different way, so that you can see how the conventional sources of energy stack up over the next, therefore, accounts for 2020, and how

you see even significant increases in energy for wind and solar, they still remain a small share of energy.

That is important because, for the world outside the U.S., renewables can, indeed, play a very important role, especially if you have areas that are off the grid because the cost of building the grid there would certainly be prohibitive. So renewable sources of energy can play a very important role.

Indeed, in the U.S., renewables can play an important role if we get the prices right. My favorite example is in the case of solar. If you have peak-load pricing, time-of-day pricing, it makes solar much more attractive.

In other words, for example, in Montgomery County, where I live, I pay about 25 cents a kilowatt at peak. Well, as the cost of solar comes down, that makes it fairly competitive at some point, probably in the not-too-distant future. So it is the combination of those things that are going to be important in terms of how we look at what our energy policy should be.

Where is the source of demand? This is pretty much consistent with what Guy has put up, where you see strong increases in demand outside of the OECD, the rest of the world, Latin America, Asia Pacific, and most of that demand is going to be for transport. That is because, as was mentioned, 4 million new cars being sold in China will generate a lot more demand for petroleum products as a result of that.

So we have got this that virtually everyone agrees with in terms of where the demand is going to be. It also means we are going to have a massive amount of supply growth needed.

Going forward, it is going to have to be a lot from OPEC, a lot from non-OPEC sources, and so what we are going to see is kind of a separation between where the demand growth is versus where the supply growth is, and that is characterized by this, where you can see the United States as a net importer of energy.

Right now, we import 55 to 60 percent of our petroleum, 15 percent of our gas, a couple percent of electricity, and that is going to all grow. From 26 to 30 percent of our supplies will be imported, but we have got large sources of energy, both oil and natural gas--and this is just for oil--concentrated in like the former Soviet Union and Eastern Europe and, of course, in the Middle East for both oil and gas.

So what that creates is this logistical issue of getting secure sources of supply moved from where they are produced to where they are consumed, and that is going to be a challenge.

So now what do we recommend in terms of going forward? Well, briefly, I am going to say that economy will play a very, very important role. We can expect it to change dramatically. Just the technological development that we have had in, for example, deep-water drilling over the last decade is incredible in terms of being able to find 10 billion barrels of oil in the Gulf that we didn't know existed before. So we will be able to develop new technology for production and new technology for consumption.

Consistent with the NCP's principles, we believe in markets, that they should play a fundamental role in terms of flexibility and in terms of efficiency in market discipline.

We also believe as part of that, that oil is going to continue for a while as the main source of energy, no matter what you think. As was mentioned, they probably talked about running out of oil since 1859.

One of the favorite quotes I have was in 1874, a geologist from Pennsylvania said we were going to run out in 10 years, and that was just using it for kerosene, without even motor gasoline.

So, over the last 150-odd years, we found more oil than we consumed. We build our reserves up continually. So is the end of oil in sight? Not now. At some point in the future, it is entirely possible that we will see complete declines through exploration and so on, but at this point, oil will continue to play a very important role for the foreseeable future. So we shouldn't try to phase it out earlier than makes sense as long as we need it.

Finally, running out, as I said, is not likely. Now, there has been quite a bit of controversy over the past couple of months over running out of oil. There was an announcement by one company in terms of reserve changes, which precipitated a whole lot of questions about, well, is the oil really there, and the answer is yes, it is still there.

There are some accounting issues and so on, but the oil is still there. Then, that was followed by the debate between Matt Simmons and Aramco in terms of is it a Saudi source of oil supply coming in that is going to be running out.

In terms of looking at the debate that went on between those two folks, I would say that Matt puts together a very powerful statement. He has done a tremendous job in assembling a lot of data and so on, but if I compare

what his statements are versus what the Aramco folks have put together, on a balance I would say the evidence supports them. So we are not running out of oil in the near future, but we do need to think about what our resource needs are going to be going forward.

In terms of developing additional supply, as I mentioned, we are going to need a lot more no-OPEC supplies, but those are moving into challenging frontier areas, such as Kazakhstan and so on, deep water where we are drilling in thousands of feet of water.

Gulf OPEC, as Guy mentioned needs to increase, basically double their capacity to be able to meet those needs, and the capital needs are enormous, not "enermous."

[Laughter.]

DR. FELMY: When you do these things at night, spell-check doesn't always work, anyway. Spell-check is, I think, a tool of the devil because you can get yourself in a lot of trouble with it, anyway. But I didn't use it there.

So, anyway, looking at the IEA's projections of demand for capital investment, we are talking about trillions of dollars that is going to be needed to bring all sources of energy supply going forward for consumers.

To get this, we need policies that promote free investment and trade. That is essential. We don't need the types of policies that restrict activities across borders.

We need to really make an accurate depiction of resource development. There is a lot of information that floats around that says uniform-only resource development for countries is bad. We know that is not true.

Certainly, there have been problems, but we know that there are benefits from it, and we have got to have a realistic assessment of what it will be.

We have got to reconcile the notion that a lot of folks are opposed to these types of developments everywhere. They fit in, in the United States. They fit in the world, but development against some of these resources will continue to be opposed.

I will close in terms of overall policy looking forward for long-term energy supplies. Just as in the movie, "The Graduate," I think the statement--but I couldn't check it last night because my Internet connection crashed, but it was "I have one word for you, young man: plastics." Well, I have one word for you, hydrates.

Methane hydrates are potentially the resource of the next millennium. If you look in the United States alone, the USGS estimates that we have 320-thousand-trillion cubic feet of methane hydrates in the United States in terms of undiscovered deposits, but we don't have the technology available to develop them yet.

But if you take a look in terms of fossil fuels in the United States, we consume about 80-trillion-feet equivalent of natural gas of hydrates. So this is potentially a resource that is 4,000 years of energy, a millennia of energy. So that is the long-term thing, but now let me turn to the major elephant in the room in terms of what is going on with policy, and it is climate change.

In my opinion as an economist and I think based on studying solar activity for the last 18 years, the climate science has clearly not settled.

Many argue that it is, but in the slides that I will show you, I will make my analysis for why climate science is not settled.

If you look at solar activity and temperature for the last 150 years, you see a lot of movement up and down, but even in a cursory examination, you can see that solar activity has increased dramatically over the last century.

In fact, we probably had a thousand-year peak of solar activity in the late '50s, and on balance, over the average of a year of the last century, we had higher solar activity than we probably had over a thousand years.

If you take and try to smooth this out and look at how average temperature and average solar activity have moved over the last century, this is what you get. The correlation there is .97.

Now, I don't know how you can possibly say that science is settled when you have this type of correlation between solar activity and temperature. If you look back over the last 300 years, how has temperature and solar activity moved? Basically, they were lock step in the last period for which we have data.

In fact, you can see that if you go back through the beginning of solid solar activity, you have much lower levels of solar activity going back a couple hundred years ago than you have had in this century. So it is clear, solar activity is dramatically higher.

Finally, on this point, irrespective of how you want to argue the causality, this is how solar activity has increased over the last century versus carbon. Carbon is yellow, solar on the top, and temperature in the middle.

From an economist's perspective, it means that when you have two series moving together like this, you have got your data and you really can't explain or attribute in a statistical sense a share of impact from one versus the other. So it is clear the science of climate is not settled, but the economic impacts of some policies like Kyoto and potentially McCain-Lieberman policies are, and they are extremely negative for the U.S. economy or the world economies.

So, on balance, we recommend that going forward, even if the science is not settled, it is not an excuse for inaction. In fact, our industry is focusing very much on reducing our emissions and improving our technology and dramatically improving our efficiency in those areas. That is what we should be doing, but just as if the science isn't certain, it is also not an excuse for doing bad policies. So we need to look at that.

Finally, the last thing I will address is regulatory policy. As was mentioned in gasoline markets, this is a case of regulatory policy run amuck.

We have 18 different types of gasoline in the United States, and many of the problems in California right now are attributed to the unique type of fuels that they have there that aren't used anywhere else. So, as we go forward in terms of developing an energy policy, we need to be conscious of unintended consequences because this clearly is a case where layers of Federal policy, State policy, and local policy have created what is simply a mess of gasoline regulations that really accentuates the boom and bust that we have had in those prices for the last 4 years.

So, with that, I will close and thank you, and I will be happy to answer any questions later.

[Applause.]

MR. DeMUTH: We have just a couple of minutes. So what I want to do is see if, Guy and John, you have any remarks to make on each other's presentations. Otherwise, I am going to move immediately to questions and comments from the group.

DR. FELMY: Well, since I used Guy's statistics, I am not going to criticize them.

DR. CARUSO: John raised hydrates, and our geologists are very optimistic about hydrates in the post-2030 world. It is an enormous resource.

MR. DeMUTH: Okay. Yes, sir. Please wait for the microphone, introduce yourself briefly, and then ask your question.

MR. : Yes. My name is Gru Swami, Energy Environment Security Initiative in Colorado.

I hadn't heard anything about hydrogen. Is that a resounding vote of confidence on the hydrogen policy of the administration?

DR. CARUSO: Our model, as I pointed out, assumes existing policies, rules, regulations, and programs as of September of last year when we did the latest long-term outlook.

Based on what was in place then and the kind of programs that are available now, the model does not see any significant amount of hydrogen penetration to the energy economy by 2025.

MR. DeMUTH: John?

DR. FELMY: Our companies are all working hard on hydrogen fuel cells-type issues.

The issue with hydrogen is going to be how do you get it there, how do you manufacture it, how do you deliver it to consumers, and my personal opinion is that it is going to be a competition between the pure forms of hydrogen and some type of hydrocarbon which uses an on-board reformer to be able to power-generate the hydron on board and then power the fuel cell.

That is a significant advantage in that the infrastructure to deliver that product is already in place. We have got 167-or-so gasoline stations, pipelines, things like that to deliver the hydrocarbon or perhaps natural gas as an alternative, and then you can reform it on board.

We would have to make a massive infrastructure investment in pure hydrogen pipelines or transportation devices and so on, but it is a tremendous opportunity in terms of reduced emissions and efficiency.

MR. DeMUTH: Yes, sir. This gentleman here.

MR. : Following up on that last question, we have technologies in existence today which are under improvement, certainly within a few years. We could have advanced diesel engines which are now getting 50, 55, 60, on the highway, miles per gallon. In conjunction with a hybrid electric drive train, we could see cars getting 100 to 120 miles per gallon, conceivably, but American society has not been willing, either individually in the marketplace or collectively through the political process, to pay the cost of that, which would be 10- to $20,000 incremental cost of the vehicle, a good deal of which would be recovered in fuel savings over the life of the vehicle.

That being the case, what reason do we have to believe that Americans are going to be willing to pay the $100,000 or so that hydrogen fuel cell vehicle prices may get down to, if they work at all, and isn't this whole notion that there is going to be a hydrogen economy 10 or 15 years from now, isn't that a decoy? Isn't that counterproductive to making real progress in energy policy in the interim?

DR. FELMY: Well, my perspective on that is clearly the diesel hybrid technology could play a very important role.

The efficiency in terms of well to wheels for that technology can be virtually identical to the optimal hydrogen fuel cell drive on that, but both need technological development.

I am not an automotive engineer to be qualified to say it is 20 years from now or 30 years from now, but I will say that it is important that the promotion of these types of technologies not be biased in any sense, that it is the marketplace that plays the role.

DR. CARUSO: We have some penetration of the advanced technology, diesel engine, in our outlook, but it is relatively small, largely because of consumer preference, as you indicated.

On the hydrogen, if I could step out of my EIA role, I think the DOE's view is that that is an appropriate role for a government to get into, in this case, hydrogen when it is basic research and development, to try to move it along towards a commercialization.

It is clear that we have a long, long way to go to bring that cost down, which is why I said there is no hydrogen in our 2025 forecast strictly because of the economics that you referred to.

MR. DeMUTH: Reed?

MR. : I am Reed Detchen [ph] with the Energy Future Coalition. I have a question for John Felmy.

Given that you foresee, and I think everybody foresees, continued increases in demand for oil--and in fact, the bigger problem is meeting the demand--setting aside sort of macroeconomic concerns, why would it be a concern to the oil industry or the oil and gas industry whether or not there is some sort of financial penalty placed on carbon? It seems that that might dampen demand in a way that would make it easier for you to respond to it.

DR. FELMY: Well, it is fundamental economics.

Imposing mandates such as restricting carbon, when I feel that they are not justified in terms of--based on sound science, it is an extremely negative--it will impose extreme negative impacts on the economy from a broad sense.

MR. : But in terms of the oil and gas industry itself, what would be the negative impacts?

DR. FELMY: Well, of course, if you impose carbon controls on all energy, then petroleum demand will suffer because you are raising the relative prices of that because of these others, other lower carbon fuels.

MR. : And how would that work in transportation?

DR. FELMY: Well, it would raise the cost, which, of course, will affect the demand, irrespective of competition. It could promote natural gas vehicles as an alternative to it, which from our industry's perspective is fine because we produce both oil and gas.

MR. : So what is the problem?

DR. FELMY: Well, the problem is that it is bad policy from an economic policy. It is not justified.

MR. : But from the oil and gas industry's perspective, financial economic perspective, what is the problem?

DR. FELMY: Well, the problem is that it is bad overall economic policy, and we as an industry are not going to embrace a bad economic policy, irrespective of the individual impacts on our industry.

MR. DeMUTH: Guy, do you want to give the administration's position on a carbon tax?

DR. CARUSO: We are against it.

[Laughter.]

MR. DeMUTH: This gentleman right here.

MR. HOLDREN: I am John Holdren. I am going to get my chance this afternoon, but I am afraid that the same people might not be in the room, and in particular, I am worried that Dr. Felmy might not be in the room.

DR. FELMY: I'm sorry. I won't be.

MR. HOLDREN: So I want to make an observation on his solar theory of climate change, which is that your theory is not sound science.

When you look at the correlation between solar output and temperature change, you have to be worried not only about the trend, but you have to look at the amplitude, and the amplitude of the solar change is not remotely sufficient to account for the observations.

Basically, the magnitude of the solar forcing, by the best estimates of the scientific community, are five times smaller than the magnitude of the CO2 forcing and 10 times smaller than the magnitude of greenhouse gases and absorbing particles altogether. So it just ain't remotely there. That is why the National Academy of Sciences rejects your view. That is why the Intergovernmental Panel on Climate Change rejects your view. That is why the American Geophysical Union rejects your view.

I will be more interested in your views on what is driving climate cycles when you get more interested in my views on what drive economic cycles.

Thank you.

[Applause.]

MR. DeMUTH: John?

DR. FELMY: I respect your opinion on that, but what we also say is that 20 years ago, nobody felt that solar had any impact at all. Now that is dramatically different. It has increased significantly as a result of scientists finally acknowledging--acknowledging what they don't know or understand, and that is an important component.

If you look at those trends, you have got to acknowledge what we don't know. I am not saying the science one way or the other. I am just saying

there is sufficient doubt in that over hundreds of years to show that there is a correlation there.

MR. HOLDREN: I wish you were going to be here this afternoon.

DR. FELMY: I would love to, but I can't.

MR. DeMUTH: We have time for one more question, and then we are going to conclude this panel.

Well, this gentleman has already asked a question, so behind him.

MR. : Hi. I am Paul Lottner [ph] from American University. A follow-up question, really.

What would it take for skeptics of climate change to open to another position? The Intergovernmental Panel on Climate Change, the National Academy of Sciences and so forth, what we have heard--what would it take--what is the kind of evidence as you weigh this out? As long as, it seems to me, the science of climate change is a black hole, it is infinitely complex and so forth, and there is always going to be some scientific uncertainty, but what is the level of confidence that someone like you or the industry would accept to shift their perception on this issue?

DR. FELMY: Personally, I have looked at all of these documents. We have reviewed them, and we find deep flaws.

If you look at the whole explanation that I have seen, that, oh, well, you know, solar impacted the first half of the century, but it really didn't have a big impact on the second half of the century, if you look at my charts,

you don't see anything like that. So I don't know how they come to that conclusion.

Fundamentally, the issue of uncertainty is important in that it means you need to be cautious. It means that you need to do things that makes sense, which is reducing emissions, improving technology, and moving forward, and that is what the industry is doing.

We have made massive efforts in terms of quantifying our emissions, in terms of reducing our emissions, in terms of improving our efficiency, and that is what one should do that is prudent.

On the other side, if there is an uncertainty, it is not an excuse for doing something that is bad economic policy, and that is my point in this, not whether or not you will ever accept the certainty of the science or whatever.

You could just as easily have seen solar activity turn down over the next century, and we would be moving into an ice age. Well, then, if you would have adopted policies which would have destroyed our energy system, you would have done the wrong policy. So the key thing is to use caution going forward in terms of what is the justification for doing activities that make sense and not doing activities that don't make sense.

MR. DeMUTH: We are going to take a break of 8 to 10 minutes for coffee and stretching our legs.

The next session which is on energy geopolitics will be chaired by James Steinberg, director of Foreign Policy Studies at Brookings.

We will reconvene a minute or two after 10:30. Thank you very much.

THE BROOKINGS INSTITUTION

"GLOBAL CHALLENGES FOR U.S. ENERGY POLICY"

Economic, Environmental and Security Risks

Friday, March 5, 2004

[TRANSCRIPT PREPARED FROM AUDIOTAPE RECORDINGS.]

PANEL 2:
ENERGY GEOPOLITICS: WHAT ARE THE SECURITY
AND ECONOMIC RISKS OF EXTERNAL ENERGY DEPENDENCE?

Moderator:
James Steinberg, Vice President, Foreign Policy Studies, Brookings

Panelist 1-Strategic Implications, United States Rising Energy Consumption
R. James Woolsey, National Commission on Energy Policy

Panelist 2: Diversity of Fuel Mix and Diversityof Suppliers
Fiona Hill, Senior Fellow, Brookings

Panelist 3: Heightening U.S. Energy Security
James A. Placke, Senior Associate, Cambridge Energy Research Associates and Nonresident Senior Fellow, Brookings

THIS IS AN UNCORRECTED TRANSCRIPT.

MR. STEINBERG: Let's get started. The surest way to get people to come in is to actually get the program going. So I will do that.

Welcome to our next panel on global challenges for U.S. energy policy. We have a very distinguished panel which we discovered almost could be subtitled "The Panel of Jim's," but we are going to have to rename Fiona, "Jim Hill."

There are a number of analysts here at Brookings on the foreign policy studies side who have been making the argument over the last several years that we are moving from an age of geopolitics to global politics, in an era where because of the nature of globalization and trans-national threats that geography is becoming less important as a part of national security strategy, and we have to think in new terms.

But there is certainly one area where geography still matters, and that is in the area of energy policy, particularly in the area of fossil fuels. Hard-to-move oil reserves and who sits on top of them still is a very important fact of life. So it is appropriate that we have an opportunity as part of this overall discussion to look at the economic and security dimensions of geography and how the politics of suppliers and producers affect some of the choices in front of us.

This was obviously a very important topic and a very familiar topic in the 1970's. We have a lot of debate about these kinds of issues and the relationship between energy policy and national security policy, but it pretty

much dropped out of the conversation in the '80s and mostly the '90s. Yet, we have seen a dramatic resurgence of the topic for a variety of reasons.

The first, of course--and our panelists will speak to this at length--are the changes in the Middle East and the fact that there is dramatic upheaval going on in the countries that are sitting on some of the largest reserves in the world, obviously dramatic changes in Iraq, but also political forces and potential forces of change throughout the Gulf and the region.

Second, we have had a set of events in Russia which have dramatically changed the energy equation, both in terms of the internal dynamics of Russia, its economic system, its political system evolving over the last decade, and its relationship to the rest of the world changing very dramatically, Russia becoming more integrated politically and economically and, thus, its role as an energy supplier, playing a very different role than when it lived in the insular world of the Soviet Union and the Warsaw Pact.

We have seen China emerge to the world stage not primarily as a producer, but rather as an increasingly important source of demand and its own interests as a consumer of energy as it begins to play its own foreign policy and national security strategy increasingly with an eye to its energy needs.

We have seen the introduction of politics into the equation in Venezuela, even in the last couple of days seen very dramatically the potential of the energy card being played by President Chavez, and even in Africa, we see how politics, once again, affect the energy equation in Angola, Nigeria, and elsewhere.

So we have a very distinguished panel to begin to go into some of the depths of these complex equations, and as I said, only several of them are called "Jim."

We will begin with Jim Woolsey, well known to all of us, a good friend and former colleague, former director of Central Intelligence, served in a variety of capacities and--[audio break].

[Side A of Audiotape 2 of 4 begins.]

MR. STEINBERG: [in progress]-- through the administration on national security policy.

We will then next turn to Fiona Hill, a Senior Fellow here, who has done considerable work, along with Cliff Gotti, on Russia's energy policy in Central Asia.

Finally, a semi-member of Brookings, Jim Placke, a Nonresident Senior Fellow here, who has had a very distinguished career in the Foreign Service. He was a Foreign Service officer for almost 30 years--is that right, Jim?--including Deputy Assistant Secretary of State for Near Eastern Affairs and a true expert on the intersection of energy policy and politics, and Jim is an associate now with CERA and Dan Yergin.

So let's begin with Jim. I have a feeling we are going to have a little bit of energy in life to this discussion as we hear the different perspectives on how national security politics and energy intersect in the 21st century.

MR. WOOLSEY: Thanks, Jim.

I was honored when Jim asked me to be with you all today, but to tell you the truth, until I went straight a couple of years ago and went out to

Booz-Allen, I practiced law as a Washington lawyer for 22 years and I spent some time in the CIA in the Clinton administration. So I am actually pretty well honored to be invited into any polite company for any purposes whatsoever.

[Laughter.]

MR. WOOLSEY: I want to say just a few words about what I think the problem is. I summarized this in a piece called "Destroying the Oil Weapon" in commentary a year ago, last September, but generally speaking, I think there are two aspects to the problem our oil use poses.

One derives from issues that you have talked about, and I won't talk about further this morning, in other contexts having to do with issues related to pollution and global warming. You might call those malignant effects because nobody is planning them. Nobody is planning to sink Bangladesh beneath the waves by driving SUVs, but we may be doing that. Those are problems we need to deal with, and they are, in part, caused by oil use, by fossil fuel use, and they are major issues.

I want to focus on another type of problem, which I would call, rather than malignant, malevolent; that is, the potential use of oil as a weapon to affect our security and our behavior.

This deserves from the fact that the cheapest place in the world to produce oil is the Middle East, and if the constitution or basic document being adopted and signed in Iraq today leads Iraq toward being a government under law and moving toward democracy, then we will have one Arab democracy, but as of today, we have two democracies in the Middle East, Israel and Turkey, and

the other states vary between being pathological predators and vulnerable autocracies.

This is not a good mix. It is particularly not a good mix when such a volatile, in price terms, life blood of modern economy as oil is most cheaply produced there.

Yes, there are other parts of the world where at $30 a barrel or so, or maybe even $25, people will be able to make a profit, like Russia, but nonetheless, as India and China come online with their increased demands and growth of a middle class and more vehicles and the like in years to come, even with Iraq coming online, the people whose judgment I most value on these issues I think would suggest that we are likely to see a very substantial increase in demand for oil probably not matched by an increased supply.

Much of the supply will continue to come from parts of the world and from countries such as Saudi Arabia and Iran, at least at present, that are volatile, that are themselves in a region and operating as governments in such a way that terrorist interference, for example, with Saudi production or a coup, all of these things are possible.

We have had three oil spikes since the early '70s, and these can be also done intentionally, either price depressions or spikes, and they can be done at the present writing because of its control of such a substantial share of the world's swing production by decision of the Saudi government itself.

Now, Saudi Arabia is a complex place, and I believe Crown Prince Abdullah, currently managing the affairs of the ailing King Fahd, probably would take the kingdom if he were free to do so in some reformist

directions. I don't want to exaggerate that because I think they would be small and halting. They are small and halting, but that is not the end of the matter.

He is 80 years old. One of his potential, I would say, current rivals and one potential successor for King Fahd would be Prince Nayef of Sudairi, currently the head of the interior ministry, and his view of the world can best be summed up by the fact that his continuing public position is that the Jews did 9/11.

Prince Nayef as an interior minister is a very powerful man, in a position possibly to be a strong contender to be the next King of Saudi Arabia, and on top of that, we have, of course, the possibility of something like the scenario that opens Bob Baer's book, "Sleeping with the Devil," crashing a fully loaded 747 into the sulfur, clearing towers up at the northeastern part of Saudi Arabia, not far from Ra's al Khafji, taking millions of barrels offline of production for many months.

All of the tumult, indeed, and all of the uncertainty of this part of the world sits very heavily on the oil market.

Now, I don't think the problem is resolved by the United States buying less oil from the Middle East and other people buying more oil from the Middle East. That is a particularly stupid solution. The world is one oil market for a first approximation, and I don't really think solutions that point toward changing the pattern of oil consumption in that way deserve the time of day.

I also believe that since the problem is a worldwide economy that is hostage to the possibility of substantial increases or big increases in oil

production, one really has to focus on our overall use and our American leadership in the world technologically in being able to deal with that.

Let me tick off just a few things and then turn it over to the other members of the panel.

I think it is ridiculous to put the emphasis for vehicles that would use substantially less oil on the hydrogen economy and fuel cells. That is an interesting technology. It is worth spending some time and effort on, but if the fuel cells reform on board and you can pump gasoline at the station, they are going to be very large and expensive fuel cells. If they reform at the station, you have a [inaudible] problem, who goes first, the energy companies reconstituting all of the filling stations in the country, so that they can pump hydrogen or the automobile companies producing fuel-cell cars.

Far more sensible is moving to give encouragement for things like hybrid gasoline, electric vehicles, and some alternative fuels that can be used in the existing infrastructure, such as diesel from Fischer-Trope, from coal gassification, such as diesel from processes such as thermal depolymerization that ConAgra is now using in Missouri to process the refuse from a turkey processing plant, turning it into diesel and fuel gas, or biomass--not corn, not corn, not corn--biomass ethanol.

[Laughter.]

MR. WOOLSEY: The reason I say biomass rather than corn is that you use about as much energy to produce grain-based ethanol as you get out of it. It is an interesting and lucrative subsidy for ADM. It doesn't have much to do with moving toward real substitutes in volume for oil use for transportation,

but if one has--and we are right at the edge, I think, of having--genetically modified biocatalysts that can produce ethanol from kudzu, from rice straw, from switch grass, one has something very different.

Some combination of these approaches, again, in the existing infrastructure of fuel economy of the dramatic sorts we are already seeing from hybrid gasoline electrics, of alternative fuels that can be used in the existing infrastructure, together with policies that help, I might say as a final footnote, bring democracy and the rule of law in the Middle East, seem to me to be a mixed strategy that has some promise for us.

[Applause.]

MR. STEINBERG: Jim, before I turn it over to the others, I have just one strong--

MR. WOOLSEY: One convert. One at a time.

[Laughter.]

MR. STEINBERG: Let me just push you a little bit, and understanding that this is obviously a continuum, but we all have been hearing and discussing the question of projecting increases in demand in the future. It is, certainly, unlikely that demand is going to go down in the near future.

MR. STEINBERG: What kind of order of magnitude of change of fossil fuel use do you think would be necessary in order to reduce the kinds of risks and reduce the kind of leverage that you have identified as your sort of area of concern?

MR. WOOLSEY: I would like to see us turn these curves of fuel consumption by moving towards things like hybrids and by use of alternative

fuels sharply in a direction such that, within a decade or two, we could start seeing a decrease in our use to begin to come close to matching what we produce.

I think that asking for all gasoline--I mean, we produce about half our own oil. To ask all gasoline to be replaced by ethanol and then project massive amounts of land that that would require is really kind of a stupid exercise.

I think what you want to do is to try to put together these two, low fuel utilization and alternative fuel tendencies.

Let me just give one illustration. I am on the list for a Prius. My next-door neighbor, Bill Butler, has a fine Prius, 60 miles a gallon in town. If a Prius is also a flexible fuel vehicle--and what that means, since there are several million of them on the road--a lot of Ford Tauruses are FFV. It just means a slightly different kind of plastic in the fuel line and a reprogrammed computer chip. It costs 100 bucks or so a car. Detroit gives it to you free because they get some credit for it.

So, if a Prius is also a flexible fuel vehicle, that means it can use 85-percent ethanol rather than only 10 percent in the cars most of us drive.

If you have a 60-mile-a-gallon Prius using 85 percent of its fuel, biomass-derived ethanol, you have something that is getting in the ball park of 300 miles a gallon of gasoline. That ain't bad. You don't need to wait for the hydrogen revolution and so forth to have dramatic impacts if you put together these alternative fuels and better milage.

I think if you gave tax credits for things like hybrids instead of a declining tax deduction, which is what we have now, if you gave tax credits and deductions for things like hybrids and for some of these types of alternative fuels that can be used in the existing infrastructure, you could start to see 2020, 2025 are headed toward matching our gasoline consumption with our domestic gasoline production and thereby removing from our Saudi friends the ability to be in their plane flying to Crawford and have a female air traffic controller come on and have the Saudi pilot say, "I don't want to talk to a woman, Air Traffic Controller," and have the FAA switch to a male traffic controller. Oil does that.

MR. STEINBERG: Well, you focused on demand-side strategies.

Fiona, what is possible on the supply side?

MS. HILL: Well, Jim Woolsey is always surprising in his beginning presentations, and I was actually sitting here, all getting myself ready for yet another discussion of the geographic diversification of supply away from the Persian Gulf. So you have certainly caught me by surprise there, and I am going to rush out and buy my Prius this afternoon.

MR. WOOLSEY: Bravo.

MS. HILL: But actually, I think this is really rather refreshing because, in fact, as I was just saying, most of the discussions that we tend to have on the geopolitics all really do focus on the geographic diversification of supply, and we have too little of the conversations that Jim has just picked up on that we had in the first panel about real supply diversification, talking about renewable energies and new technologies on the U.S. as well as on the global scale. So that was actually very refreshing.

As Jim did start out, oil is usually the focal point for any of the geopolitical discussions of energy precisely because of the dominant influence of the transportation sector as being the main driver for oil demand. As Jim noted and as other panelists in the first session today noted, we have only just hit the tip of the ice berg in personal ecology demand in places like China and India.

If anybody has been to Russia recently over the last 10 years, there is an enormous growth in car demand, and rather disturbing from the climate change point of view, a market in secondary car purchases of some of the old clonky cars that have all gone out of fashion elsewhere in Europe driving around the streets of Moscow.

Obviously, if automobile usage is following current trends, we can probably expect that it might increase to about 56 percent of world oil consumption over the next two decades. So, absent these kinds of changes in new technologies, it is going to be very difficult to book this trend.

As a result of our fixation on oil, we have obviously been searching globally for alternative suppliers, precisely because we have been fixed in this kind of image that Jim has outlined about looking for other supplies as our supplements or alternatives to the Saudis or to the Persian Gulf.

Actually, when you look at the case of the United States, it has to be said--and I think other panelists made this clear earlier today. But there has already been considerable geographic diversification in supply in the United States as well as globally over the last 10 years.

In fact, the Persian Gulf, although it still accounts for a quarter of U.S. crude oil imports, it is considerably less important than it was before. We

have got fully 60 countries now having increased their oil production over the last 10 years and now supplying the United States.

Half of all crude oil imports come from the Americas. Jim Steinberg started off pointing to now the concerns about Venezuela, another of our neighbors in the Americas. Fortunately, Canada seems to be nice and stable, and we are having Vincente Fox visiting the President at his ranch in Texas. I hope that goes well. We don't want any more upsets on the American oil front.

But we also have to think of Africa as a new major supplier, about 15 percent now of U.S. crude oil imports, and Europe still remains a major supplier for the United States at about 7 percent.

Now, as Jim Steinberg mentioned, Russia has become a major focal point for us, and I am going to focus on Russia for a while because that has been the area of work that I have been doing for the last several years here at Brookings.

Over the last 3 years, there has been a great deal of speculation here in the United States that Russia could somehow displace Saudi Arabia as a major supplier. As Jim Woolsey said, there has actually been a rather facile degree of speculation. It is worth dwelling on for a while about why we have been so fixated on Russia.

Well, the first point, of course, is that the Soviet Union, rather than Saudi Arabia, was actually the dominant world oil producer back in the 1970's and 1980's, and it was only with the collapse of the Soviet Union that that oil production went down.

Russia's oil production as the major bulk producer within the Soviet Union really declined rather dramatically in the early 1990's with the collapse of its economy, but it has really bounced back over the last 5 years, especially thanks to the rise in world oil prices after 1999, which helped the Russian companies undergo a major restructuring initiative. They improved the management of the companies and increased sufficiency in a rather dramatic fact, in part also because of the collapse of the Russian ruble in 1998 which lowered the cost of all of the imports into the industry. There has been considerable foreign investment, too, in the Russian Oil sector.

We have had major production increases, now well over 8 million barrels per day of oil production in Russia, which may, in fact, move very close to 9 million barrels per day this year. There is potential still, according to almost all Russian oil analysts, of more increases in oil production in the medium term up to about 11 million barrels per day.

Now, it has been based on these rather dramatic production increases, moving back close to where the Soviet Union was before its collapse, that have led to people looking to Russia as an obvious new source of supply, and indeed, prior to the arrest of Mika Obagashi [?] back in October last year, we had a great deal of discussions with the Russians, a lot of claims from Russian oil companies like UCOS, that in the medium term, Russia might eventually supply as much as 1 million barrels per day of crude oil to the United States, which would be a pretty significant portion of U.S. daily supply, if that was possible.

But as most people who really look seriously at Russia have noted--and I am sure all of the Jims are with me in this--in spite of all of these major improvements, Russia has some big challenges, and most of these come down to infrastructure.

As it stands right now, we actually import very little crude oil from Russia and the other states of the Soviet Union, and this is also including the major oil producers in the Caspian and Azerbaijan and Kazakhstan, which have very substantial oil reserves and are already exporting also with increased capacity.

If you put that altogether, it is actually under 1 percent of our total daily imports because the bulk of Russian crude, because of the pipeline system that was left over from the Soviet Union, actually goes to Europe, well over 80 percent.

That also includes not just the EU countries, but also the Eastern and Central European countries, the former Soviet bloc. So Europe is really the dominant importer of Russian oil.

Russia wants to also increase its oil exports to Europe over the next 5 to 10 years, but actually have to make a major shift in decisions of this point if it were to supply more to the United States, and the problem there is that Russia is already exporting at maximum capacity. Unfortunately, infrastructure has not kept pace with the increases in Russian oil production.

Russia is exporting about 5 million barrels per day, and it could export more because of such a depressed demand internally in Russia for crude

oil because of the economic decline and particularly the decline in heavy industry over the 1990's.

Now, there have been improvements in export pipeline capacity in Russia over the last 5 years, but it is still limited. Many oil exporters are having to resort to rail, to river barge, and other methods, actually, to get the product out to world markets.

We have been in a lot of discussions about new pipelines, for example, from Myrmansk, the pipeline. In 2 more months, there can be port facilities to export to the United States, but these are still in their discussion stage, and they have slowed down considerably since the arrest of Mika Obagashi who was a major motor for the construction of new pipelines.

So, again, we have to bear in mind that this major point, the construction of a new pipeline and new export facilities, has not kept pace with this dramatic increase in Russian oil production. So that is the major problem there.

Also, apart from the United States, China, Japan, and many other Asian countries are also interested in Russian oil, but again, it gets back to the infrastructure problem and also to the part that Russia would have to develop new oil fields in Eastern Siberia to meet that demand.

We have got a big debate right now between China and Japan over who will get a new oil pipeline and access to Russian oil fields, which again has been thrown off by the arrest of Hotokovski who, again, was a major motor of those discussions.

As I mentioned, the development of the oil fields over the longer term is going to be a problem for Russia. Although Russia has increased its production, as I mentioned, by about 2020 it is going to peak and then decline because the current fields in western Siberia are reaching their maturity.

There is a lot more oil out there in Russia, and in fact, there is a great deal of speculation about the extent of Russian possible oil reserves, especially in the Northern Seas area, just within the Arctic Circle, as well as in Sakhalin Island and the northeast Pacific. It looks like there is a lot of oil there, and some new technologies will make most of this exploitable.

But there is also a question about will all of Russian potential reserves be ultimately recoverable after 2020 and then will be in the discussions about infrastructure to bring those to market. So there is still a lot of challenges ahead in thinking about Russia, and we can't just simply factor it in as the great new frontier and the great hope for a replacement of the Middle East over the longer term for the global world supply, not just for the United States.

Getting back to that original point about the speculation of whether Russia could replace Saudi Arabia or the Middle East, in fact, for the U.S. or any other oil-importing country, it clearly, as Jim Woolsey said, is just not possible.

Russia will obviously have some impacts on world markets at the margins, especially with the major exporter increase, but it is not going to ease overall the vulnerability of world oil markets.

We keep talking all the way about oil, and I would actually like to shift to gas because I think when you look at gas and especially rising gas

demands in Asia, which was mentioned in the first panel, this is extremely significant. We must not neglect the rising economies of Asia when we are thinking about global energy supply, and that is China, Japan, Korea, and, of course, India.

Already Asia accounts for about a quarter of world energy consumption. It is like it has moved to about a third in the next couple of decades. China is the second-largest consumer of energy after the United States. India is in sixth place and rising upwardly. Of course, a lot depends on whether it be current economic growth in Asia continues as it is, but I think we can at least expect that there will be a sharp rise in energy demand.

It won't just be in the automobile sector. It will also be in the static power generation sector, and that is where an actual gas demand is being pushed up.

China has also got green to some degree. They are very concerned about the effects of pollution on the major cities, and although China us pretty much self-sufficient in coal, there has been a great deal of concern about the air quality, not just in Beijing, but across all of the industrialized cities of China. There is a great desire now to push into more natural gas use.

The problem for China, of course, is although it is self-sufficient in coal, its natural gas reserves domestically are very small.

China, of course, is sitting right next to Russia. So it seems, again, that this may be a logical source because, when you think about natural gas, Russia is to natural gas as Saudi Arabia is to oil. Russia sits on one-third of the world's natural gas reserves.

Gas has become a global commodity over the last decade. Most of the gas that is consumed on a global scale is now transported across national borders, be that by pipeline or in the form if LNG that was discussed this morning.

Along with China, Japan, South Korea, and many other Asian countries would like to increase their gas consumption to mitigate not only pollution, but also dependency on Middle East oil. They are all in the same position that the United States is in.

In terms of gas reserves beyond Russia, although Russia really outranks all of the other major suppliers, Iran is the next largest holder of natural gas. In fact, between them, Iran and Russia hold half, a full half of the world's gas reserves.

So, two decades from now, we might be having completely different discussions about world energy potential, which we already have Russia full and center, but put Iran even more to the forefront of our discussions. I will be curious to see what Jim Woolsey will have to say about that.

If current trends in gas consumption continue, Russia is going to be the primary supplier in gas certainly for Europe, if not all for energy. It already accounts for about 20 percent of the European gas supply, 70 percent of Turkey. Turkey is pretty much captured by Russian gas at this stage, although Iran is also a factor there.

Russia is poised for expungement into future markets, but with several caveats because, although there is a lot of competition in oil globally in terms of suppliers, there is even more in gas, especially in Asia.

Although, as I said, China and other countries in Asia and East Asia, Japan, and Korea look like they might be captive markets for Russia, given Russia's location and the fact that there are large gas fields in the top and eastern part of Siberia, there are lots of alternatives for Asian countries, Bangladesh, Australia, Malaysia, Iran, Qatar and the Persian Gulf, and especially if you move over to LNG, it makes gas more transportable and Russia no longer looks as if it could be the dominant supplier.

Even consumers like China, which are currently thinking actively about Russian gas, if these discussions and difficulties over signing contracts and building pipelines continue, they may be tempted to turn to other Asian suppliers and Australia and the Middle East in shipping LNG rather than having to rely on Russia over the long term.

So, although Russia's capacity is great, the window of opportunity for Russia to break into new markets may be closing.

Also, there needs to be a great shift over in domestic infrastructure, the same sorts of shifts that we have been talking about in the transportation sector, to increase gas use for household heating and also for power generation in many of the Asian countries.

In the U.S., we haven't really talked about Russia as a factor in gas, even though at some point, we may be seeing our gas import dependency mirroring today's oil import dependency.

I know one of the previous panelists are somewhat optimistic on the prospects of gas supplies from North America, and right now, we have the bulk of our gas imports coming from Canada, but at some point in the next 20 to

30 years, I can imagine we will be in a similar situation talking about growing gas dependency as we are now on oil. So Russia as a future supplier of LNG to the United States may well come into play, but then we will have again to think about Iran, given the size of its supply.

Now, a final point on Russia when we are thinking about geopolitical issues is that for Russia, oil and gas are really big politics. It is not just an economic or a commercial issue, but oil and gas really totally dominated the political scene in Russia today. That is precisely because of the huge size of Russia's natural gas and oil reserves, but also because of the impact on the Russian economy in terms of budget revenues and exports, fully half of Russian export revenues and about a third of the state budget revenues.

So there are multiple and conflicting demands on Russian energy for the internal political situation for fueling Russia's economic development, especially outside the commodity sector, and frankly, also, on a very practical level as we outline, Cliff Gudd [ph] and I, in a new book that we have just written called "The Siberian Curse," which shows that millions of people in Russia today literally could not survive in the harsh climates in which they live in wintertime were it not for this abundance of energy and especially low-cost gas.

This is a major sticking point for Russia in the future. It heavily subsidizes its internal energy prices, well below world prices, and the European have been particularly irritated by this as the main importers of Russian supply and are pushing the Russians to bring their domestic energy prices and world energy prices into line and, in fact, trying to effectively block Russia's entry into

the WTO. So we are going to see energy wars to some degree between Europe and Russia on that very fundamental level because in Russia it is actually a life-or-death issue of basically keeping the lights and the heating on in places like Siberia in the middle of winter by heavily subsidizing energy.

There is another problem for Russia which is that it has also tied its economic growth, not its whole economic development, but the actual growth that we are seeing now in the Russian economy to the world oil prices.

If you look back to 1997 and look at the growth in Russia's economy, there is almost a direct correlation with the increase in world oil prices since that point. Unfortunately, although Russian oil companies are now quite well-restructured to withstand the boom-and-bust cycles in the world energy markets, in fact, they could easily operate and be profitable at prices well under where we are today, perhaps around $16 per barrel and well below. They have even said that they could perhaps continue that profitability at prices as low as $10 or even lower. That is not the same for the Russian state. The Russian state has not restructured itself sufficiently to be able to withstand this.

Russia has become addicted to a price regime well over the world median, which is about $18 when you go back over the last century. So this means that the Russian government is going to be fixated on issues of oil and gas for the foreseeable future, especially if they want to continue the growth in the economy. So any kinds of discussions about the future of Russian energy and Russia as a supplier will have to factor in politics and the desires of President Putin and other Russian leaders in the future to maintain their current levels of growth.

So, for Russia, energy is all about geopolitics, not just about commercial issues.

MR. STEINBERG: Before we turn to our last Jim, let me just push you on that last point.

Jim Woolsey has identified tow political risks from dependence on Middle Eastern energy, one, the thread of terrorism and the terrorist disruption of oil supplies from the Gulf, and the second is a political risk that leaderships of states with control over resources would make a decision to try to influence the behavior of others by withholding energy.

My question to you is you have identified one factor that affects the Russian government's decisions about energy policy, which is its interest in maintaining prices which may lead it to participate in cartels and do other kinds of things. What risks are there that Russia will see this as a political card it can play to influence the behavior of others? Say, for example, given European dependence on Russian energy, particularly gas, do the Russians think about this as something where they say if you don't let us into the EU, if you don't get us into the WTO, we will use this as a geopolitical tool?

MS. HILL: I think there is a lot less likelihood that Russia will try that with Europe.

In fact, if you look back to the Soviet period, this was a major concern of analysts here in the United States during the cold car that, in fact, the growing dependency of Europe on Soviet gas would play very badly for the United States and allied interests.

In fact, it turned out to be completely the contrary. The Soviet Union was essentially keeping itself afloat by increasing its gas exports to Europe, and there was no chance that they were going to turn off the spigot because it was the major source of foreign currency, of hard currency.

That, to a large extent, remains the case today for Russia as it wants to expand into European markets even more than it is and to emphasize its dominant position. I don't think that that is a card that it will play, but it will certainly be used as a political factor.

I think the greatest risk is that it will be played in the weakest states around Russia and already is being played. We have seen that in Ukraine, but it is often for different reasons than one might assume. It is not simply for Russia to emphasize its continued influence over economic or political developments in those states, but it is also to persuade them to lower transportation tariffs, for example, or to allow Russia access across their territory for increased exports to the other states, pushing Ukraine, for example, on a new pipeline agreement to facilitate Russian exports to Europe or pushing, for example, which we may see in the future, Georgia or Armenia, for example, for electricity exports or oil and gas exports in the future to Turkey and other potential markets.

It is also has clearly been a factor in Russia playing with its relationships with China and Japan right now, kind of hedging and sort of offering the carrot of oil and gas supplies to whoever will pay the most. In that way, I think the Russians are playing a very clever game and hoping that

perhaps Japan or China will fit the bill for paying for most of the infrastructure that needs to be developed.

In fact, I think Russians are also betting that the United States' disillusionment with Saudi Arabia or fears about the Middle East would, in fact, compel U.S. policy-makers to make strategic decisions, non-market decisions about paying for infrastructure development that would facilitate greater exports to the United States. So it is definitely going to be a tool that Russia would like to use, but not necessarily in the ways that we might have thought of in the past.

MR. STEINBERG: Jim?

MR. PLACKE: Let me move over to the podium because, like some of my predecessors, I have got a PowerPoint presentation here, if somebody will put it up for me.

Good morning, ladies and gentlemen. Let me begin by sharing with you the conclusions that I draw from the presentations of the two preceding speakers.

From Jim Woolsey, we have learned that the United States and, indeed, any right-thinking nation shouldn't import oil from the Middle East and particularly from Saudi Arabia.

[Laughter.]

MR. PLACKE: From Fiona Hill, we have learned that Russia, we should not anticipate being an alternative to Middle East or Saudi oil supplies for a series of structural reasons and to some extent Russian policy reasons that she has already outlined.

Well, the conclusion I come to in light of this is that prudence dictates that we should get ready to turn out the lights. So, in the few remaining minutes that we have under the lights, let me begin with this.

In a way, this really verifies some of the points that Jim Woolsey made earlier. It is really political events over the last 30 years that have primarily dictated dramatic changes in oil prices, and most of those political events have been involving the Middle East, but let me draw out a couple of other inferences.

There were twin oil shocks in the 1970's. The first one was the Arab oil embargo that followed the October war. It hasn't been repeated, however, in this succeeding nearly 30 years, as you may note, and I think there are two reasons for that.

First of all, it didn't work. The purpose was to influence American policy. The United States came to Israel's support vigorously in the context of that war, which was an invasion by Egypt and Syria on a surprise basis, and Israel desperately needed military resupply and the U.S. provided that.

The answer was an embargo aimed at the United States to change that policy. The United States policy certainly has not changed. I think we are all pretty well aware of that, and it hasn't been repeated because it didn't work for the policy reason.

The other reason it hasn't been repeated is at that time, OPEC and for the preceding decade, OPEC rather than Arab/Middle East, although the Arab states account for about two-thirds of OPEC's oil exports, but OPEC lost about half of its market share over the following 10 years.

They had accounted for about two-thirds of total world oil exports. Since that time and up to the present time, it is running around one-third. So there was a very high economic cost to be paid as well.

We come to the second oil shock, which was the years preceding--about 2 years preceding the overthrow of the Shah of Iran, which occurred in 1979. This total is a quadrupling of oil prices, and I would point out to you where prices were at that time in today's dollars, $70 a barrel, which is roughly twice what we are today and last year prior to the U.S. military action in Iraq. So, from that perspective, maybe it doesn't look so bad, but the lesson to draw out of this is that prices do matter.

Actually, world oil consumption declined from 1980 through 1987 by about 2.5 million barrels a day. More than half of that was in the United States.

Now, oil prices in that period from 1973 through 1979 quadrupled. That is a tremendous bill to pay, but it did matter. It encouraged conservation. It encouraged greater fuel efficiency, and it drove us to do some things that we since seem to have drifted away from.

Well, the other elements here, we are all familiar with. They are more recent history, except I would like to point out the last one.

I think I am the last surviving American observer of the first OPEC conference in Baghdad in September of 1960 at which OPEC was formed. After observing that meeting, I decided I didn't need to go to another OPEC meeting.

OPEC was set up to do what couldn't be done at the time, and that was to get a much larger share of the revenue for its members. Ultimately, that changed over time. Even though OPEC's share of total oil supply has declined as supply constraints, as others have illustrated this morning, intensified, OPEC matters more now than it did then.

We have this period of OPEC market management that really began with the Asian financial crisis of 1998 and has continued up to the present time.

Can it continue? Can they really defy Economics 101? I have never thought so, but they have done it now for about 5 years, and maybe that is something to take a second look at.

Jim Woolsey did us all a favor this morning by dismissing something that is a shibboleth that I encounter frequently, and that is, well, you know, we will just redirect American oil purchases to somewhere else, not to Saudi Arabia, but to somewhere else.

Well, that has already happened over this period of time from 1995 to 2003, and it happened for a variety of reasons. About the mid '90s, the major oil refiners and distributors in the United States discovered what the Japanese first introduced, and that was just-in-time supply management which meant you can reduce your inventory carrying cost if you don't carry a big inventory. Oil refiners today carry a much smaller inventory in the United States and elsewhere around the world than had been true up to that time.

That meant there was a premium increasingly on oil supplies in the western hemisphere, and I would also point out from West Africa, which is

represented here only by Nigeria, but there is a growing oil province off the western coast of Africa that will become increasingly important.

The anomaly here really is Saudi Arabia, and that is worth taking a moment to consider. Why Saudi Arabia when oil supplies from most of the rest of the Middle East? This is so small as to be highly volatile as it went up 500 percent, but it is only 50,000 barrels a day. So it is not something that one needs to worry about.

Basically, the U.S., when you are talking about Middle East oil supply, it comes mostly from Saudi Arabia. That is not a matter of U.S. policy. That is a matter of Saudi policy. The Saudis consider that to maintain their part of what historically has been referred to as the strategic relationship, oil for security or oil for a security guarantee, which is unwritten I should note, they need to remain the number-one supplier to the United States.

Except for a couple of years in the mid '90s, they have been, and it is very easy to do. Saudi full-cycle oil production costs--that includes exploration and discovery and development--are under $2 a barrel. The average Saudi return on a barrel of exports--and they have a variety of crudes that come at different prices, but the averages are in the mid twenties. Today, it is somewhere between $26 and $28 a barrel. That gives you a pretty big margin to play with.

So it is very simple to be the number-one supplier to the United States. You price your oil accordingly.

Now, Saudi Arabia could get a larger net back if it were exporting more to East Asia, particularly China, consumers. They do export a

lot to China, to Japan, and to Korea, and those exports will grow. That is where most of the Middle East oil now goes.

Their oil continues to come here to that extent because they see a political benefit to it. They may or may not be right about that, but that is their policy. In effect, there is a small subsidy to the American consumer built into Saudi oil exports.

I won't spend a lot of time on this because we have already heard a good bit about it from a variety of speakers.

We presented two alternatives, a high and a low case for 2010 and for 2020 as to what the share of primary energy demand from various energy sources might look like. Well, these are scenarios. They are certainly alternative scenarios.

The one thing I guess I would point to--and this bears on Jim Woolsey's comments--the expectation here, as reflected also in other speakers earlier this morning, is that the renewables, geothermal, wind, and solar, are going to remain relatively constant if nothing else changes. Jim has pointed out some things that could change or that we could make them change, and if that happens, then that would look very different. Left the way they are, there probably isn't going to be a proportionate increase.

Nonetheless, there will be very substantial growth in that sector. There has to be because we are talking about an expansion of demand quite significantly over that period of time.

The other is coal. I think the high scenario here is definitely more realistic because there is, given what has happened to natural gas or what

is about to happen to natural gas, going to be a return to coal, with more modern technology in terms of controlling emissions and so forth.

The one that nobody has talked about and it is for a very good reason, which you probably all chuckle at, is nuclear.

We all know that one of the main problems--well, in addition to licensing and plant siting and all of those contentious political problems, there is the very real problems of disposal of nuclear waste. Maybe with the development of a nuclear disposal facility in Utah, which is now going ahead, that could possibly be less of a constraint than it has been up until now.

Of course, like all other areas, nuclear technology has changed over the years as well. Is that likely to be enough to overcome the in-built political resistance to that? Very doubtful, but it depends on a lot of factors and particularly the prices and consequences of some of the alternatives. Anyway, that is one way to look at the future.

This, we have all seen, too, earlier today in various other formats. This is U.S. consumption versus imports. Consumption goes up, and domestic production is going down. The result is we are becoming increasingly dependent upon external sources of energy.

Right now, it is approaching 60 percent, and there is nothing in the short term that is likely to turn that around.

U.S. oil production actually peaked in 1970 at about 9.5 million barrels a day. Today, it is about one-third less than that.

Finally, the subject of gas, as we have also heard earlier today, gas was the fuel of the future, particularly as applied to electric power

generation. It had environmental advantages, it was plentiful, and it was relatively cheap, but that is "was." That is past tense because that situation began to change fairly dramatically at about the year 2000.

Now, there is some discussion as to has U.S. gas supply hits its peak and stabilized, which is the Cambridge Energy view, or is there still some way to go. If there were some regulatory changes, if there were some prohibitions lifted, there could be more gas produced and found in the United States.

I think eventually, it will be brought down from Alaska. This does not involve the Alaskan Wildlife Refuge. It is just building a pipeline across western Canada to get the gas from where it is in northern Alaska to where it is consumed in the U.S., in the lower 48. That, I think will happen.

So there are some possible variations, but basically, North American, that is, Mexico, the United States, and Canada, gas supply has essentially peaked. Gas demand, of course, is going to continue to go up.

Those powerplants, 200 gigawatts of electric power generation that we have heard about that were built in the 1990's, are going to continue to operate for another 20 years, and they are going to operate on gas. The gas has got to come from somewhere, and increasingly, it looks like it will be the only alternative, liquified natural gas or LNG. This is what we see on that basis for LNG imports into the United States.

As someone else observed already--I think in the course of this morning, we pretty much have observed almost everything that is observable.

[Laughter.]

MR. PLACKE: It is true that when you go through the list of major gas reserve-holders in the world, as Fiona pointed out earlier, Russia is number one by miles and miles. Iran is number two. Qatar, a small Persian Gulf state, is number three. Saudi Arabia is number four. UAE Is number five and so on.

Then you do get into Algeria, Nigeria, and so on, other sources of gas. Basically--and this should surprise no one--the cast of potential gas exporters looks very much like the cast of potential oil exporters. So there is not much to be gained in terms of additional energy security by going down that route.

I will go back to close to where Dan Yergin started this morning, and that was his reference to Churchill and Churchill's prescription for energy security. He used the word "variety." I think today, we would call it "diversification."

There really is no better way to go than to diversify supplies and also to diversify sources. This comes back to where Jim Woolsey started.

If we can do the things that he identified--and they have a lot of benefits to them, not just diversification of source, but also environmental and other benefits--that would be part of the answer, definitely. To do that, however, you have to drive a Prius instead of a Lincoln Navigator.

When I come into work in the morning, I see more Navigators than I see Prius. So you can legislate, you can regulate, you can raise prices, you can do some combination of all of these things to bring about a different future.

The future that most of us have talked about this morning--and this is a disease that I think all economists especially suffer from, and that is, we tend to project today often into the indefinite future, and we all know that won't happen. That is the one thing that you can be certain of. That won't happen. It will be different. It we knew what it would be, we wouldn't be here.

So we can make a difference without the future. We can make the world look different, but there is a cost to doing it. My sense of the political mood in the United States is that American consumers like consumer choice, they like relatively low prices, and they don't like their congressional representatives who want to change these things.

This being an election year, I wouldn't anticipate a great deal of change.

Thank you.

[Applause.]

MR. STEINBERG: Thank you, Jim.

Before we turn to the audience, let me ask you one question.

What we have heard from all of you is that as a result of the globalization of energy markets, it is harder and harder for even significant producers to target individual countries with their energy political strategies.

Fiona suggested some, perhaps, small exceptions in the space around Russia, but that for the most part, a country couldn't decide simply to try to cut off the United States, the diversification of supply and such, but that the big factor, therefore, is price, and that the one place where there is a potential

real vulnerability is if a supplier could take off enough supply that there would be a price impact that would be a global price impact.

So my question to you, as you look back on the price shocks of the '70s in particular, what kind of order of magnitude would it take in terms of supply restriction to produce a comparable effect, and how do you think the global economy would respond? What parallels should we draw or lessons should we draw from the medium-term response to those price shocks in terms of what would then happen to both the global economy and consumption patterns?

MR. PLACKE: Let me answer that very good question this way.

At Cambridge Energy, we do a lot with scenarios, and we have addressed various kinds of supply disruption scenarios and what would be the price response, where would the additional supply come from to fill in, and at what cost and so forth.

The one scenario for which there is no solution is to eliminate Saudi Arabia. There is on way out. The world goes into a deep recession and stays there for an extended period.

Given where we are today, if we weren't consuming that much oil, well, yes, it would all be different, not only because Saudi Arabia producing around 8 million barrels a day, second only to Russia, as Fiona correctly pointed out. They are, however, the world's largest exporter, and as Jim Woolsey mentioned, they hold most of the world's spare capacity.

So, if that 747 did crash into the gas-processing plants at Abgake [ph] and so forth and eliminated Saudi Arabia or if there was an Islamic

revolution that put Saudi Arabia on a completely different course, whatever scenario you like, there really isn't a way to deal with that.

When we came out of it, the world would not stop, but we would all have a very bad couple of years. When we came out of it, the world probably would look more like some of what Jim was talking about.

We would certainly have learned some lessons. We would turn to alternatives. This event would have accomplished what we would have failed to do in a regulatory or legislative matter. So price matters.

The price differential that I refer to there between the early 1970's and the peak in 1980 was a quadrupling, so something on that magnitude, and you can write your scenario as to how that might come about.

MR. STEINBERG: I think there is a little kind of perverse conclusion that one could draw from that, that in order to achieve the world that Jim Woolsey wants to see, we need to have an effective terrorist organization that can pull off that kind of a--

[Laughter.]

MR. : We just have to be smart.

MR. STEINBERG: And I am confident that is not what Jim is advocating as the way to get to his world of Priuses.

MR. WOOLSEY: I never watch shock therapy.

MR. STEINBERG: Let's turn to the audience. Those were very good presentations.

I guess we have mics, and it would probably be useful if you would identify yourself before you ask your question.

MR. : Thank you. David Mickel [ph] with the Center for Trans-Atlantic Relations at Johns Hopkins University.

Much of the discussion this morning has focused on the ways in which diversifying the geographic sources of fuel and the different fuel types would increase our energy security, and I would like to turn that question around and ask how those type of policy results would influence the situation of those politically unstable countries in the Middle East whose impacts we are trying to avoid.

The journalist, Thomas Friedman, talks about the problem of the sitting-around guys in Saudi Arabia, economic development in the Middle East, and if we are able to diminish our reliance on energy sources from those countries, are we, in effect, diminishing their revenues and making the economic transition that they will have to make more difficult and perhaps increasing the number of sitting-around guys in Saudi Arabia who could be available to terrorist organizations?

MR. STEINBERG: It looks like a softball for both Woolsey and Hill at a minimum in here.

MR. WOOLSEY: It will make it more difficult for them, and that is all to the good.

What we want is for the Arab world, in particular, to change what it does for a living. The 23 Arab states plus Iran have a population slightly larger than the United States, 300 million or so. Between them, except for oil and gas, they export less than Finland, and Finland is a country of 5 million people.

There are a number of successful countries in the world that operate under democracy and the rule of law. There are 121 democracies these days, by the way, 32 of them, under Freedom House's calculations, partly free, 89 of them, elections plus a rule of law.

My two favorites right now--I am chairman of the board of Freedom House. My two favorites right now are Mongolia and Mali, both of which are perfectly fine functioning democracies that are diversifying their economies. They are starting from a low level, both of them, but people are opening businesses. They are starting to learn to do things for a living that will bring them up out of the situation that they are in now.

Would it be a shock for Saudi Arabia or any other country that relies so heavily on oil for its people to have to go to school and to college and to learn something other than rote learning, to learn how to be engineers and--[audio break].

[Side B of Audiotape 2 of 4 begins.]

MR. WOOLSEY: [In progress]--scientists and mathematicians and even lawyers? Would it be a shock for them to have to learn to produce--

Even economists.

[Laughter.]

MR. WOOLSEY: --to produce textiles to get into the business of learning how to earn a living in this world? Yes. It would be a shock. It would be a shock, I would dearly love to see them have to go through.

Should we operate this and conduct ourselves in such a way that we try to make it a relatively easy transition for them, that we try to help with

these transitions, so that it doesn't produce more terrorists? Sure. But should we sit here and gorge ourselves on their oil?

By the way, Jim, Lexus is coming out with an SUV in September that gets 37 miles to the gallon in town because it is a hybrid. You can drive big cars if you want to, as long as they get good mileage.

MR. STEINBERG: Fiona?

MS. HILL: I wish it were all so simple. I was sort of sitting, listening to Jim Woolsey, thinking, well, wouldn't it be great if your average Saudi could be a software programmer or something like this. If you look at the case of Russia and all the countries around Russia in the Caspian Basin, Kazakhstan, Azerbaijan, and Turkmenistan--of course, maybe we should leave Turkmenistan to one side. That is a tricky one to talk about. The fact is that their comparative advantage, their competitive advantage in the world is natural resource production.

Even if you think about Russia, which is actually a very much more diversified economy than Saudi Arabia, you have got an awful lot of lawyers sitting around in Russia, many of them quite busy right now with Hotokovski and others in jail running around here.

[Laughter.]

MR. STEINBERG: He needs a lawyer.

MS. HILL: That is right.

You have a lot of software engineers sitting in strange places like Novaseebisk [ph]. Many of them might prefer to be in Miami or San Jose, but they are out there.

Where they are located is a bit of a problem because you can't sit in Novaseebisk and type away on your computer, making up the next software, unless the lights are on and you are sitting in heating because it is an extraordinarily cold place to be at this time of the year.

That requires, again, for the domestic economy of many of these states--Saudi Arabia actually has the opposite advantage of being an extraordinarily hot place. So you need air-conditioning to be able to carry these things out. They need their own sources of energy for the development of their own economies.

For Russia, it actually is one of these Catch-22 situations. If they don't pump out more oil for export, they can't keep everything going inside because of the highly subsidized nature of the fuel prices, which not just keeps sort of [inaudible] industries that ought to be restricted going, but keeps the new technology, the new industries, the new service sector, the new high-tech industries going, too.

There is a big debate in many countries across the world that maybe isn't taking place in Saudi Arabia, but it is taking place in places like Russia and Kazakhstan and Azerbaijan about how do they diversify their economies. Russia would like to be a high-tech producer, but how does Russia then compete with Japan, with Korea, with the United States, for that matter?

So it is not a simple issue to think that you should put your natural resource wealth on one side and shift over to other kinds of industry. The Soviets tried to do that with a massive industrialization campaign, in fact, got themselves even more locked into energy use than they were before. So,

unfortunately, a lot of these restructuring issues, which would be ideal, also raise a whole host of other questions.

Will Saudi Arabia's competitive advantage be in producing lawyers or in producing refrigerators or in producing software packages for Microsoft? I am not entirely convinced that that will be the case if you look at other countries.

MR. STEINBERG: Let me do this because Jim Woolsey has to leave at five to 1:00. Let's take a couple of questions, and then we will give each of the panelists an opportunity to comment on what they think is most relevant. So I will take three or four questions, and then we will go to responses.

Right here.

MR. HERSHEY: I am Bob Hershey. I am a consultant.

How will new technologies play into this? For instance, Jim Woolsey had mentioned getting synthetic diesel from Fischer-Trope process, which will exploit some of the natural gas that is locked in. How will that and some of the other technologies play into this?

MR. WOOLSEY: You can take several.

MR. : Yes, Mr. Woolsey. I was the one that applauded after your presentation. I wouldn't describe it so much as me converting as me applauding what I see as the evolution of your thinking on this over the last couple of years.

[Laughter.]

MR. : In particular, in the past, you have talked about the threat to our security from a combination of Wahabis, Bathists, and Jahidists

[ph], but one thing I haven't heard you talk about is something I call the American Jehadist, and this follows up on the previous question.

There is a group that has grown up who has decided that the right thing for the U.S. is to think of the Saudis and the other Middle Eastern autocracies as our enemies and to antagonize them, and that a goal of U.S. energy policy should be specifically to deprive them of the funds in order to strangle their support for world terrorism, i.e., buying oil that supports Arabs and Arabs are terrorists and that sort of thing.

In fact, Saudi Arabia has been a friend to the United States in a great many ways, not least of which is their commitment to keeping approximately 2 million barrels a day of reserve capacity in order to stabilize the market.

That is what I would like to hear you respond to.

MR. STEINBERG: Let's go over here.

MS. : I would just like to ask the panel what the motivations are behind Saudi Arabia now seeming to want to cease being a price moderator.

Lately, we have seen them push through, them solely pushing through OPEC production cuts when prices are really high. Obviously, revenue maximization is one thing, but do you see any political factors at play?

MR. STEINBERG: Let's take one more.

MR. : Jack Bronze [ph], Nuclear Energy Institute.

You all have commented on how diversity or variety, as Churchill I guess would put it, was very important, but not until Jim Placke came up did anybody really mention the "N" word.

But after he said that, he said, well, there are some significant barriers, licensing and so on. The licensing as far as I know is probably not more difficult than pipelines or refineries, but the same with siting, but more importantly, what got everybody's heads nodding was this waste issue.

I would appreciate it if somebody could explain to me how, since all the nuclear waste is where it was produced and isolated from the environment, that is substantially is worse than the waste from the 90 percent of our sources that has just liberated the atmosphere.

MR. STEINBERG: Let's turn to the panel. I don't know whether we have enough expertise up here to speak to the nuclear waste issue, but I welcome any panelist who wants to go into it.

Why don't you go first and then you can slip out.

MR. WOOLSEY: I am going to apologize for leaving after I make remarks because Chris DeMuth has me up at AEI on another panel at 1:00.

First of all, on the issue of the Saudis being good guys, I think bad guys are potential good guys. We conquered Iraq. They adopted a democratic constitution.

I spent a week there about 2 weeks ago and was out in the Sunni Triangle and Shiite villages with American military commanders, and the Shia keeps saying, "The one thing we don't want you go do is let your military leave." This part of the world is potentially a wonderful, prosperous, democratic place.

It is just going to take us some time and effort for a lot of things to get changed, but there are allies in that part of the world, including in Saudi Arabia who want different types of societies than dictatorships. That seems to me to be part of the answer on the energy side is that the more stable and over the long run, the democratic and more oriented toward the rule of law the Middle East is, the better chance we have of having stable economies that aren't being disrupted by terrorists or by the next Saudi king, being somebody like the current interior minister.

I think a big part of the issue with technology that was raised here--and I must say, this is a question on which I at least have a rather different emphasis than Jim and Fiona--is I think that there are two separate problems.

The lights aren't going to go out, Jim, if we stop importing oil because the lights aren't powered. The electricity isn't produced by oil. We are down to like 2 percent or less producing electricity by oil.

We got two distinct problems here. One is oil dependence and the geopolitics of the Middle East that drives that, and those are the issues I was speaking to initially.

A whole separate issue is how do we produce electricity and what is secure or not secure and where should we go with the electricity grid.

My judgment is the big security problem, the national security problem, the electricity grid. It doesn't have anything to do with the fuel you use. It is a question of the grid's vulnerability, both the SCATA [ph] systems and the transformers and terrorist attack, hacking. It is even vulnerable to branches falling on wires in Ohio, as we found out last August.

If you are talking about producing electricity, I don't think we need to get so worried about LNG imports and natural gas and so on. My answer to Fiona's question is four words: coal gassification-combined cycle.

If you are producing gas-fired electricity now at roughly 6 cents a kilowatt hour because gas has gone up so much in the last few years, you are probably at the ball park of being able to do it for 5 cents a kilowatt hour with coal gassification in combined cycle. Then, you have got a system that permits you to sequester the carbon.

Coal gassification-combined cycle does everything you are going to be able to do positively with respect to most of the renewable, solar, wind, whatever, except that it doesn't sequester the carbon automatically, but it makes it a lot easier. It does raise the cost, and it is something we are looking at in the National Energy Policy Commission.

Two of my fellow commissioners, John Holdren and Phil Sharp, are sitting here on the front second row. They have forgotten much more about this issue of electricity generation than I will ever know. So questions about these issues seems to me on electricity can be useful directed to them, but the point is we don't have an overall energy dependence problem on the outside world.

For some decade or two or three here, we have got a serious problem with the Middle East, and the Middle East produces oil. We need to generate electricity. We got a lot of ways to generate electricity. Some have more strengths than others.

I happen to think coal gassification with combined cycle is the wave of the future, and it is something that ought to get a lot more attention than it has had so far, but the security issue, to my mind, is not importing LNG from Russia or anyplace else. The security issue has to do with the very vulnerable electricity grid we have gotten ourselves into and what we have to do to fix it.

The grid is sort of in the situation that some of my Russian friends used to say their own economy was in the early 1990's if they decided to change from driving on the left-hand side of the road to driving on the right-hand side of the road, but they decided to change the first year with the bicycles, the second year with the motorcycles, the third year with the cars, and the fourth year with the trucks.

[Laughter.]

MR. WOOLSEY: The electricity grid in between, its regulated and deregulated situation is in that kind of a mess right now. To my mind, that is our security problem with respect to electricity.

MR. STEINBERG: Thank you, Jim.

Let me just take the chairman's prerogative to comment on the Saudi issue.

I think the issue with the Saudis is not whether they are good guys or bad guys or whether their interests line up with ours, and I think there are some good guys and there are some bad guys there, but the main problem is that in some respects, our interest had been coincident with the Saudis because they have worried about their security and threats to their energy capabilities,

which we also share an interest in. So they have wanted a security relationship with us, and therefore, they have done some things to support it.

But they also wanted to sustain their regime, and so they have cut some deals with radical forces in their own society, which is not in our interests, the Wohabist leadership in their own society, which is not in our interest. So what we need to do is we need to move it to a situation in which the Saudi interest and ours are more in align because we cannot tolerate a world in which, in their pursuit of their self-interest, they are doing things which are becoming increasingly intolerable in terms of our own.

I think if you look at it that way and you don't try to figure this out in terms of good and evil and nice guy and bad guy, I think it leads more sensibly to sort of think about how we orient our policy.

Fiona?

MS. HILL: I don't really have too much to add to these. I think Jim Placke might be able to comment more on the Saudi motivations about price moderation. I don't know if you can think about the nuclear issue, but I just wanted to echo what you just said there.

I think the problem is in looking not just at the Middle East, but across most of the major countries that are energy suppliers. In fact, it sort of seems to be, with the exception of Norway, Britain, and a few other places, that oil and gas seem to be in some places that have some tricky political development problems.

MR. STEINBERG: Which is cause, and which is effect?

MS. HILL: I think, though, it is not necessarily the cause in many instances.

In fact, we will see this in the future if we look at some of the new states of the former Soviet Union, like Azerbaijan and Kazakhstan. Azerbaijan was, of course, the first major oil producer in the world. It was the boom city of Baku back to the times of Malfred Nobel [ph], but went into abeyance for an awfully long time. They are sort of starting off again.

I think, in a way, Azerbaijan and Kazakhstan have opportunities perhaps to prove whether things are cause in effect, and in actual fact, in looking at states like this, you will see that they are actually trying very hard to think about all of the issues that we are concerned about in terms of diversification in their economies. They are just running up with a problem. They have multiple transitions in moving away from being under the Soviet system.

So I think we have to separate all of these things out. There is a lot of complicated processes going on in many countries, and Saudi Arabia is suffering from many of the problems of decolonialization and the collapses still of the Ottoman Empire going back into a historical perspective.

We tend to see oil as the driving factor for most of the problems, and I think just as Jim Woolsey was trying to separate out the electricity sector, those vulnerabilities, structural vulnerabilities, we have to sort of separate out what is really going on in these countries away from the 800-pound gorilla of oil, which tends to focus our brains often in the wrong directions.

MR. STEINBERG: Jim?

MR. PLACKE: Let me follow up on a couple of things that Jim said. Unfortunately, he has departed.

First of all, the mention of coal gassification in combination with combined cycle technology, that really is a very definite prospect for the future, and that may well be one of our best alternatives. When I referred to increasing use of coal, as others did during this morning, that was really what that was a reference to.

Jim's discussion about the vulnerability of electricity grid, absolutely, nobody could question that, and that has nothing to do with fuels. That is a combination of regulatory and investment problems.

However, the LNG aspect in the short run, we are going to import more LNG, and if the present trends hold, say, through the rest of this decade and on into the next, it will be sufficiently important that it will be another supply security concern, even if we move in the direction of coal gassification technology and other things.

From that, let me take off to the mention of Fischer-Trope. The Fischer-Trope process, which is alive and well and living in South Africa, is one of several approaches to extracting liquids from natural gas and making gas into liquid fuels.

What you get--and for shorthand, it is GTL--it products a very, very pure product. It does not produce a product that you can put into your automobile or into your truck if it uses diesel. It something that can be combined with more conventional fuels that come out of the refining process and will help you meet emission standards and so forth, but by itself, it is not a

fuel. So, to talk about that as if it were a replacement for conventional gasoline or conventional diesel is a technological misunderstanding.

Finally, there are two things. The nuclear, I will take last because I know the last about it. On the question about what might have motivated the Saudis, I don't know that they led the effort, but they certainly were concurrent in it in agreeing that OPEC should reduce their output by another million barrels a day, beginning 1st of April.

Two things. The 1st of April is the beginning of the second quarter of the year. That is the quarter in which petroleum demand cyclically is at its low, and OPEC in its market management mode that I referred to in my remarks is trying now to anticipate, as they would need to, what has to be done to adjust supply to maintain prices in a certain band.

Do they always get it right? No, they almost always get it wrong, as anybody would because the supply system is so big, so complex, the Saudis, the Americans, nobody anticipated or can tell you today where is Venezuela going to go, how much political disruption is there going to be, and what effect will it have on oil supplies.

It has already been referred to this morning that that has had quite an impact on U.S. supply in the last series of political disruption in Venezuela and could well again. So there are always surprises that nobody can anticipate.

I guess my answer in why I don't think it is politically driven, there is an economic rationale to it, although it may not be entirely rational. Look at what OPEC does, not what they say.

The OPEC production almost always exceeds, sometimes by a very substantial margin, the nominal quotas. So they seem to have a price objective in mind. They are trying to manage the market around that objective. It is a very tricky thing to do. I am not sure they can succeed. Generally, they have failed in the past, but they are making the effort again, and as I have said, they have done pretty well with it for the last 4 years. So I think it is economics and not politics in this case.

Finally, on nuclear--and I am in an area here where I really have zero background, but from listening to what others have told me and what little bit of reading I have done over the years, the reason why disposal is such an issue there as compared to anything else that comes out of the broad spectrum of energy sources and particularly hydrocarbons is that the wrong exposure there can kill you fairly quickly.

Whereas, there is an argument to be made that breathing polluted air will have the same effect, but it takes a lot longer. So, therefore, it is just more dramatic, and I think it has a lot more political impact.

Given the history of how the nuclear age dawned with a bright light over Hiroshima, it always carries some additional political freight, and I think people have an allergic reaction to nuclear, especially because I think the public in general, and not unjustifiably, feels that it was misled by the statements of the '40s, '50s, and '60s about nuclear energy being the cleanest possible source being renewable, being low cost, and being all the things that ultimately it proved not to be.

I think it is going to be a hard sell to convince people that something has changed, and I don't know enough to assert to you that it has changed, but I think it is probably worth looking at.

MR. STEINBERG: Let's thank the panelists for a terrific presentation.

[Applause.]

THE BROOKINGS INSTITUTION

"GLOBAL CHALLENGES FOR U.S. ENERGY POLICY"

Economic, Environmental and Security Risks

Friday, March 5, 2004

[TRANSCRIPT PREPARED FROM AUDIOTAPE RECORDINGS.]

Conference Keynote Speaker
Kyle McSlarrow,
U.S. Deputy Secretary of Energy

THIS IS AN UNCORRECTED TRANSCRIPT.

MR. : [In progress]--going to hear out the contending interests and points of view and to advance a policy and to advance the policy of the Administration which is never easy under any circumstances in this town.

I have a particular regard for Kyle because of some of his previous experience, one, that of working on Capitol Hill. He had worked extensively on the Senate side with a distinguished majority leader, such as Bob Dole and Trent Lott. In case you don't know, I am a Democrat, so this probably carries a higher praise than what might otherwise be presumed kind of thing.

In particular, I find something for which he deserves a great credit is that he ran for the United States House of Representatives in 1992 and 1994. Now, I didn't win until my third time, so I am very sympathetic to anybody who is willing to stick their necks out and try to engage in the public policy process in that way.

So, we are very pleased to have with us Kyle McSlarrow, and I think it is particularly appropriate that we have now the administration and the people at Department of Energy work very hard. It is very hard in this country for either the media or the Congress to recognize the efforts that they make, so I want to particularly say we ought to thank them as public servants because the Department of Energy and the Secretary of Energy in particular play a very special political role in America, and that is, when gasoline prices go up, when natural gas prices go up, when oil prices, whatever it is, anything that gets the mass media and the public's attention, it is time for a public flogging, and administrations of both political parties and Capitol Hill forget who these people

are and send them out to take the flogging on behalf of the American--and then we flog them, then, the market gets itself straightened out, and we go forward.

So, they perform a very great service to a market America, and I want to particularly thank Kyle McSlarrow, more seriously for his very serious leadership of the Department of Energy.

[Applause.]

SECRETARY McSLARROW: Phil, thank you. I think it depends on the crowd whether or not what you said about me is praise or going to permanently damage me and my party, but I am going to assume for this crowd a somewhat bipartisan hue, so thank you very much, very gracious.

I couldn't help but think of when you were talking about the floggings and the inevitable political maelstroms that develop about price hikes, that Spence Abraham is fond of saying that, you know, when the price of gas or any other commodity skyrockets, it is his fault, and when it plummets, it is the market at work. So, somehow he and I have not yet figured out how to change that paradigm.

I appreciate an opportunity to be here. Obviously, there are a number of people in this room with whom I have worked very closely. It is good to see all of you, and I appreciate the interest in all these topics. I am going to try not to duplicate the other distinguished speakers that I have seen on the list. It is probably inevitable, I suppose, but I will try not to.

I would like to make a couple of observations about how we in the administration have approached and are approaching the energy challenges

that face the United States. Our approach really has a couple of fundamental elements.

First, our energy strategy is a global strategy. It has a healthy dose of self-help, of course, but we have an aggressive focus on international cooperation, as well.

Second, all the threads have to hang together, which is why it has to be a comprehensive approach. Those of us who are in the energy field tend to use the term "interdependency" in the context of energy security, and we know what we mean, we mean when the lights go out, we worry about whether or not there is an impact on the water system or in hospitals.

I can actually recall during the blackout on August 14th of last year that I was on the phone worrying about whether or not electricity is going to get to two refineries in Toledo that were critical for the Midwest supply, but there is actually an interdependency at a higher level than that among all the fuels and how we use energy, not just in this country, but globally that I would like to talk a little bit about.

The third, it has been our belief, and continues to be our belief, that an energy strategy has to be staged, that is, both the opportunities and the challenges have short, medium, and long term horizons.

Let me first run through the challenges we face, and I know Guy Caruso was here earlier, and as I said, I am going to try not to duplicate by running through a bunch of numbers, but let me just sort of hit some highlights.

The way I am going to approach this is to think about the problems and the opportunities in terms of fuels. Mentally, there may be aspects

to energy policy that that misses, but it captures a lot, as I hope I will have an opportunity to show you.

So, let's just start with oil, why not. You all are undoubtedly aware and have heard many, many times we are importing 55 percent, say, today, of our petroleum, and it is projected in 2025 to rise to 70 percent.

There are a lot of environmental issues associated with petroleum, and we are now in an interesting perennial but recently interesting debate about the status of reserves in the world.

On one hand, every time we have this debate, those of us who believe in a free market, are usually proved right because price signals do actually spur more production, so in the one sense, I take with a grain of salt those who are worrying that right around the corner is a massive falloff in our ability to produce globally.

On the other hand, there have been some interesting debates, and people have probably read about the debate with Matt Simmons and Saudi Aramco about the state of Saudi reserves.

What is interesting to me is, without taking sides, that for all of the forecasting, you know, if you go to EIA and you say show me where the oil is going to come from, they can show you where all the oil comes from out 20, 25 years.

If you actually go to each one of those countries and you add up what they think they are going to produce, it doesn't really add up too well after about 15 or 20 years. We are running out of oil. As I said, I think price signals

matter a lot, but it is an environment that is probably much more challenging than I think people understand today.

The other aspect to it is that the mix of imports is going to change. I think most people know that OPEC's share of imports hit a peak of 70 percent of our imports in I think 1977. It fell to about 40 percent in 2002, but it is forecasted to go back up to about half our imports over the next 20 years, and if you actually focus on Persian Gulf producers, the same phenomenon occurs. It was higher, it has been lower in recent years, and now it is forecasted to go back up.

The other aspect to the mix of imports is because we don't really expect any new grass-roots refinery facilities. The existing ones will expand, but no new grass-roots refinery facilities to be built.

Refined petroleum products will be an increasing percentage of imports. Today it is about 13 percent, and that is probably going to double in the next 20 years. Why is this important? It is important because increasingly, given all the specs that we place on refined products, increasingly, other people outside the United States are going to be responsible for, and have control over, how those supplies make in the market.

I don't necessarily know what that means, but it means something, and it is something we have to keep an eye on. If you take natural gas, switching away from oil, we are all aware that natural gas is the fuel of choice for electricity generation.

What that has meant in recent years is the traditional double hump that we had of electricity generation and usage in the summer, and then

the same thing occurring in the winter for home heating or heating in general, is starting to smooth out as increasing numbers of natural gas-fired plants are coming on line and you are starting to have just a lot of demand all year long.

Traditionally, people worry about whether or not we have 3 tcf in the ground at the end of the storage season on November 1st. Big debate going on right now whether or not that is actually a relevant number, and last year was kind of a scare that we have gotten through okay this year, but all of this is just a harbinger of what Alan Greenspan, the National Petroleum Council, the Energy Information Administration, and a host of others have said for the last several years, which is we have got declining production in the United States.

More than that we have got declining production in Canada, which has in recent years supplied about 15 percent, and most people assume at some point we are going to have the Alaska Gas Pipeline, most people assume that we will build on our existing four LNG facilities, but both are challenges in and of themselves.

There is a huge debate in Congress on the energy bill about what kind of incentives would be supplied for the gas pipeline, and as we have seen recently with LNG facilities, that is not slam dunk either.

The interesting thing is if neither of those things comes to pass, you can add another buck 20 to the already high forecasted wellhead price in 2020. So, we are living through a very high baseline in terms of natural gas prices, and there is hardly any scenario that suggests that it gets much lower, and there are quite a few that suggest it gets worse.

Coal, pretty straightforward. We have got 250 years of reserves. This is our ace. We only have one or two or perhaps three problems, and they all start with the word "environment." We know what the challenges are that we have to confront, and we know that the uncertainties surrounding those challenges is itself an impediment.

Nuclear power, obviously, what do we do with the waste is a huge issue. The industry has had trouble figuring out how to jump-start new builds with what we tend to call generation three and a half, that is, technology that is available, designs that are available and being built other places, but not yet in the United States.

They face a lot of uncertainty of regulatory and licensing regimes, and in recent years, trying to come to grips with what a new build means in the context of moving from a regulated environment, when it was a little more straightforward on how you would recover your return on capital to a competitive environment is something that has yet to be straightened out.

Then, you overlay all of that with concerns about safety and nonproliferation depending on the fuel cycle that you might be talking about. If all of that wasn't enough, this all takes place against a backdrop of uncertainty of investment in infrastructure especially in electricity transmission, uncertainty of the regulatory environment, and uncertainty about where we are and where we want to go in terms of competition, whether it is electricity or others, all of which is locking up capital.

So, that is the backdrop. So, what do you do? Well, you could start with the short term and just work forward, or you could start with the long

term and work backward, I suppose. You can't ignore the political dimension of the short term. We were just talking about the gas prices in recent weeks and obviously, what is being forecasted to come in April and May.

I have to say, though, I am sure a lot of you have read--I think, Dan, you even spoke earlier, right--probably most of you have read The Prize. I read it a long time ago and then re-read it after about a year of being at the Department of Energy. I have to say when I got to the part, which I had forgotten about, where about 50 years ago, he writes about the gasoline price spikes and then the inevitable investigations on Capitol Hill, I had to laugh out loud that we have just been doing this over and over and over again. It seems to work for everybody, right?

But it highlights in my mind the fact that these really are long-term systemic issues, they have to be approached that way. Of course, we have to approach both, the short term and the long term. You are just not going to be able to skip over and say, hey, we will get back to you in 10 years, we are going to have to do things along that front, but we have really tried not to miss the long-term nature of these challenges in terms of developing the strategy.

I would say that as we pursued both the short, medium, and long term, we have really tried to use a phrase, that is sort of a catch phrase that people have used, which is a diversity of supply and a multiplicity of fuels. It kind of rolls off the tongue, but it does capture in some sense what it is that we have been trying to do.

So, in the short term--and I will get to the energy bill in a minute--when you focus on oil, what I think about when I think about oil is today,

where probably the goal of production is about 82 million barrels a day, it is roughly 78 to 82 depending on the time of year, and that means that in terms of spare capacity, that capacity that is available, but not being used in the world, if you look back five years and you look forward five years, and assuming the forecasts are roughly accurate, I think beyond those points of time they might not be, but I think within that band, they probably are, you are talking a maximum of spare capacity of 4 million, maybe 5 million barrels a day, often, as is the case right now, maybe 2 or 3 million barrels a day.

That is an important point because when we think about what it is we are trying to do, often people think that what we are trying to do is throw the long ball and figure out how we are going to find 10 million barrels in one field that can produce 10 million barrels a day.

It is not going to happen obviously, there is no field like that, but the point is on the margin, where we can make a difference is the effect on spare capacity, because obviously, Saudi Arabia is the swing producer, but as more of the non-OPEC producers are entering the mix, the more on the margin you can affect the ability to ensure supply and you can affect price, so it matters a lot.

So, when you say you can bring a million barrels a day onto the market, the right comparison, in my view, isn't a million barrels vis-a-vis 80 million barrels, it's 1 million versus 4 million of spare capacity, that is, 25 percent of spare capacity has been brought on line, so these numbers may sound small in some context, but in other contexts are hugely important.

So, therefore, we have immediately--and this is a continuation of the policies of the previous administration, at least on the international front, we

have been very aggressive about working with Russia, and in the Caspian, we have been very aggressive in West Africa. Obviously, this is industry, industry mostly, but it does matter in terms of the government-to-government discussions about how we can address investment.

There are some real opportunities that we are pursuing now, and there has been some good news. A lot of uncertainty right now obviously in Russia, but over the last two years--and I say this as somebody who has served as the U.S. co-chair of the Russian-American Energy Working Group--I think we have seen a lot of new opportunities whether it is in the Northwest in Murmansk, the Shtoteman [ph] gas field Timomperture [ph] or in the East with the Sakhalin Islands, a lot of things are happening, a lot of good things are happening, and some of the obvious challenges that have been there for the last few years is still going to be present and we just have to work through them, but I feel good about how we are moving forward.

The interesting point about new oil, if you will, is really what the role is for Canada. Dan Yergin and I have been laughing for the last couple of years because two and a half years ago, it seems like he and I were the only two people who would continually list the Oil Sands, about 180 billion barrels, as real reserves, and now increasingly, it is starting to slip in there, so now you are starting to see Saudi number one at 250 billion barrels, Canada next with 180, and then Iraq with supposedly 112.

There is still technological challenges to go there, but you can imagine for the United States, if and when the Oil Sands really open up as an opportunity, that is a huge important part of our energy portfolio with our next-

door neighbor and is something that we in the North American Energy Working Group have been focused on.

So, we have done it on the international side. We in the administration also said we need to do more on the domestic side, so we have been pushing ANWR, and all of you can probably attest to the success of that so far, but as I said before, the significance of ANWR, and I think it has been unfairly treated in a number of ways, but for the purposes of today's discussion, unfairly in one narrow sense, is that it really could make a big difference when it comes to the spare capacity in the global market, and it is not anything to sniff that. It doesn't matter where you come out in the debate on what the size of the reserves are. Even if you just take the median estimates by the U.S. Geological Survey, there is still a heck of a lot of oil and important.

So, we are not planning on giving up, but it obviously has not been greased very well out there on the Hill. We also can't forget about energy efficiency, and this administration right off the bat asked Congress to lift the moratorium on doing something about fuel economy standards. We have actually proposed increases on light trucks, and we have moved forward pretty aggressively on trying to fund the research and development that goes into hybrids both in terms of the R&D dollars that we spend at the Department of Energy, and also by proposing tax credits that would deal with them.

The next way we have tried to address the challenges is we have thought about this in terms of reducing the pressure on natural gas. Now, that happened several ways, one, figure out how to produce more, the other is how to figure out not to use it so much.

We are in this very odd position where, for environmental reasons, we have driven people--after the Hughes Act--we have driven people toward the use of electricity generation and for environmental reasons, whether or not we are placing moratoria on drilling, on E&P, or what have you, we are keeping people at bay from finding it, so it is sort of this odd policy situation.

We tried to reduce the pressure in short term by streamlining the regulatory side, by helping make the possibility of expansion of LNG facilities more likely, that is, FERC's decision on open access that they made, I think it was a year a half ago now, for new terminals, which would encourage investment in LNG facilities, but obviously, there are other concerns as I mentioned before.

We just saw within the last week what happened to Marathon's project in Baja, California. That is not going to be the last LNG facility that runs into challenges, and we are just going to have to work through them.

But there are a lot of other things that affect natural gas, as well. The administration's Clear Skies proposal, renewable tax credits, electricity reform, all of them are important in their own right, but the interesting aspect to them is they all have, to one degree or another, some effect on the use of other fuels and lessening the continued just almost myopic focus on the use of natural gas when it comes to electricity generation.

On nuclear power, obviously, Congress has approved moving forward on Yucca Mountain, but the real news in terms of the short term is the continued success of up rates and the continued success of relicensing before the NRC.

So, that is kind of the short-term activity, but ultimately, when thinking about the future, we decided we wanted game changers, long-term challenges and solutions with potentially payoff that required decisions today, and this is where I think this interdependency of fuels is acutely important.

If you think about power generation and if you looked out, say, 50 years, and you said what is it going to look like or what could it look like, I think our answer for the administration would be potential fusion, a long way off, but it is why we joined last year, ITER, the International Thermonuclear Experimental Reactor, which is an international consortium.

We think something has fundamentally changed in the last decade that allows us more confidence in moving toward what essentially is a burning plasma to produce fusion power. That something, by the way, is actually computer power, and our ability to model and simulate things in a way that gives us a lot more confidence.

So, that would be way out there, and in the medium term, for power generation, we still believe we need a strong role for coal, so we proposed FutureGen, which is a billion dollar, 275-megawatt reactor that is designed to gasify coal, produce hydrogen, allow us to sequester carbon, and it is something that the President announced last year, and over the next 10 or 15 years, we are going to try to build this plant. At the end of the day, it is something with zero emissions.

Our believe is coal has to be in the mix. The idea that we can walk away from coal, given the reserves that we have in this country, when we

do have the technological ability to confront what are admittedly tough challenges is we think foolish.

So, we are going to go for it, we are going to try to produce what we think will have to be the future of coal in the country. We think we have to have a strong nuclear mix, and that is why, in addition to trying to help with regulatory and licensing challenges that we have had over the last really 20 years, we are also going to continue looking past just the designs we have today and looking toward what we call "generation 4 designs," and looking at advance fuel cycle all with the goal really of trying to achieve low cost uses of nuclear energy that are both safe and proliferation resistant.

We are going to continue focusing on renewable and energy efficiency. The interesting thing is that our budget requests for renewable energy and energy efficiency at the Department of Energy since we have come in and each year been more than the combination of fossil and nuclear energy combined. I am not sure exactly what that means, but I do know that it is a little bit different than is often printed in the papers, and there is a reason for it, not because I just love renewables, but because I think the government's role in trying to get the cost down for renewables is a completely appropriate one, whereas, I suspect oil and gas is a lot more mature.

I think that is where we actually do our best work, so we are focused on the kinds of basic and, in a lot of cases, applied scientific R&D, to try to do everything we can to make these technologies work in the free marketplace.

Finally, in the short and medium term, we obviously do think it is important to move forward with LNG and the Alaska Pipe Line, but we would also add in gas hydrates as a promising avenue for R&D. We are not exactly sure where it takes us, but it is one of those things where the numbers are so huge about the gas that is involved, that if you had a payoff, it would really be huge.

So, that is power generation. So, now think about transportation. The relationship between domestic and foreign sources of energy is not often well understood, but it is particularly not well understood in the context of the relationship of electricity generation and the transportation sector.

Here is what I mean. I just ran through all these electricity generation sources. Nuclear provides about 20 percent, coal provides 50 percent, renewable energy is a portion, probably 10 percent if you are including hydro power, natural gas is in the 20s, but increasing.

Then, you took over to the transportation count, right, it's all petroleum. What we are trying to do when we talk about moving to a hydrogen economy is more than just talking about how we move to a cleaner environment. That is obviously a hugely important point, but for the purposes of today's discussion, it is about something different, which is hydrogen is an energy carrier, it is not a source. It has to be produced.

Right now, on one side of the count, on transportation, it is all oil and it is increasingly imported. Now, I don't know that there is ever going to be a consensus on what is too much imported oil, but I have yet to meet anybody

who actually thinks 70 percent imported oil is a good thing for this country or for any country. You just can't put all your eggs in one basket that way.

So, what we are trying to do with hydrogen is essentially to shift from the domestic production, which we have loads of, whether it is coal or nuclear or renewable energy or natural gas, once you get everything else into the mix, and use that, not just for the production of electricity, but for the production of hydrogen, too.

The good news is you can do that. For example, he FutureGen plant that I was just talking about is designed, not just to show that we can burn coal cleanly and produce electricity, it is designed to separate the hydrogen, as well, which you can then use in the transportation side.

We are also pursuing the next generation reactor, a very high temperature reactor, which is going to essentially just crack water and produce hydrogen up at our Idaho National Lab, because we think there again there is a significant role for nuclear in the future, and if we can combine that role with the role of producing hydrogen, so much the better.

That is really what is going on with the hydrogen economy is a fundamental shift both to make the production of energy cleaner, and also for us to make it more secure.

There are a lot of challenges, and I don't mean to gloss over them, but in the interests of time, I will just say that the National Academy of Sciences just did a report on our road map and our pathway on hydrogen.

They had some recommendations on how we might change things, which is fair and in many cases we will probably do that, but they also essentially validated the road map, and we are very pleased by that.

The last point on that, that I will say, is that in all of these things, we are not doing it alone. On the generation 4 future nuclear plants, we are working with a consortium of international countries. Obviously, ITER is an international consortium, but we have also established the Carbon Sequestration International Forum for people to participate both in sequestration technologies, and if they want to, in the FutureGen plant.

Last year, we also established the International Partnership for Hydrogen Economy, so we could leverage the work particularly that is being done by the EU, but other countries around the world who have an interest in hydrogen and in fuel cell work, so that we are not all duplicating each other's activities, and we can leverage it and focus on things, sort of the mundane but important things like establishing codes and standards, so we can actually build an infrastructure.

So, if I could just summarize the points that I was just making, I would say what we focused on is we are trying to create power and transportation fuels at the same time, we are trying to maintain a diversity of fuels and enhance flexibility or even fuel switching.

We obviously seek to promote our energy security. We are trying to use our competitive advantage, which is technological solutions to complex problems, and we are trying to leverage international partnerships.

Let me just close with the point, since it would be odd if I didn't say anything about the energy bill, and just say this. We really do have to act this year. Congress needs to pass an energy bill.

I don't know how it is that members who are trying to hold up an energy bill can explain to their constituents the price spikes that have gone on for the last three years, whether it is gasoline to natural gas to home heating oil, and then we start all over again, and we know it is not something that is going to be fixed in the short term, we know it is a long term.

We know the energy bill won't solve all the problems, but it is going to get us down the road toward addressing them. I don't know how they explain that. I don't know how they explain to constituents who suffered the blackout in August 14th. I don't know how they explain to people in the chemical, fertilizer, and aluminum industries who lost their jobs and had wipeouts because of the high price of natural gas in this country.

I don't how they explain to the poor who pay a higher proportion of the energy commodity process than anyone else. There are fair grounds for debate about what the energy policy must be with the idea that we have gone all this time, and worked bipartisanly, and haven't yet done a bill, I think is unacceptable.

It also needs to be comprehensive. Some want to pick, you know, cherry-pick energy policy, and, of course, we all have our pet projects and our pet peeves, but it really is true, you know, the old canard, you walk down all the fuels, nuclear is too dangerous, coal is too dirty, wind energy kills birds, solar uses up too much land, you know, hydro kills fish, we just go on and on, and

there is not a single energy use or source that doesn't have an advocacy group against it, and if you listen to all of them, of course, we would get nothing done.

Our view is we need it all. It is interdependent, as I hope I have shown a little bit today, but we need more energy. We need more choices and flexibility, we need it to be cleaner, and we need to use it more efficiently.

Of course, all of this is a hugely complicated subject, and that may be one reason why it is so hard to get people to act, and that is why I personally am very grateful for all of you who have come together to help us think through these problems, so thanks for having me today.

[Applause.]

MR. : I want to thank Secretary McSlarrow very much for being with us this afternoon. Now, I turn it over to David Sandalow.

THE BROOKINGS INSTITUTION

"GLOBAL CHALLENGES FOR U.S. ENERGY POLICY"

Economic, Environmental and Security Risks

Friday, March 5, 2004

[TRANSCRIPT PREPARED FROM AUDIOTAPE RECORDINGS.]

PANEL 3:
ENERGY AND ENVIRONMENT: HOW CAN WE MEET GLOBAL ENERGY NEEDS WHILE PROTECTING THE GLOBAL ENVIRONMENT?

Moderator:
David Sandalow, Guest Scholar, Brookings

Panelist 1-Climate Impacts of Projected Growth
John Holdren, Teresa and John Heinz Professor of Environmental Policy, Harvard University, and Co-Chair, National Commission on Energy Policy

Panelist 2-Integrating Energy and Environment: An Economic Perspective
Robert Hahn, Executive Director, AEI-Brookings Joint Center

Panelist 3-New Approaches to Global Cooperation
Nigel Purvis, Brookings Scholar on Environment, Development and Global Issues

THIS IS AN UNCORRECTED TRANSCRIPT.

MR. SANDALOW: Hi, everybody. My name is David Sandalow from the Brookings Institution.

Some of you might remember a movie from several years ago called "The American President." It was a hit movie, a Michael Douglas, Annette Benning romance, and some of you might even remember that this is a movie in which Michael Douglas played the president and Annette Benning was an environmental lobbyist, and her cause in this movie was global warming. As Michael Douglas was wooing her in this movie, the words "20 percent emission cut by the year 2020" passed Annette Benning's lips, so it was for those people that work on global warming, a very exciting experience.

Around the same time as this movie came out, there was another movie called "Water World," which was a Kevin Cosner action flick. The premise of this movie was that all the ice in the world is melted, the continents have been submerged, and the only thing the survivors have left to do is ride around in fast boats and shoot each other.

For those of you who have seen it, you know it was a truly sensitive treatment of an important social issue.

Now, we learn in some newspaper articles in the past week or so that Hollywood is once again turning its attention to the issue of global warming and in the spring will release a major new disaster movie in the tradition of Armageddon and Deep Impact, and if you go back a ways, the movie Poseidon Adventure and others.

In this movie we understand because of global warming, vast tidal waves will sweep through lower Manhattan, which will alternately then bake and freeze, and all kinds of other mischief and mayhem will occur.

Well, all of this certainly gets attention to the issue of global warming, but global warming is much more than a Hollywood hype. Global warming is also obviously an issue of tremendous importance and one of the great public policy challenges of our time.

It is an issue that this morning was called "the big elephant in the room," and it is an issue which we have this afternoon a very distinguished panel to help us address.

Global warming is challenging for at least three reasons that I would highlight, and the first if the mismatch between political and natural time scales. If you ask the vast majority of earth scientists what they think about global warming, are they concerned about it, they will tell you, as John Holdren will elaborate in a few minutes, that yes, they think this is a very serious problem.

If you ask why, they will say, well, among other things, as a result of the rise of greenhouse gas emissions, we expect temperatures to increase during the lifetimes of people born today, somewhere between 2 1/2 and 10 degrees Fahrenheit. That, by way of comparison, is roughly the same difference between today and the end of the last Ice Age, at which point glaciers were over much of the northern United States, and that change in temperature of that magnitude going in the other direction over the course of nearly a century is a very serious thing indeed.

So, then you go to your average politician and you say I have got a problem for you to worry about. During your next election cycle, the average temperature of the planet is going to increase by 0.2 degrees Fahrenheit, and furthermore, the science isn't quite well developed enough yet to tell you exactly what the impact is going to be in your district, ma'am, and you can see why it really takes an extraordinarily political vision and leadership to address this issue.

Then, the politician asks what can we do about it, and you describe the possible solutions, and there are many of them, and it turns that numbers of these solutions involves quite significant tinkering with the global energy infrastructure, and that, as Bob Hahn, of AEI, will tell us, inevitably raises cost concerns, which is the second reason that global warming is such a challenging public policy issue.

As Bob I think will explain, global warming presents a textbook case of externalities. The cost of greenhouse gas emissions are by no means fully internalized in energy production consumption of the cost of other goods, and economists have very well developed recommendations as to how to address externality problems like this.

Those recommendations are not always well received in the world or real interest group politics, leading to a lot of complicated sorting out of possible policy solutions.

So, a third reason that global warming is challenging is its international dimension, as Brookings Scholar Nigel Purvis will discuss today. Not only is the atmosphere of global commons and any attempt to limit

emissions inevitably raises free rider problems if the whole world isn't involved, but there are hugely varying national circumstances among all the participants in this dialogue internationally.

We have the average American emits about 8 times the amount of greenhouse gases as the average Chinese person, about 12 times the emissions as the average Indian, however, it is in precisely those countries, China, India, and other growing developing countries, where the vast growth of emissions will take place over the next several decades, and those facts have made it extraordinarily difficult to come up with global solutions deemed equitable for the world, as a whole.

So, global warming is very challenging, but, of course, that doesn't mean that it should be ignored. Quite the contrary, the world has met many great challenges over the course of the past century from the defeat of fascism to the defeat of Soviet communism, finding a cure for polio, putting a man on the moon, and surely, this is a challenge with the right type of attention we can meet as well.

I think if you look back at those other challenges that we have succeeded in addressing, common elements of our success have been societal commitment, they have been attention from leaders and thinkers across a wide range of disciplines, and they have been a vigorous exchange of competing ideas, and there is no lack of that vigorous exchange on the global warming issue.

So, before I turn this over to Professor Holdren to talk a bit about the science of global warming, let me just make one more point. Today's topic

is actually described in the agenda as Energy and Environment: How can we meet Global Energy Needs While Protecting the Global Environment?

Of course, global warming is only one of the important environmental issues that energy production and consumption causes around the world, and the tyranny of the clock prevents us from getting into the other issues in any detail in today's session, but I would just highlight, of course, a number of other important environmental issues associated with energy production and consumption.

They include local air quality and health impacts as a result of the emission of particulates from coal production in many countries, wood-burning in many countries. They include very significantly the impact on biodiversity from energy infrastructure, energy production infrastructure in tropical forests and marine ecosystems around the world.

They include oil spills. It was only about a year ago that we had a terrible incident off the Spanish coast from a ship that went down, and it is still leaking oil from the bottom of the sea off the Spanish coast.

So, there are a whole host of issues which one could get into, and we can talk about those in the question and answer session if anybody would like.

All of these issues, by the way, have been receiving attention in a very interesting context lately, which is at the World Bank, where there is a very interesting exercise going on right now called the Extractive Industry's Review.

An outside panel has recommended to the World Bank a number of very important steps in addressing its energy funding over the course of the next several decades.

That panel has recommended that the Bank phase out investment in new oil projects by 2008, and it has also recommended to the Bank to set actually hard targets for renewable lending of 20 percent, which is an interesting idea that even Annette Benning might endorse.

It is my extraordinary pleasure to be able to introduce Professor John Holdren, the Teresa and John Heinz Professor of Environmental Studies, I believe at Harvard University. Somebody told me that limiting John to a 15-minute presentation should be considered a criminal act, but, John, it is great to have you here.

MR. HOLDREN: Thank you very much, David. I am going to try to cover a lot of ground in the 15 minutes with my usual measure of talking twice as fast as if I had been planning to do it in half an hour.

I have a budget for the talk. The question is whether deficit spending is avoidable. I am going to spend five minutes on the broader energy environment economy nexus before getting more deeply into the climate change issue, which I call the Energy Climate Challenge, and I will spend a few minutes at the end talking about uncertainty, controversy, and prudence in the context of the climate change issue.

Starting with the energy-environment-economy nexus, I think we all understand that energy in convenient and affordable forms is an

indispensable ingredient of economic progress. The problem is that energy is also a major cause of many of the most difficult environmental problems.

Indeed, a remarkable share of the most difficult of environmental problems at every level of economic development from the damage that the very poor do to their immediate environments, and therefore do to themselves, to the damage that the very rich do to global environmental systems, and thereby damage everybody, a remarkable share of those problems arise from the harvesting, the transport, the processing, and the conversion of energy.

I agree with many of the speakers this morning we are not about to run out of oil. A more interesting question is whether we are going to run out of environment. Energy supply is the source of most indoor and outdoor air pollution, of most radioactive waste of much of the hydrocarbon and trace metal pollution of soil and groundwater, of essentially all of the oil added by humans to the seas, and of most of the human emissions of greenhouse gases that are altering global climate.

Those environmental problems are much more the nuisances, the integrity of environmental conditions and processes is no less a pillar of human prosperity than the integrity of economic conditions and processes or the integrity of sociopolitical ones. We need all three legs of that stool to have a prosperous and functioning civilization.

The World Health Organization has estimated that the more easily quantified environmental problems alone were contributing about 15 percent of global mortality in the year 2000. Swiss Re estimates that climate-related disasters will be costing the insurance industry in the range of 30 to $40

billion annually within a decade, and that the additional uninsured losses will exceed 100 billion annually.

Let me just show you the World Health Organization's 2002 report figures on global mortality measured in millions of years of life lost, so one considers not only premature deaths, but how premature they are, and the environmental ones where we don't call tobacco and alcohol environmental problems.

The environmental ones are in red, and they add up to about 15 percent of the total. Because the environmental characteristics of the energy resources and technologies that we are depending on today can, as a general matter, only be changes slowly and at considerable cost, the dilemma that is posed by energy's dual role in economic prosperity and environmental disruption is not an easy dilemma to resolve.

In light of all of this, in fact, I suggest that energy is the core of the environment problem, that environment is the core of the energy problem, and that the energy-environment-economy nexus is the core of the sustainable prosperity problem for industrialized and developing countries alike.

Now, let me turn to the climate dimension of this issue in a nutshell. I suggest that the problem of disruption of global climate by human-produced greenhouse gases in the atmosphere will come to be understood in the next decade or so by publics and policy-makers alike as the most dangerous and most intractable of all of the environmental problems caused by human activity.

It is the most dangerous because climate is the envelope within which all other environmental conditions and processes operate. Distortions of

the envelope of the magnitude that are in prospect are likely to so badly disrupt these conditions and processes as to impact adversely every dimension of human well-being that is tied to environment, and that is most of the dimensions of human well-being.

The problem is intractable because the dominant cause of the disruption, emission of carbon dioxide from fossil fuel combustion is arising from the process that today supplies nearly 80 percent of civilization's energy, and it is intractable because the technologies involved in doing that cannot be quickly or inexpensively changed or replaced in ways that would eliminate the difficulty.

Sometimes I amplify on this point by noting that the capital investment in today's world energy system, the overnight cost of replacing it if you had to, is in the range $12 trillion. That investment ordinarily turns over on a time scale of 30 or 40 years. We could not make it turn over a great deal faster than that and afford the cost.

Most current policies and practices moreover, whether they are of governments, of firms, of consumers, or investors are either actively contributing to driving up the risks we face from human-induced climate change, or if they are aimed at abating those risks, are falling far short of what would be need to reduce the risks significantly.

Let me look at this in a little more detail. First of all, why exactly is it that climate matters so much. We first have to ask what climate is. Climate consists not only of averages, but also of the extremes of hot and cold, wet and dry, snow pack and snow melt, winds and storm tracks, ocean currents and

upwellings, and not just how much and where, but the timing of these phenomena.

Climate governs the productivity of farms and forests and fisheries, the geography of disease, the livability of cities in summer, the damages to be expected from storms and floods and wildfires, property losses from sea level rise, expenditures on engineered environments, how much of the environment we have to air condition, how much we have to dam and dike, and the distribution and abundance of species.

The evidence for recent unusual climate change-- and I will go through quickly because you have all I think heard it before--the average temperature of the earth is clearly rising, up in the range of seven-tenths of a degree centigrade in the last 140 years according to instrumental records, that means thermometers. Nineteen of the 20 warmest years since 1860 have occurred since 1980.

The 11 warmest, now the 12 warmest--this is already out of date because the figures are in for 2003--the 12 warmest years in the last 133 have occurred since 1990. 1998 was the warmest year in the instrumental record, probably the warmest year in 1,000 years according to tree ring and ice core records, 2002 was the second warmest. We now know that 2003 was the third warmest.

The last 50 years appear to have been the warmest half-century in 6,000 years according to ice core studies. Compilation of worldwide ocean temperature measurements shows significant ocean warming between the mid-50s and the mid-90s.

Observations over the last few decades also show that as one would expect in a warming world, evaporation and rainfall are increasing overall, not everywhere, but on the average, more of the rainfall is occurring in downpours, permafrost is melting, corals are bleaching, glaciers are retreating, sea ice is shrinking, sea level is rising, wildfires are increasing, and storm and flood damages are soaring.

The smoking gun is that essentially all of the observed climate change phenomena are consistent with the predictions of climate science for greenhouse gas-induced warming. No alternative culprit that anybody has identified so far, no potential cause of climate change other than greenhouse gases yields this fingerprint match.

A credible skeptic would need to explain both what the alternative cause of the observed changes is, and would need to explain how it could be that greenhouse gases are not having the effects that all current scientific understanding says they should have. No skeptic has done either thing.

The consequences of continued business as usual, the scientific consensus best estimates are that continuing business as usual greenhouse gas emissions, what would arise from the projections that we saw this morning, will lead to increases of 2- to four-tenths of a degree centigrade per decade in the global average surface temperature, or 2 to 4 degrees centigrade warmed than now by 2100, and this is important, mid-continent warming will be 2 to 3 times greater than the global average.

The earth will then be warmed than at any time in the last 160,000 years. Sea level will be 20 to 100 centimeters higher than today, best

estimate 50 centimeters, and this global average warming will entail changes in climatic patterns in storm tracks, distribution of precipitation and soil moisture, extremes of hot and cold. Climate is not just about the average temperature.

Because of the pace and the magnitude of the changes in climatic patterns, and because society's interactions with the environment are attuned to the current climate, the impacts on human well-being will be far more negative than positive.

I note at the bottom that the full range of the Intergovernmental Panel on Climate Change scenarios, which include lower emissions scenarios than the business as usual forecast to which these numbers apply, and also higher emissions scenarios, gives an even wider range of temperature possibilities.

The Intergovernmental Panel on Climate Change 2001 Working Group--it should actually say, yes, it is Working Group 3 report on impacts--projected adverse impacts based on models and other studies include the following: a general reduction in potential crop yields in most tropical and subtropical regions for most of the projected increases in temperature; a general reduction with some variation in potential crop yields in most regions on mid-latitudes for increases in average annual temperature of more than a few degrees centigrade; decreased water availability for populations in many water sparse regions particularly the subtropics; an increase in the number of people exposed to vector-borne diseases, for example, malaria, and water-borne diseases, for example, cholera, and in increase in heat stress mortality; a widespread increase in the risk of flooding for many human settlements, tens of millions of

inhabitants in the settlements studied from both increased heavy precipitation events and from sea level rise; increased energy demand for space cooling due to higher summer temperatures.

Of course, the picture is not all bad. Working Group 3 of the IPCC said there are some projected beneficial impacts based on models and other studies including increased potential crop yields in some regions at mid-latitudes, for increases in temperature of less than a few degrees centigrade, a potential increase in global timber supply from appropriately managed forests, increased water availability for populations in some water-scarce regions, for example, in part of Southeast Asia, reduced winter mortality in mid- and high latitudes because it is not as cold anymore in the winter, and reduced energy demand for space heating due to higher winter temperatures.

But most studies to date of the adverse and beneficial impacts of climate change have focused on just a doubling of pre-industrial carbon dioxide, not because we are going to stop there, but for comparability among the different studies that are being done.

Alas, under business as usual, under the kinds of forecasts that we have been discussing here today, we will careen past the doubling around mid-century, heading for a tripling by 2100, and a quadrupling soon thereafter.

At those higher levels of greenhouse gas forcing and the resulting climate disruption, early positive impacts get reversed, negative ones grow beyond manageability, and unpleasant surprises become expected surprises.

What are shown here--and I am sure it is a little hard to read, but I will explain the graphic--these are computer simulations performed by the

Princeton Geophysical Fluid Dynamics Lab to compare the warming expected under a doubling of carbon dioxide from the pre-industrial level with the warming expected from a quadrupling, which again is where we are headed under business as usual.

The doubling is on top, the quadrupling is on the bottom. The temperature scale is Fahrenheit, yellow to orange is 5 to 15 degrees, the red to dark brown is 20 to 25 degrees Fahrenheit average increase. The quadrupling on the bottom, that is a roasted world.

The kinds of unpleasant surprises that could be encountered, large increases in the frequency of highly destructive storms, drastic shifts in ocean current systems that control regional climates, multimeter sea level rise over a period of centuries from the disintegration of the West Antarctic ice sheet, runaway greenhouse effect from decomposition of methane clathrates.

They are indeed one of the biggest energy sources out there. They are also one of the biggest reservoirs of a very dangerous greenhouse gas out there. Such runaway greenhouse effect would drastically increase the severity of all the expected impacts, as well as the probability of big surprises.

Now, it needs to be emphasized these outcomes are all possible, but none can be assigned a probability with confidence at the current state of knowledge. There is a lot that we don't know, and the mistake that many make is to assume that we don't know our ignorance is a reason for complacency. It is not a reason for complacency.

What are the options for corrective action? There are basically five possible approaches. Reduce the emissions of greenhouse gases, No. 1. No.

2, remove greenhouse gases from the atmosphere. You can do that by growing more trees or growing more phytoplankton, or if you had enough money, by technological means.

No. 3 is to try to counteract the climatic effects of greenhouse gases in the atmosphere by geotechnical engineering, trying to tinker with the system to offset the effects of the greenhouse gases.

No. 4, you can adapt to greenhouse gas-induced climate change, dams, dikes, change the patterns of agriculture, better medical care for tropical diseases, and on.

No. 5, you can compensate the victims.

We will surely do on the list 2 and 4 and 5 in considerable measure. We are already doing a lot of adaptation, we have no choice. We will do more. We might or might not do geotechnical engineering, No. 3, depending on whether we learn enough about it to become confident that we will do more good than harm.

But Nos. 2 and 5 together cannot avoid the need for No. 1, adaptation becomes costlier an less effective as the degree of climate disruption grows. Emissions reductions are essential. The question becomes by how much must emissions be reduced and what would such reductions entail in the way of improvements in energy efficiency and expansion of carbon-free energy supply.

Here is a set of projectories. The broad orange one on top is business as usual. The green one in the middle is the emissions trajectory for the planet out for the next roughly 290 years, that would be required to stabilize it twice the pre-industrial carbon dioxide concentration.

What one sees is that the stabilize at twice pre-industrial, which, by the way, is by no means assured to be safe, it is, as we will see, hard enough to do that it is difficult to imagine that we could do much better.

If you were purely preoccupied with safety, you would probably want to do better than that, but that requires leveling off at around 10 billion tons of carbon per year from fossil fuels compared to a bit over 6 today, by around 2035 or 2040, and then declining over the long run.

What would it take to do that? It is a rather easy, back-of-the-envelope calculation to estimate by how much we would have to expand carbon-free energy. That means renewables, nuclear, and fossil fuel energy technologies that can capture and sequester the carbon away from the atmosphere. Those are the options under carbon-free energy.

You can ask how much do we have to expand those as a function of how rapidly we can improve the energy efficiency of the economy. If the energy efficiency of the economy improves at 1 percent per year, which is the long term historical average, and starting with 100 exajoules of carbon-free energy, which is what we had in the year 2000 when you include the traditional biomass energy forms that are often excluded, the year 2000, we had 100 exajoules carbon-free, 350 exajoules of fossil fuel.

You need a 6-fold increase in the carbon-free energy by 2050, and a 15-fold increase in the carbon-free energy--[audio break].

[Side B of Audiotape 3 of 4 begins.]

MR. HOLDREN: [In progress]--renewables, the carbon sequestering fossil fuel technologies in the space of a century. If you can make

the ratio of energy to GDP fall at a rate 50 percent greater than the historical average, you still need a 3 1/2-fold increase in the carbon-free energy by 2050 and an 8-fold increase by 2100 only if over the whole world and the whole century, you can double the rate of energy intensity improvement from its historical average of 1 percent per year, on in that circumstance can we get the increase required from carbon-free energy sources down to a mere tripling or so in the 21st century, still a consider challenge by the way. So, you get a sense of how hard the problem is.

Finally, a few very quick remarks on uncertainty, controversy, and prudence. The first question, what about the skeptics? Among those with the training and knowledge to penetrate the relevant scientific literatures, the debate about whether global climate is now being change by human-produced greenhouse gases is essentially over.

Very few of the climate change skeptics who appear regularly in the op ed pages of the Washington Times and the Wall Street Journal have any scientific credibility at all. The most distinguished scientist from the camp of the more or less skeptical, who is Meteorology Professor Dick Lindzen from MIT, signed without dissent the 2001 National Academy of Sciences report requested by President Bush, which affirmed the soundness of the third assessment of the Intergovernmental Panel on Climate Change, and which declared in its opening sentence that greenhouse bases are accumulating in earth's atmosphere as a result of human activities, causing surface air temperatures and subsurface ocean temperatures to rise.

Uncertainties do remain, significant uncertainties about the climate change issue, and debates about them persist, but the argument is no longer about whether climate is changing or about whether human greenhouse gas emissions are responsible. It is about the precise magnitude of the climate changes to be expected by 2030 or 2050 or 2100, if civilization doesn't change course.

The debate is about the details of the character geographic distribution and timing of the damages to human well-being to be expected. It is about the probability that much bigger than expected damages will result from pushing the climate over a threshold or a tipping point, and it is about the feasibility and the costs and the leverage of various potential remedies, and, of course, therefore, the debate continues about the appropriate character and timing of national and international policies to reduce the risks from human disruption of the global climate.

We need to remember that uncertainties are two sided. Yes, it could be that the climate changes occurring under a continuation of business as usual would be less disruptive, and the adverse impacts on human well-being less severe than the best estimate portrayals that I have presented here. Those have been based on the work of the Intergovernmental Panel on Climate Change and other mainstream scientific groups.

But it could equally well turn out that the climate changes under business as usual are more disruptive and the impacts on human well-being more severe than the current best estimates suggest.

The assertion of the skeptics that the Intergovernmental Panel on Climate Change consensus scientific view has been biased by political pressures toward overstating the problem is nonsense. The principal political pressures on the IPCC have been in the other direction, to understate the problem.

You have to ask yourself what interest do the governments of the world, which are the governments that apply process on that process, have in overstating the issue?

A word about burden of proof. The skeptics routinely brandish some single contrary piece of evidence or analysis, often a newly reported one that has not yet been subjected to the scrutiny of the scientific community, and they declare that this new result invalidates the mainstream view.

That is not how science works. Contrary results appear regularly in all scientific fields. When a strong preponderance of evidence points the other way, as in the case of climate change science, isolated, apparent contradictions are given due scrutiny, but they are not initially given very much weight, and the reason is it is far more likely that the so-called contradiction will turn out to be explainable as a mistake or to be otherwise consistent with the preponderance of evidence than it is that the preponderance of evidence will turn out to have been wrong.

Of course, all science is contingent. Every scientist knows this. It is always possible that persuasive new evidence and analysis will come to light that will change the mainstream view, but the greater the consistency and coherence of the existing body of evidence and analysis, the lower the likelihood that the principal conclusions derived from it will be overturned, and the

consistency and coherence of the evidence and analysis supporting the mainstream view of climate change risks that I have presented here are substantial.

Supposedly prudent decision-makers on whose decisions the preservation and expansion of their own and the public's well-being depends are irresponsibly gambling against large odds if they bet that the mainstream position is wrong.

Thank you very much.

[Applause.]

MR. SANDALOW: I am delighted to introduce Bob Hahn, the Executive Director of the AEI-Brookings Joint Center.

MR. HAHN: Thank you, David. I am almost thinking about ditching the talk and responding to Professor Holdren, but maybe we will hold that for the question and answer period.

What I would like to do in my brief time is talk a little bit about how an economist thinks about integrating energy and environmental policy and perhaps touch on the climate change debate, maybe thinking about how to provoke a little discussion, because I don't agree completely with the framing of the problem that Professor Holdren gave.

I am going to start by asking the question why should we care about energy use and then present the standard economist view, which also is my view, on how we should think about energy externalities, then, discuss energy use and climate change, and present a little data from a few economic studies about this, talk about how economists view the solution or think about

how to address this problem, and then how political scientists or political economists think about some of the constraints that David and John touched upon in their remarks, and then conclude.

Why should we care about energy use in terms of public policy? Well, some of this material came up this morning, so I am going to just go over briefly. Obviously, you use energy, it contributes to pollution, indirectly it can contribute to congestion, more miles driven, and so forth.

It can contribute to safety problems and if there are energy supply disruptions, it can also have macro economic impacts.

We also care about it as consumers because there may be large players in the market who can ultimately affect what we pay for energy, for example, OPEC, some people believe that OPEC had a lot of market power, was a cartel, can raise the price of energy, and some people have suggested, in opposition to that, we may want to as a large country, the United States, think about being a major purchaser and the impact we have on price.

The bottom line, though, for energy or environmental policy--and I think this hasn't changed very much at least over the decade or so that I have been looking at this in Washington--is we need to think about the fact, very carefully, that users do not always face the full social cost of energy, and this contributes to efficiencies and sometime over-consumption of resources, and as I will argue, in some cases, under-consumption.

I am going to quickly just go through the are we running out of energy debate, I think Julian Simon has handled that, and this is a graph from a

book by Bjorn Lomborg, "The Skeptical Environmentalist," which updates some of that data about energy prices.

While we saw a spike in I guess the late '70s or early '80s, the real price of oil hasn't changed dramatically over the last 100 years, and I believe, although I haven't looked at the stats in the last year or two, that proven reserves are still increasing, so I don't think the issue--and I think here I would agree with David and John--I don't think the issue is about whether we are running out of energy, and I do agree that the issue is how we should prudently manage our environmental resources.

If nothing else is going to be on the exam, I can promise you that the first line of the PowerPoint presentation will be on the exam, what do economists like to do about these problems. We like to, in fancy terms, internalize the externality or make people pay the full cost in this case of valuable energy resources.

We do that by recognizing that the costs can be broken loosely into two parts, the private cost of production typically, and also the cost you impose on others through things like congestion and pollution.

For nonrenewables, the problem is a little bit more complicated by the fact that if you use a barrel of oil today, you don't have it tomorrow, but the basic idea is still the same. If you are imposing costs on other folks, you may want to incorporate that in the price of the resource.

Let me present a little data from a study that Perry and Ken Small did on gasoline, where they looked at or tried to compute what they thought would be optimal gasoline taxes in the United States and Great Britain.

The first part of the table simply illustrates that it is possible to compute things like externalities associated with pollution and congestion, and their best guess was that--well, you can see them here--they are on the order of a quarter for pollution and a little bit more for congestion in the two countries.

Then, when they compute an optimal tax, their best guess again--and I emphasize "guess," there are a lot of uncertainty in these numbers--that a gas tax on the order of a dollar is probably not unreasonable. We have taxes on the order of 40 cents, and I think that is federal, but I am not sure, and they have taxes on the order of $2.80.

So, if you just took their analysis at face value, the British are being overcharged for gasoline, and the Americans are being undercharged, and most of you are well acquainted with the political economy of raising energy taxes in this country.

Now, let me turn to climate change. Economists again generally even make more heroic assumptions in the context of climate changes. Professor Holdren pointed out there are a heck of a lot of uncertainties in computing both the costs, the benefits, how the economy is going to evolve, or, over time, what kinds of innovations we are going to see.

Nonetheless, people, especially Professor Nordhouse at Yale, have taken a shot at this problem. In this graph, you see two lines. The blue line, the lower line, is an optimal--or I guess it is a purple line--the optimal tax according to Nordhouse when he ran this model.

Then, you see if we were to try to freeze emissions at 1990 levels, much higher implicit carbon taxes, and also in the case of this analysis, the tax would increase over time.

Most economists I think would agree that it would be good to do something on climate change. They may not be as alarmed as Professor Holdren's presentation would sort of imply about the gravity of the issue relative to doing things about other issues, but they would agree that it is good to do something if you could get widespread cooperation, but as David pointed out in his initial remarks, and I think you are going to talk about a little bit, there are some serious problems in doing that.

Also, in addition to our mantra of internalizing the externality, we like to do things in the most effective way possible if we can, and we have a sense of what the benefits and costs are over time, we like to balance those, and then we like to introduce regulatory mechanisms be they taxes or marketable permits, or some combination that would get you to whatever your goal is in the least expensive way possible.

For example, 10 or 15 years ago, Bill Reilly, who I know is here today, worked very hard on implementing a market-based approach for reducing sulfur dioxide in the context of the 1990 Clean Air Act.

The Kyoto protocol unfortunately, at least from the viewpoint of most economists that I know, did not meet these criteria, and that is one of the reasons that it was heavily criticized in the academic community or at least the economic community.

Now, let me turn to, and not to steal too much of your thunder since I don't know what you are going to say, but turn to the political side of the equation, because I got into a debate about this with a former colleague on national public radio at one point.

My own view is that it is very unlikely, independent of the technocratic or scientific merits, that we are going to do much about this problem in the short term no matter whether John Kerry, George Bush, or Mickey Mouse is president.

The Senate voted down what I will loosely called Kyoto-type protocols by the slim margin of 95 to nothing a few years back. My own view of the political tea leaves is I don't see that things have dramatically changed in this great country.

The concerns that the Senate expressed at the time were that they didn't want to impose many costs on the U.S. economy for what they viewed might be speculative long-term gains, and they were also concerned about the fact that a large share of the emissions 50 years from now will be coming from major countries in the developing world.

The second political economic problem, which I like to loosely call the Shelling, Barrett Impossibility Theorem, named after a great economist Tom Shelling and my good friend, Scott Barrett, is that it is really hard to come up with a credible agreement or any kind of understanding among major emitters in the short term, and it is not for lack of trying. I mean several people have advanced proposals, but I use the word "credible" in the sense of it being

individually rational for the countries who cooperate, not to renege on their commitment.

There is no doubt, for example, that I could get a developing country to sign onto an agreement--and I will probably be kicked out of Brookings for this--if I gave the leader of that country lots of Mercedes that he or she could trade in on the open market and do what they wanted with, but the next time around they might come back and say I would like a few more Mercedes to sign up for this agreement.

So, it is really hard for us to figure out ways to get folks to buy into these agreements, and that is why political scientists are working very hard to think about linkages that could get folks to buy in, in a credible manner.

It doesn't mean necessarily that we shouldn't do anything alone, but if we do something alone, we have to ask ourselves, well, how does that benefit us and how does that benefit the world.

It does mean, in my view, I think this statement is intellectually defensible, but a first best solution, first best as defined by an economist, is not likely to be attainable. As Boyden Gray likes to point out, the perfect can be the enemy of the good, so we shouldn't hold our for a first best solution. I will have a little bit more to say about that in a minute.

What should we do? I have my own views about this and I wrote a couple of them up in an AEI book about five years ago, but I think it is fair to say that there is no general agreement among the social scientific community.

There are a lot of different proposals. Many economists like marketable permits because they might get you there in a relatively inexpensive

way, or taxes, or some combination, but some who are more sensitive to the feasibility issues that I hope we talk about during the question and answer period.

Some of advanced technology standards, which generally economists hate simply because they may be easier to monitor. Tom Shelling has advanced the idea of policies and measures, which is loosely commitments that are not enforceable contracts, but commitments that countries might make in moving towards what I will call a more well defined property rights regime that would get enforceable reductions down the road.

There is a lot of disagreement about what the appropriate scope is, should you start with a very wide agreement and relatively small emission reductions, or just a few countries and deep emission reductions, or just a few countries in an experimental context, which I have advocated, and what pollutants should be covered in the case of climate change, what greenhouse gas emissions.

There are technical issues and there are policy issues, and I am going to skirt those in the interest of time.

But the bottom line, at least from my reading of the literature, and certainly in terms of actual policies that have been implemented, no one has been able to come up with a credible approach, and my own view is that Kyoto was destined to blow up, and it only took the policy-makers a few years to figure that out.

So, to summarize, where are we? In principle, we know how to meet energy needs while protecting the environment. We are not running out of energy. What we need to do is for the major externalities, not the tiny ones, but

the major externalities, calculate what they are and try to monetize them, and then convince our decision-makers to incorporate some of those damages and the price, so the consumers see the full social cost of energy, claim victory, and go on to another, hopefully better paying job than being an academic.

In practice, it is not so simple for global environmental problems for many of the reasons the two preceding speakers touched on, and some of the reasons you have heard this morning and this afternoon.

Countries are frequently going to want a free ride, let the other guy do it. In the same way, it is cheaper for you to have the other guy put on a catalytic converter on his car than you put it on your car and have to pay the additional cost, and then you both get the benefit.

Remember climate change has characteristics of a global commons problem in the sense that it doesn't matter where I emit extra greenhouse gases or where I reduce extra greenhouse houses. What is of interest here for the damage function is the accumulation of greenhouse gases in the environment.

There are a lot of uncertainties in the science and economics, which is another reason that makes these problems difficult to deal with. Frequently, as Professor Holdren pointed out, it is difficult to sort out the politics and the science and the economics.

I have a somewhat different view of the politicization of the IPCC than Professor Holdren does. I think there are self-selection mechanisms which attract certain kinds of folks to be on the IPCC, and others not to participate in that event, and in particular, those folks who tend to feel that

global warming or climate change is a more important issue will gravitate towards working on some of those committees.

In conclusion, this is a big problem, so, you know, you have to pay an economist to tell you that? Agreement on a set of actions is any agreement or set of actions is likely to be seriously flawed at least from an economist's perspective compared to the first best.

The crucial policy question which we should ask for all policy problems is, is the cure that we are thinking about or different folks are advancing likely to be worse than the disease, not is it perfect, but is it likely to improve on the status quo.

My own view is in the case of Kyoto for climate change, the answer was probably no, but there are probably pragmatic solutions out there, and we just need to continue to work on finding them and implementing them.

Thank you very much.

[Applause.]

MR. SANDALOW: Thank you, Bob. I want to assure you, you will not get kicked out of Brookings for making any controversial points. In fact, as you well know, you are at risk of being asked back to repeat them.

It is my great pleasure to introduce Nigel Purvis, Senior Scholar here at Brookings. He had a distinguished career at the State Department, once a current colleague, and a great friend.

Nigel will talk about International Aspects of Global Warning.

MR. PURVIS: Thank you, David. It is a pleasure to be talking about a very important topic, and my assignment I think is particularly difficult,

which is to share with you some thoughts about new approaches at the global level for enhanced cooperation on climate change.

I would like to try and provide some thoughts on three specific questions: What are U.S. foreign policy objectives on climate change? How can we achieve them? What is the future of the UN negotiating process particularly the Kyoto Protocol?

I approach these questions from the perspective of someone who is a lawyer and a diplomat rather than a scientist or an economists, and the thought that I am going to be sharing with you are thoughts that I did share with the Clinton administration, and I also shared with the current Bush administration, which I served under for a year.

So, these are suggestions about how the United States might approach the global challenge regardless of when we decide that climate change is a problem or the importance that we attach to it.

As a quick review, what are our objectives? First, we want to prevent a dangerous interference with the earth's climate system. We need to do so in a manner that protects the U.S. economy, and our third objective is to spur global action precisely because Bob Hahn has said this is a problem that requires collective action, it's a global problem that will require global solution, and so an equitable global action is vital, not only to achieve the environmental objective, but also to ensure that others are doing their part and therefore the burden on the U.S. economy is manageable.

So, what should be our strategy? I would like to suggest a four-part approach. The first is that we should focus primarily at this stage on domestic action.

The second is that we need to use that domestic action in our policies and programs under domestic law to leverage international action.

The third thing we should is link the U.S. system to other domestic systems, particularly with the economies of our major trading partners.

Finally, we should engage poor developing countries on terms that are fair, but probably different by action that we are taking here at home.

So, let me say a few things about each of those four points.

Domestic action is absolutely key to making progress both at home obviously, but globally, as well, and that is true for one very important reason. The United States at the moment has very little to offer the international community beyond its existing policies, and therefore has very little to put on the table.

We have a not very high level of credibility. We have been one of the principal contributors to human changes in the climate, and yet the policies that we are proposing are viewed internationally as not particular substantial.

So, in order to have credibility and to negotiate effectively, would need to have a domestic consensus in the United States for taking action beyond what we already have, and my suggestion is that until we have that bipartisan political consensus for a domestic policy that is more robust then the current

approach, it would be counterproductive for the United States to be making major new international proposals.

In addition, domestic action is key as a matter of geostrategic and political reality. We are the largest power in the world and systems that are not consistent with our own domestic approach are unlikely to have significant political support here in the United States.

We know from our experience in other areas that regimes that are not consistent with our own interests frequently fail to attract the interest of the Senate or of the American people as a whole.

Let me give you a few examples in the international treaty-making world. We know that international pressure has not brought the United States into the land mines convention, into the international criminal court, into the law of the sea, into the convention on the elimination of all forms of discrimination against women.

These are treaties that are almost universally ratified around the globe, and yet the United States stands apart. The history of international environmental treaty-making specifically is marked by a very specific pattern. The United States figures out how it is going to approach a problem, it enacts that problem into its laws and builds a domestic political consensus in favor of the approach, and then it engages the world.

We have seen this on the issue of the ozone hole where international action was, in fact, modeled after a pre-existing domestic law.

So, the suggestion I make to you is that international action is key, but that domestic action must come first. Well, what are the prospects for

performing a bipartisan consensus on climate change? While I agree with Bob Hahn that it is an extremely difficult challenge, and we are certainly not there yet, I would suggest that actually, we are seeing a favorable trend.

We know that Americans care about climate change in roughly the same degree as Europeans. It is a fallacy to think that the European public is incredibly agreeing, but the American public is not. Certainly, we have our differences, but in poll after poll, climate change places in roughly the same level of importance in the United States as it does in Europe.

In addition, the state and local political landscape is changing quite significantly, and I would recommend for you a recent book published by Brookings by author Barry Rabe [ph] of the University of Michigan, which makes the case that there is a very remarkable shift occurring at the state and local level, and that ultimately this change will induce further change at the federal level.

In addition, there is probably more climate action on Capitol Hill now than there has been in a decade. In addition to the McCain-Lieberman vote, which was quite significant last year, there are a number of other climate change bills that relate to such problems as carbon sequestration and significant improvements or enhancements in funding for research and development.

So, there are reasons for optimism. We know from other seemingly intractable issues, that change can happen rather quickly. Who would have predicted three years or five years before welfare reform that we were on the verge of a significant change in that system.

So, it is a major problem. It is hard to see when we will achieve a bipartisan approach to climate change, but there is change afoot.

Let's assume for the moment that, in fact, the United States did forge a new bipartisan approach to climate change. How would we then take the second step? That second step I am suggesting is to spur international action by using our own laws.

Some progress is possible in this manner. We can use the programs that we adopt here at home to influence international behavior, and let me give you a couple of examples.

Had McCain-Lieberman been enacted into law, it would have created incentives for corporations to invest in emission reduction projects abroad. So, through the creation of a regulatory approach in the United States, we actually would have changed the emissions curves of other countries, particularly developing countries.

Similarly, we know from experience that the variety of federal programs that can be used to promote export of clean technologies and to subsidize investments in countries in climate-friendly programs. These are programs that are already underway in the Overseas Private Investment Corporation and Export/Import Bank of the United States.

If we adopted programs on a different scale, that were along these lines, one might have a significant impact on foreign emissions, and this could be achieved entirely under our domestic law.

Of course, as Bob Hahn has pointed out, the development of the political will here in the United States is tied to spurring international action

because of the free rider problem and of concerns about loss in competitiveness and employment.

So, ultimately, we need to be more effective in linking up with our key economic trading partners and allies to make sure that those concerns are addressed. So, I would suggest that at some point, we will need to take a third step, and that is to harmonize our systems with those of other major economic powers.

We will need to do this, so that we have greater leverage, so that collectively, the action that is being taken is commensurate with the environmental risk. We will need to do that because it will increase efficiency of market-based approach and other financial mechanisms, such as emissions trading can be used to reduce costs and gain access to low-cost emission reduction opportunities abroad, and we need to ensure that the competitiveness balance that we now have continues.

So, how might we do that? Well, there are a variety of different ways and not all of them involve going back into the United Nations process. We could enter into an agreement with Europe and Japan, so that emission reduction credits that were approved under those countries would have value here at home and vice versa.

We could strengthen cooperation on research and development with other advanced countries to launch a new sort of Apollo program for research and development of climate-friendly technologies.

We could team up with other donor countries to ensure that we are engaging the developing world on a scale necessary to change their emission levels, a sort of new global Marshall Plan for climate change.

So, there are a variety of different policy instruments that would be available to us to pursue with our major economic partners that would achieve economic efficiencies, spur a greater amount of action, and engage developing countries in the effort.

Let me say an additional word about this fourth element developing countries, because it is a unique challenge. There is enormous interest in the developing world for energy cooperation with the United States. In contrast, there is very little interest in the developing world for what they view as climate-changed medicine.

The challenge for the United States is to engage developing countries in a manner that they see as consistent with their long-term development objectives. They are interested in reducing the cost of energy for their people, in fighting poverty through the diffusion of clean energy technologies that are less polluting and more affordable.

We, the United States, have a very strong foreign policy interest in helping achieve those goals. We have economic interests in making sure that other countries are stable and participating actively in a global trading market.

We have environmental interests in ensuring that their people are healthy and are not contributing to climate change more than is necessary. We have security interests in making sure that the overall global demand for

petroleum and for other energy is as small as possible to minimize the power and economic rents that are extracted by energy-producing countries.

So, there is a strong foreign policy justification for engagement with developing countries on terms that are acceptable to them, energy cooperation rather than climate-changed medicine is the key.

So, what sorts of new international frameworks will be needed to put into place the legal mechanisms to carry forward these new international policies? Here, I would like to suggest that while I agree with Bob Hahn that no single answer has emerged, for me, that is actually a cause for optimism.

We have a wealth of options. There are a variety of different policy approaches ranging from research and technology to quantitative emission targets and national goals. We have flexibility about when to pursue those policies, with whom to pursue them, whether in the UN context or bilaterally with our key partners about what legal status they should have, whether they should be voluntary programs or legally binding, what the compliance consequences should be.

There is an enormous amount of flexibility in choice. In fact, I have cataloged over 23 specific international climate change proposals that have been put forward by U.S. scholars since the 1997 Kyoto Protocol.

These are from mainstream credible scholars who together I think suggest that there is a tapestry of different proposals that we can choose from. The challenge is to develop the political will to act. If we develop that will, I am confident that there will be a range of choices for policy-makers to choose from.

So, what is right for the United States? Well, I suggest that I have already provided some clues to that answer. Since we need to act first at home, it is almost impossible to decide now what the right international approach should be.

We first need to develop the political consensus about how to deal with the problem in a more fundamental way here and then we need to build on that approach and carry it forward for other countries.

Let me turn in the time remaining to the final question. Does Kyoto still matter, and what is the future of the UN process? I would like to offer somewhat of a mixed assessment. On the one hand, Kyoto is much less relevant than it was when it was first negotiated. The Kyoto targets have been significantly weakened, not only by the withdrawal of the United States, and therefore the reduction in the expected price of carbon, but also by the agreements that were reached in Bonn in Marrakech 2001 following the U.S. rejection of the treaty.

Whether Kyoto enters into force or not will probably be determined by whether Europe extends WTO concessions to Russia rather than by any climate policy. Whether the Kyoto targets will be reached by Europe and by Japan is a very open question.

Those countries have adopted some significant policies, but the policies that they have enacted to date are not sufficient to make their Kyoto targets, and it is unclear with the withdrawal of the United States, and once the policies that have been adopted start biting their economies, whether they will

have the political will to reach the Kyoto targets regardless of whether the treaty enters into force.

I would suggest, though, that for the United States, Kyoto is largely irrelevant at this point. As a matter of economic reality, even if the Senate provided its advice and consent, and President Bush had a change in heart and approved the treaty, it would be almost economically impossible to achieve the Kyoto goal.

Even strong supporters of the Kyoto process including Senator John Kerry, who was present at almost all of the key negotiating sessions, have accepted this point. Senator Kerry's position is that he would be advancing other climate policies rather than Kyoto at this point.

So, Kyoto, on one hand, is not really where the action is at, on the other hand, Kyoto is still relevant in a modest way. Kyoto, to the extent that it either comes into force or provides a political bench mark against which countries in Europe and Japan try and measure their climate action, will be providing important information for the United States and for others about just how expensive achieving reductions in greenhouse gas emissions actually is.

In addition, it has quite significant symbolic effect as a measure of the political will that may or may not exist in Europe and Japan to address the climate problem. Finally, the rules for international emissions trading and project investments, and other sorts of technical rules that were established during the Kyoto process have a life that may extend beyond the actual negotiations and could be useful in a new international process.

So, in summary, let me just say that I think that Kyoto is no longer the central question in the United States, and those who seek to focus on it, I think are doing us a disservice. We really need to figure out whether the United States has political will to take more robust measures against climate change.

If we do, then, we should do so first at home, and then secondly, use our domestic policies and measures to leverage international action. Having done that, we will then create the space to link our systems with other international approaches, to build bridges to our key trading partners, and to erect a strong framework for engaging developing countries that is consistent with their objective of sustainable development.

There are a wealth of international options for pursuing this. Many of them could involve a new treaty, but they needn't, at least not immediately. The question is whether we have the will to act, and my hope is that we soon will.

Thank you.

[Applause.]

MR. SANDALOW: Many thanks to all our panelists. They were just tremendous presentations.

I know there are a lot of questions. I am going to ask each panelist a quick question and then throw it open to the audience.

John, I wondered if you could offer some thoughts on how much sooner we will know more than we do now about climate change science. You

had a very compelling presentation talking about the many things that we already know and the uncertainties that remain.

But with a steady application of Moore's law and doubling of computing speed and more and more data, 10 years from now, 20 years from now, do you think we will be able to predict with reasonable confidence, regional impacts, local impacts of global warming over the long term?

MR. HOLDREN: Thank you for asking that question because it lets me say, first of all, that I didn't actually disagree with that much that Bob Hahn said. One of the things I did disagree with is that not much has happened since 1995, when the Senate resolution was passed.

A lot has happened since 1995 in our understanding of the problem and in narrowing some, but by no means all, of the uncertainties. In fact, just to give you one example, just five years ago, the end of the 1990's, none of the coupled atmosphere ocean general circulation models used to study the climate could reproduce El Nino, and this was a quite force criticism, how can you expect very much in the way of being able to understand regional changes if these things don't even reproduce El Nino, the most powerful of the regional climatic phenomena that most people are aware of.

The generation of atmosphere ocean climate models that are now coming into use do reproduce El Nino and very realistically. The progress is quite rapid. That is not to say that uncertainties won't remain 10 years from now, or 20, or 30.

It is a very complicated system. In some sense, we will never understand it completely, and in many respects it is chaotic, which again ought

to worry us rather than consoling us, just as an aside, but we are learning a lot more.

The year 2000 National Assessment of Climate Change Impacts on the United States has a lot of compelling analysis of plausible patterns regionally of impacts on the United States, not at the status of predictions where you can say with confidence this will happen here, but plausible ways in which the regional consequences will play out, and those models will continue to get better, the capacity to couple the global models to the regional ones.

The other understandings that will get better is our understanding of the possibilities, the opportunities, and the costs of better technologies for addressing these issues. In that respect, too, we know already a lot more than we knew 10 years ago, and it will ultimately become easier to understand the costs, as well as the benefits, of taking different kinds of evasive action.

MR. SANDALOW: Thank you.

Bob, I wanted to say for the record, too, I disagreed with very little of what you said, as well. I wanted to ask you what domestic politically acceptable policy approach you support.

What I heard you say was here is the ideal solution, but we can't let the perfect be the enemy of the good, therefore, we should calculate the externality, impose it on consumers, and claim victory.

I just wanted to push you a little bit beyond that level of specificity to detail what you have in mind, what you would raise your hand to vote for when you are in the U.S. Senate.

MR. HAHN: If I were advising this president or any president, I would take a little different approach than I think Nigel would. I am not so concerned about the U.S. demonstrating its leadership position by putting some kinds of emission controls on all these power plants or whatever, because I don't think it's feasible, politically feasible.

I don't know what political will is. When I think about political will, I kind of think about the politicians calculus, what is going to get that person to vote for it, and I think that the political will come, one, as the income in America rises, because environment is a luxury good, the richer you are, the more you demand it.

I will get to answer your question, I promise.

It also comes as the cost of addressing the problem is reduced. Several of you mentioned research and development, I think that is a good idea.

I think one of the points in John's slide, which does answer your question directly, about we are going to need to adapt if this turns out to be a serious problem no matter what, I would like to see more research in that area.

But sort of my bugaboo and what I wrote about five years ago, and I don't think as much has changed as John suggests, particularly on the political side, maybe on the science side, what I would suggest is if you think you need international cooperation for a problem like this, and I think you eventually do, why not start small and see if you can devise political institutions for emissions trading or taxes, or whatever, on a very, very small scale, not aimed at making a significant dent in the problem, but simply showing that you can build these institutional models like between the U.S., Canada, and Mexico

are three of the countries that you suggested, to just build that infrastructure because you know if you are going to have to address the problem on a large scale, you are probably going to want to do it in a cost effective way.

Now, the problem with my suggestion is it's a little airy fairy. You know, President Bush or, I don't know, the prime minister of Japan says to me, "You want me to sort of run an experiment and tell the people that I am only going to reduce things a little to build the institutions to address it in the future?"

My response is, "Yes, we need to do that and we are going to design a low-cost way politically and economically for you to do that."

I guess I don't read the same newspapers or polls that you guys do, but I mean the American people weren't real hot on a 5 cent a gallon gasoline tax, so I just don't see a lot of wiggle room in the near term to get the U.S. to do things even if it is desirable.

MR. SANDALOW: That goes in part to the question I wanted to posed to Nigel, which is the chicken and egg problem here. You point to the fact that the American public is unwilling to go forward with an international solution to this problem in the absence of a domestic solution, and recommend therefore pushing the domestic approach.

Are we at risk as we do that, then, of having a dialogue in which the political forces say yeah, but we are not going to do a domestic solution until we have an international framework in place, and how do we bring those together?

MR. PURVIS: I think ultimately, the two have to go in tandem. My point is more about what is the first step. There is I think a real risk that by

trying to do too much too quickly, it ends up backfiring and there are real competitiveness issues, there are costs on the economy, and the absence of global action ends up becoming a real issue, and arguably, that is what happened in the Kyoto process.

What I am suggesting in fact is very similar to what Bob just said, which is that we need to lead here for our own purposes, not out of some moral obligation, but until we figure out how do we want to approach this, we are really not going to have the ability to engage internationally and answer the question, well, how would you do it. So, we need to figure that out first.

I would separate it into two parts. There is the question of building the architecture, creating the rules and the incentives that are going to drive investment and change the long-term capital stock in a timely way, and then future action that would actually have more dramatic effects in terms of achieving emissions reductions.

Until we answer the first question of what are the rules of the game and what is our preferred set of policy tools, my fear is that not only would we not really have moral standing with the international community, but more to the point, we really wouldn't be in a position to be able to tell them what we wanted to do, or if we did, we might find ourselves in the same situation that those of us who were in the Clinton administration had, which was we had negotiated something internationally, and it didn't yet have political support domestically.

So, I think for that reason, domestic action needs to be the first step, but clearly, it is an iterative process, and because it is a collective action

problem, will require reciprocal steps from other countries, but we need to get our act together first here.

MR. SANDALOW: There is an enormous amount of expertise in this audience, which is filled with some very distinguished folks that have worked on this issue for a long time.

Any questions?

There is a microphone and if you could identify yourself, please.

MR. LORENBUCK: Dave Lorenbuck [ph]. I am a taxpayer, I am not in the industry. I just heard about this today in the paper, thought it was interesting.

Actually, a little [inaudible] question. Assuming that there is only two choices, being dependent on foreign oil and developing resources, that we find out there a substantial supply exists, say, in the Arctic National Wildlife Refuge, which of those two choices do you support, being continually dependent on foreign oil or developing our own resources here at home even if they are up in Alaska in the area designated in ANWR especially in light of the fact that 9/11 attacks were most likely financed by oil money, and mostly the oil is still in Saudi Arabia, and China is now increasing its demand for energy, the energy prices here in the United States will probably go $2.00 a gallon? So, I just want to find out, in light of all that, what is the position of any of you, do you favor that?

MR. SANDALOW: Thank you very much. We had discussion around some of those issues this morning in two of the panels, but do any of the panelists want to touch on that briefly?

MR. HOLDREN: I will touch on it very briefly. The first point I would make, it is not an either/or choice. There is not enough oil in ANWR to relieve us of the burden of dependence on imported oil.

It is a question of on the margin, do you want to reduce your dependence on imports by the amount that ANWR could provide in exchange for the costs of developing ANWR including the political costs of going into an area of that sort.

That is a tough question, and it's a political question. The other point I would make about oil, which was perhaps not as strongly made this morning as I might have liked, is that our vulnerability is, in substantial part, not just a function of what we import, but how much oil we use all together.

People keep making the point there is a global oil market. If you think about what has been called here the macro economic shock vulnerability, the size of the macroeconomic shock to the United States if world events drive the oil price up depends on how much oil we use all together, not on how much we import.

From that standpoint, using more from ANWR doesn't help you at all.

MR. SANDALOW: Other questions? Sir.

MR. WARMEY: Bruce Warmey [ph]. I am from the Energy Environment Security Initiative at the University of Colorado at Boulder. Anybody heard of Boulder? Okay.

Boulder has its own foreign policy, so this is not the foreign policy of Boulder. This is my own. I really want to thank the panelists and

AEI-Brookings for having brought this thing together. It's wonderful for people living outside the beltway to see that you put things on like this.

My question to all three panelists is premised on certain assumptions. No. 1, it would seem that the naysayers and yeasayers, in terms of the science of Kyoto, are now coming together because if you read what the Department of Energy is putting out in their web site, it is quite clear that they claim that we are facing the biggest energy crisis that this country has ever faced.

So, therefore, they are asking for a diversity of energy sources, and this would mean--that is why this administration is looking at hydrogen. However, hydrogen is not going to supply the energy needs of the developing world because as Nigel Purvis has pointed out, the framework conventional climate change establishes the right to sustainable development, and therefore developing countries have the right to develop, and the right to develop, however, must go hand in hand without the right to savage the environment.

So, this means that we need to find different sources of energy other than what we have now. Now, unfortunately, if you cut down carbon dioxide and don't have a substitute, that is not going to happen. This is why increasingly, scientists have been pointing out--Dr. Holdren, I know you like the IPCC, but it has been pointed out that the IPCC kind of got their sums wrong in that they thought there are sufficient fuels to take the place of carbon dioxide reductions, whereas, in fact, there are not.

So, my question to the panel is shouldn't the initiative now of the United States be in the field of alternatives? I mean it could be space solar power, it could be fusion, it could be hydrogen, and wouldn't the rest of the

world come to the assistance of the United States if we embarked on perhaps a new protocol on better forms of energy.

MR. SANDALOW: Comments on technological opportunities in the developing world. Nigel and then John.

MR. PURVIS: I am very much a fan of engaging the developing world on clean energy. As I said in my remarks, I think it is our interests and it is clearly in their interests, and the challenge is to create the incentives that will drive private sector investment in the developing world.

I tried to offer a number of different tools that we could use including the export promotion that would be good for U.S. jobs, while also helping deliver advanced energy technologies to those countries, co-financing and guarantees that could be provided through the Overseas Private Investment Corporation, and use of international institutions like the Global Environment Facility, and others, who can help partially subsidize the costs of investment by financing the environmental costs or the global public good aspect of the project.

I think my concern about these approaches is not the mechanisms that exist, but rather the level of funding that would be required to achieve the kind of dent in developing the growth in developing country emissions that is really required.

I think it is where we need to start, but ultimately, we will need to try much more ambitious programs that will be much more effective in leveraging and directing investment, and that is where I think approaches like the McCain-Lieberman bill, which would have created a regulatory credit for U.S. companies, for foreign investments that are climate-friendly really need to

be looked at, because it would be a powerful new tool that would drive investment in a way that our current programs don't.

MR. HOLDREN: I agree with that, and I agree with the speaker when he says that the developing countries have a right to develop, an expectation that they will develop, and determination to develop, and they are going to find the energy to do it one way or another.

It is in our interest to help them find the energy to do it in ways that minimize the damage that they do to themselves and the damage that the do to the global environment. In the Clinton administration, in its later years, I led a study within the President's Committee of Advisors on Science and Technology focused on international energy cooperation, cooperation in energy research and development, demonstration in deployment, the title of which was Powerful Partnerships, which made a series of recommendations, some of which were just nicely summarized by Nigel, about how to go about this.

I must say, to the Bush administration's credit, one of the more concrete elements of its policy in relation to energy and climate change has actually been to advance some of these forms of international cooperation.

We have, at Harvard, a project focused on international cooperation with India and China on clean coal technology and clean vehicle technology, which is trying to find ways to accelerate the transition to hybrid vehicles and ultimately perhaps fuel cell vehicles on the vehicle side, and to integrated gasification combined cycled coal technologies on the electricity-generating side, because these countries, like the United States, have huge amounts of coal, they are going to use it.

We need to help them use it in ways that make sense.

MR. SANDALOW: Bob?

MR. HAHN: I guess I just wanted to raise a couple more generic points. I didn't know we were going to end up spending the whole time on climate change.

The first point not in my talk, but which you have all heard before, "There ain't no such thing as a free lunch." Somebody is going to pay for these export subsidies, this, that, or the other thing, so we ought to be looking at, if we are going to go down that road, we ought to be looking at the least expensive way to do things and finding out whether we get anything, either the individual countries or the world, from all these wonderful promotional agreements.

My own natural bias as an economist is to move towards agreements that are enforceable in some sense, where you know what you are getting and you put a price on the externality, then let her rip, as opposed to having a bunch of politicians or well-meaning professors say we want to give 5 cents to that technology and 4 cents to this, or whatever.

The second point is if are going to do that, if we are going to go down the road of the subsidy and regulation route, we ought to actually evaluate what we are getting because regulation frequently has unintended consequence.

That's all.

MR. SANDALOW: Topics other than global warming are very much open. I am going to take about three or four questions because we have

run over, and just collect them, , and then let each of the panelists comment on whatever thread they would like to, and then we are going to call it to a close.

MR. WARPNER: Thanks. My name is Paul Warpner [ph]. I am with American University.

Two short questions. One if just a point of clarification on Mr. Hahn's talk. I wasn't sure if you were saying that the problem is that the costs are too high, the mechanism is too imperfect, and therefore we should really back up, or if, in fact, it is worth doing this at all.

That is, do you believe the issue of climate change is serious enough for us to go down any road, or is just mainly we can't get the mechanisms right? If you could, also talk the economic benefits of maybe going down the road.

We have been talking all day that this is going to cost tremendous amounts of money. Some economists tell us actually this could be a economic boon.

The second question I have has to do with Kyoto, and I am wondering to what degree we are somewhat mischaracterizing international agreements in the sense that again Mr. Hahn said that--

[Side A of Audiotape 4 of 4 begins.]

It strikes me if we hold that up as the bar, why sign any international agreement, because free ridership is a potential problem for every agreement. It strikes me that we often forget that these international agreements evolve, and the Montreal Protocol evolved from a convention to a protocol, to upgrades, and so forth.

To toss Kyoto out and suggest that a decade's worth of international negotiation, which has established some very good bench marks, to be sure imperfect, but to now allow that system to evolve to a place where we can expect upgrades strikes me to be shortsighted, and to remove the A, not V, but A, important inspiration for the kind of political will that you spoke about.

MR. SANDALOW: Thank you. Another question right behind you and then right next to you.

MR. GOODMAN: I am Mark Goodman. At a conference last year I attended on greenhouse gas emissions trading, there seemed to be a consensus among the experts, and one answered and nobody seemed to disagree with him, that the costs of Kyoto were greatly overstated for the simple reason that if Russia and the Ukraine had both ratified, and then even assuming that the U.S. had ratified, that Russia and the Ukraine alone would have generated credits equal to about half of the needed reductions under Kyoto just by doing things that would save them a lot of money, things like stopping leaks from their gas pipelines and installing thermostats in oil-heated houses all over Russia.

Therefore, the costs of these credits would be available at anywhere from possibly as low as 25 cents to a dollar a ton.

I would like all of you to offer your perspective on that.

MR. SANDALOW: The last question here and then we will have the panelists comment--all right, last two questions.

MS. CAREY: I am Melissas Carey [ph] from Environmental Defense.

I am sorry to do this to you, Bob, but you are the economist on the panel, so I have to ask.

MR. SANDALOW: A little louder, please.

MS. CAREY: A question for Bob. The McCain-Lieberman bill came up for a vote this past October and got 44 votes on its first outing on the floor of the Senate. By any measure, quite a bit of progress from the 95 to zero resolution that some of you referenced during your talks.

I am just curious. As an economist, you gave a rather tepid endorsement, I thought, of the concept of emissions markets. Given--maybe you didn't mean it that way--given the problems with small-scale, and what I mean by that is geographically limited markets, the McCain-Lieberman bill really seems to fit the bill according to your description of an ideal solution or an ideal second best.

Just thinking about the political progress that has been made on the issue, and the ripples that McCain-Lieberman has generated, I mean in the past several months we have seen parliamentarians from Europe, there was a member of the European Commission who came to testify before Senator McCain's committee, members of the Duma have come through town, all paying attention to this bill and this issue.

I guess I would just like your thoughts on the political progress that has been made and the suitability of this particular tool.

MR. SANDALOW: Thank you very much.

The gentleman right in front.

MR. GRECO: I will try to keep this short. I am Bob Greco [ph], American Petroleum Institute.

I did want to broaden the discussion per one of Dr. Holdren's slides where he showed the mortality range where you had about 85 percent or so was in other, I would say, environmental, economic, energy issues, when you talked about clean water, malnutrition, and in a world where there is limited resources, how do you and the other panelists say we address those much more pressing issues particularly from a Third World standpoint, where they are worried about day-to-day survival as a first step in building up their sustainable economy? Thank you.

MR. SANDALOW: Bob, several of these questions came your way. Do you want to start and then we will let John talk, and Nigel can have the last word?

MR. HAHN: Sure. First, let me respond to Melissa. Emissions trading is good. I spent 10 years writing about why it was good in theory, and a few years writing about why it didn't always work that way in practice, and then I worked with one of your colleagues very closely, the head of what was then Environmental Defense Fund, to help implement the Allowance Trading Program.

Your example of McCain-Lieberman, I don't think it is a big deal for climate change. I think it is relatively easy for politicians in the United States to hammer on utilities and get utilities to cut back on emissions. I think it is a lot harder to get the American public to pay 5 cents more in a gas tax.

I think it is a modest step. I wouldn't necessarily say it's a big step forward. I think I am more in line with Nigel on this. I would like to see some sort of concrete international cooperative small-scale experiments that would actually demonstrate that we have the institutional capability to do this outside of the United States, preferably with a very advanced country like Mexico, and then sort of work down the line and deal with some less advanced countries and see if we can develop the capabilities of dealing with the problem.

One other person asked me do I think it is worth doing something on this issue. Absolutely. I wrote a little book on it and I have written several articles on it, exactly what I am not sure, but I think that it is a real issue even though I think that the IPCC in some cases doesn't always give my notion of what would be unbiased estimates, particularly for the economic impacts.

MR. HOLDREN: I can't resist saying I once heard an economist defined as a person who lies awake at night trying to figure out whether what works in practice can possibly work in theory.

I guess I want to address the question that came from the gentleman from the API at the end. There are tremendous short-run problems in the world, dirty water, dirty air, malnutrition, lack of health care. I think it's a scandal that we are not making the investments that are required to address those problems, but I also think it is a scandal to suggest that we are not rich enough and smart enough to address those short-term problems, and the longer term ones, as well, which if we neglect them and manage to solve the short-term problems, will still come around and bite us a decade, two decades, three decades down the road.

We can and we must afford to address the problems in both categories.

I work a lot in both China and India, and what I have come to understand, which most people in the United States apparently do not, is that Chinese and Indians, to a remarkable extent, are concerned about climate change.

Yes, they are concerned about dirty water and malnutrition and inadequate health care, but they are also concerned about climate change. Both China and India have very substantial climate modeling establishments focused on understanding what the regional impacts of global climate change on them are going to be, and they have concluded in both countries that they are differentially vulnerable.

They are more vulnerable than most of the rich countries for a variety of reasons, some of them having to do with the monsoons and the way in which global climate change is likely to interact with that.

This brings me to a larger question about free riding, which will be my closing remark. The free rider issue has gotten a certain amount of emphasis here. I would like to suggest that we, the industrial nations, got a free ride from the atmosphere and from the rest of the world for the last 150 years, when, in the course of our industrialization, we used up most of the absorptive capacity for greenhouse gases of the only atmosphere that the whole world has.

Seventy-five percent of the problem up until now was caused by the less than one-quarter of the world's population who live in the industrialized countries. That is why from the very beginning of international negotiations on climate change, it was understood and accepted by everybody that there would

be differentiated responsibilities, that the industrialized countries, having created three-quarters of the problem up until then, would go first.

It is astonishing to me how rapidly we now forget that.

MR. SANDALOW: Nigel, you have the last word.

MR. PURVIS: Thank you. The question I believe was addressed to me about Kyoto and isn't there something that is valuable about the process, and here, I would like to suggest that it is worth thinking about the negotiations that happened from the conclusion of the framework convention in 1992, until just--well, that are ongoing really, but that really culminated in 1997 in Kyoto and then continued through the Marrakech conference in 2001, in two different parts.

There was the negotiation of the national goals or the emission targets that was resolved in 1997, and my suggestion was that those targets are largely irrelevant for the United States, that even the people who supported those targets believed that those are not achievable and that most economists would argue that it would be a rather significant economic burden.

I think that those who are interested in this issue do us all a disservice by focusing on the Kyoto target at this point, by which I mean the specific numeric goal that was negotiated in 1997. That is not really what the issue is now.

The issue is should the United States adopt a more robust policy on climate change, and I believe that we should. I believe that internationally, there are a variety of different ways that one could go.

The second part of Kyoto is the substantive rules or the infrastructure that was created to allow nations to meet those numeric targets, and I suggested that there may, in fact, be some lasting value in that, but I would like to highlight that those rules, which were negotiated in the UN process, also carry with them some baggage, and the baggage is really quite substantial.

As someone who spent several years negotiating with the Saudi Arabian, with the Nigerian ministers, where the chief of delegated from Saudi Arabia was the petroleum minister, where those countries had no real stake in the success of the process, but rather used the influence that they had in the group of developing countries and in the negotiating process to try and retard progress.

We should be thinking twice about whether a UN framework that brings in 180 countries with such a diverse mix of interests is really the ideal forum.

So, while the Kyoto rules may have some lasting benefit, my principal suggestion was we need to start at home, but to the extent that we move internationally, we can do that unilaterally in a very effective way just by leveraging our laws, and then, secondly, we can engage our key partners without having to bring in the incredibly complex and politically nuanced negotiations that are required in the framework convention by working just with key allies.

I don't have the percentage exactly in my head, but something like 80 percent of global emissions come from just a dozen countries, so that climate change is a global problem that requires widespread participation, but it is not clear that the United Nations is the ideal forum.

MR. SANDALOW: Thank you very much to all our panelists.

[Applause.]

MR. SANDALOW: We are going to get started immediately at the request of the next panel, with the next panel. They tell me they will understand if people wander out and wander back in at the beginning.

THE BROOKINGS INSTITUTION

"GLOBAL CHALLENGES FOR U.S. ENERGY POLICY"

Economic, Environmental and Security Risks

Friday, March 5, 2004

[TRANSCRIPT PREPARED FROM AUDIOTAPE RECORDINGS.]

PANEL 4:
POSSIBLE U.S. POLICY APPROACHES

Introduction:
Jason Grumet, Executive Director National Commission on Energy Policy

Speaker 1:
Robert McNally, Vice President of Tudor Investment Corporation

Speaker 2:
Phillip Sharp, Congressional Chair, National Commission on Energy Policy

THIS IS AN UNCORRECTED TRANSCRIPT.

MR. GRUMET: Thank you, David. It was really the concern voiced by Bob Hahn and John Holdren over free ridership that caused to change our schedule. We were crystallizing our concern that some of you might free ride home, trusting that others would stay behind to listen, so we have paternalistically decided to essentially make me your coffee break and move directly to our final panel.

In the finest tradition of a casino, we have blacked the windows the removed all the clocks from the room to deprive you of any natural insights as to the time of day, but it is shortly after 4 o'clock, and I promise that if we are all focused, we will get the boxed line flowing by 5:00, so we will actually start late and end early.

I am Jason Grumet. I am the Director of the National Commission on Energy Policy, and I get to now try to move us off of the last discussion to the final panel where we explicitly focus on where we should go from here, the qualitative portion of our afternoon.

There has been I think a very pleasant consistency really over the course of the last several hours in the projections of the trends and the risks and the probabilities of our current trajectory.

Many of those presentations were qualified with the notion that what we were seeing was the expected result if nothing changes. That, of course, was modified by Thatcher's Law of entropy that the unexpected, of course, will occur, but beyond the joy of the passive discovery of the future, we have the

blessing and the burden to be living in a great democracy, in fact, in the very capital of that democracy.

We are now today flanked by two of our nation's finest think tanks, so we are forced at the end to ask the difficult question what should we do, recognizing that "we" is a broad and difficult term, but how should we change things, and we are fortunate to have two really wonderful speakers to address this challenge.

First, we will hear from Bob McNally, who is presently a vice president of the Tudor Investment Group. Prior to his work in the world of hedge funds, Bob had a relaxing two years in the White House where he just floated on the gentle waves between the National Security Council and Economic Council addressing issues of energy policy and the ramifications that those policies would have for our economy and security.

In addition, we are joined by Phil Sharp. Phil is presently a senior advisor for the consulting group of Lexicon, where he focuses on many of the issues we spoke about today. He is also affiliated with the law firm of Van Ness Feldman in town, and in his honest moments will tell you he proudest career achievement is that he is also a member of the National Commission on Energy Policy.

Prior to that, Phil was elected by the good people of the Second District of Indiana to 10 terms in the U.S. Congress where he served on the Energy and Commerce Committee and actually chaired the Subcommittee on Power at Energy, so Phil has clearly thought about these issues more than once.

In order to get us rolling, and we are going to have some brief speeches and then entertain any and all themes that can be phrased in the form of a question, I am going to ask our speakers to indulge in a minor thought experiment and to project forward 12 months, that it is now March 5th, 2005, we have a president, we have a closely divided Congress, and just, for kicks, let's assume, Bob, that you have a prominent position in the administration, that your reputation is an intellectual beacon on issues related to energy and the relationship between economics and security has resulted in you being tapped essentially to design really the next version of our national energy strategy, and, Phil, for kicks, let's assume you are a popular Democratic Senator from the Heartland, a passionate pragmatist, and that you have been asked by both parties to develop a framework for our next round of comprehensive energy legislation.

Lest you dawdle, Phil, I will have to tell you that the demographics of your district are changing, and this may be your last shot.

MR. SHARP: Make it the last shot, that's easier.

MR. GRUMET: Frame the discussion as you would like to see the nation entertain it, and then we will entertain ourselves with questions from the audience.

MR. McNALLY: Thank you very much. Before getting into that thought experiment, I want to thank you for inviting. It's an honor to be here with Congressman Sharp.

I had a very fortunate experience at the White House, two and a half years, National Economic Council and National Security Council. I thought that if over 20 years you had a major California electricity crisis, major energy

plan, major energy legislation, one real disruption from Venezuela, one almost disruption from Iraq, and just for the sheer fun of it, an Enron subpoena investigation, that that would be a good career over 20 years.

I had it all in two and a half years, so probably to get to your answer in your scenario, if I am a senior administration official in December, I am also divorced and visiting my kids on the weekend.

I noticed two things in just the parts I was able to participate in. You are all very tired and you have been sitting down for a long time, and you have apparently gotten to the hardball questions earlier in the say, so I am going to propose a straightforward bargain. I will be brief if you throw me softball questions afterwards.

Let me get at your scenario by kind of proceeding in this fashion. I would like to make some observations on the challenges I think involved in energy policy-making and the circumstances that energy policy-makers of both parties confront.

In terms of energy policy-making, in my opinion, despite all the heat and controversy that is generated often by environment energy questions, most of energy policy-making involves pragmatic, sensible adjustments to our tax regulatory and security policies, that is done by centrist moderates of both parties.

That has been my experience, believe it or not. I think there is a broad understanding that our country confronts about four important challenges in terms of energy.

The first is we have to align our electricity laws to 2004, not 1934. We have had two recent experiences in California and New York where the incompleteness of the Federal Government's adjustment to the reality of competitive wholesale markets is apparent.

My experience was we had more cooperative help with the Democrats in the Senate than even with Republicans in working this through, that we all knew we had to get to open access, mandatory reliability rules, et cetera, and so forth, citing provisions even.

The electricity legislation has been kicking around for years in the Congress, it has to get done, so the first thing I do in December was say, Mr. President, if we do anything, we have got to get with Senator Bingaman, Senator Domenici, and others, and we have got to get electricity legislation finally done.

The second thing is we have to continue to work on comprehensive policies to mitigate our economic security and environmental vulnerability to the reality imposed by geography, geology, and economics, that we are and will remain dependent on fossil fuel consumption, and we can do that in a variety of ways.

I would probably tell the president that I am fully supportive of the policy he laid out in 2001, and we ought to continue to see that that is implemented. We ought to fill the Strategic Petroleum Reserve to capacity. We ought to be building on the largest CAFE increase on SUVs in 20 years, we ought to build on what the NAS told us was possible with the CAFE program, reform it, so that we can improve fuel economy without harming safety and without harming jobs.

I would say a third major priority is we have to find ways to use coal cleanly. That is just a bipartisan imperative. We have a 250-year supply, it's half of our electricity, we are going to burn coal in the next couple decades with strong bipartisan support.

Funding for clean coal research was mentioned. Those types of things have to be continued with the Congress. Again, I see already bipartisan support for that. Finally, and this is to the longer term, and some of the issues that came up in the last presentation, we have to find a way, we have to put this nation on a realistic cost effective plan to get off of oil entirely.

We have to do that for energy security reasons, we have to do that for public health reasons, and we have to do that for climate change reasons, and the order is not by accident in my opinion.

I heard mentioned in the last panel, some of the projects I was very pleased to work on personally. We can start with hydrogen. The President embarked on a bold, new, and expensive program to subsidize research into hydrogen fuel cell vehicles and the hydrogen generation and transmission technologies, so we have got the car makers and the energy companies coming together with a research plan, with a budget, real money from the United States Government with the objective hopefully of reducing the cost differential between conventional cars and the hydrogen cars, conventional fuel and hydrogen fuel, so that by hopefully 2018, we can be in a position where we are walking into a showroom and seeing the first hydrogen cars.

Fusion. The United States walked out the fusion partnership in 1998. President Bush directed that we walk back in, so we joined with EEU, we

joined with Japan, Canada, other countries, South Korea, and we are now part of that process.

If that works, we hope we will be able to commercially develop and deploy fusion energy in around the middle of the century, so that you could almost see a plan, the best--I am not a scientist, I am not a geologist, but the experts who have come to us have said the best way we can devise out of the mess we are in, dependence on fossil fuels mainly that come from the Middle East, is to develop hydrogen.

We will first reform that from natural gas and eventually from renewable and water, and we have to have sustainable electricity generation capability. That means Gen 4, advanced nuclear capability. It means clean coal, FutureGen project. It is a 1 billion, 10-year project that will develop both electricity cleanly, zero emissions, and hydrogen, and if we can bring fusion on line in the middle of the century, we can generate electricity and the hydrogen we need for transportation.

That is the best plan and offer that I am aware, that our nation's brightest and best can come up with, and I was pleased to be part of that.

So, on those areas, and we are always going to fight over CAFE, we are going to fight over ANWR and whether CO2 should be on a multi-pollutant bill or whether it should not be on a multi-pollutant bill, but I think underneath there is a commonality of views and understanding of what work has to be done, and a commitment to get it done.

Just finally an observation on making energy policy, and I ask, and I will be interested to hear from the congressman and others if this applied

in their careers, I find it is very arduous. It seems that there is an Off and On switch. If gasoline prices are $1.50 or below, and electricity is flowing through the lines coming into people's houses, the American public and the political leaders more or less are in a state of deep, deep, deep sleep when it comes to energy policy.

That is good because I think it allows the folks who are really concerned about these problems to have meetings like this and to work on solutions, and so forth.

But then what happens is when gasoline goes to about $2.00 a gallon now at high speed, as it is currently, and it has several times in the last few years, or when electricity suddenly doesn't arrive to the homes and businesses that have come to rely on it, all of a sudden we flip onto mania and panic, and a search for instant solutions as if with everybody sure they have the silver bullet solution to the immediate problem, as if you fell down, suddenly experienced chest pains, were able to do immediate diagnosis and tell the doctor exactly how to solve it, raise CAFE, use the SPR, impose price controls.

So, it is that off-on which I find I find disconcerting. This is something I would be interested in folk's questions and ideas and thoughts on it. In my mind, he only way to manage this, because we do deal with the most important issues I think in public policy, but we deal with kind of off/on policy-making process, is we have to do a little bit better job I think of formulating both legislative proposals and the consensus behind realistic non-legislative proposals, so that when the next crisis hits, we can move through the Congress or into the public realm, an acceptance for sensible policies rather than quickly diverting

into the marshes and the swamps that we know so well, particularly in election year.

I am not optimistic that anything will happen this year, but in 2005, that is basically what I would tell the president.

Thank you.

MR. GRUMET: Thank you, Bob.

MR. SHARP: First of all, I am very sorry Bob left the administration and I hope he will go back. That was very good.

I am going to address my remarks primarily to sort of the global agenda, which is what the conference was focused on. For those who say we have no energy policy, we have a plethora of energy policies, and we could talk about many of those.

I went to Congress in 1975, when we were just coming off of the embargo of 1973, and we were very much committed on a bipartisan basis to transforming our participation in the world oil market, and we were willing and able in this country to engage in incredible interventions that most of you that are younger would not even dream should be done or could be done in a political level in this country in terms of taxes, in terms of regulation, in terms of subsidization of all kinds of things to transform that market, and that colors my view of things.

There are two issues I think that have sort of run themes throughout the day on these world markets particularly oil, but also natural gas.

One is the reliability of those markets. Sometimes we call that the security, whether they are disrupted, whether price is run up, or whatever,

and then the other is climate and what we are going to do about that, and in both cases, I just have a couple thoughts.

First of all, on the global oil market, let me give you the Doctor Strangelove view for those of you who are old enough to have seen the movie. The subtitle was How I Stopped Worrying and Learned to Love the Bomb.

Well, let me suggest to you stop worrying and learn to love the world oil market because it is going to be with your grandchildren, and if you elect Ralph Nader president of the United States, he will still be confronted with what all Americans are confronted with, what all importing nations, what all exporting nations are confronted with, and that is that the oil market and the world markets are profoundly important to us and the world economy, and we are not going to be able to be indifferent from them, we cannot pretend they don't exist, and we cannot run away from them, and we cannot pretend in 10 years that we will be substantially and significantly in a different world unless you are now willing to commit yourself on a sustained basis to a much higher level cost of energy to this country.

We have seen no evidence in 30 years, whether it is with the threat of the Soviets, with the threat of embargo, with the threat of 9/11, that this country will tolerate that kind of thing.

So, let's stop the pretense and say how do we make these markets work effectively for us and for the rest of the world economy, because that is where all our politics or much of it has to be focused on this issue.

I hate to bring cold water on those that have the quick and easy way out. I don't see it. If you have got one, I hope it will work. But that does

not make me, and I do not think it should make the country, a laissez faire attitude about these markets.

Quite the contrary. Let me suggest a few things. One that we did not talk about, it has been alluded to in a couple of instances today, but, first, the world market is in energy. Even in uranium and nuclear affairs in oil and emergent in gas are becoming more significant, not less significant, and we are still developing the kinds of institutions and bilateral arrangements these markets we correct for their problems.

We have those arrangements on the domestic front for our markets in many, many ways, and have had for a long time, but we are obviously still working that on the international front, and an administration--and this administration has done a number of positive things--needs to take this seriously, and the United States as world leader needs to take it seriously.

Let me just quickly run through a couple items. Obviously, the International Atomic Energy Agency, the President has just announced the need to upgrade a whole series of things and how we make that marketplace more safe for us in terms of nonproliferation.

In the world of finance, there have been long-time arguments over World Bank and other things, but clearly those institutions have to be directed at real world problems, and the negatives and the externalities that oil distribution and production create in some parts of the world.

On the environmental front, we have to strengthen our capacity and our leadership to see to it that the way in which oil production and gas

production occurs in other countries has a minimal protection of the local economy, as well as the distribution system.

This is not to criticize all of our companies. Oftentimes they are doing a far better job in bringing new techniques into these areas, but it is not universal, and we, by the way, are politically going to get the down side of this over time as people see us as the energy hogs who give them the pollution.

Finally, we need to strengthen and accelerate our information and coordination efforts among our governments on energy policy and energy information. The reason I say this is we went through a period when we were ready to dump the IEA, for example. It didn't seem relevant in the '80s, why are we even spending federal money to keep this silly institution going.

There may be problems with the way it collects data and announces them, but we would be very foolish to get into an energy crisis without at least best available information to the various governments that will panic, absolutely panic if Saudi Arabia is not able to up production at a time of distribution.

As we heard earlier today, there is increasing worry that they may not have the surge capacity or the political capacity to play the role that they have played in the last 20 years, which has actually been generally in our national interest.

Let me suggest the second thing where we need to focus, and that is on the crisis response kind of proposition. We did hear that several times today. We have our salt domes with about 600 million barrels of oil for our

Strategic Petroleum Reserve, and I applaud the administration in giving new emphasis to this.

Republics and Democrats were willing to start selling it off as the pressures of the budget in the last decade became big, and it didn't look like there were any problems on the horizon, and it is expensive, folks. We pay a lot of money for that.

By the way, the American people will absorb lots of money, they just don't know they are paying that one.

The fact is that it is very important. China is talking about doing it. We need to encourage this around the world, because frankly, we don't have many tools except depression as a way out.

I mean you can always solve every energy crisis by putting people out of work. It happens instantly. You just slow down the economy and it is marvelous, you get over the energy crisis, of course, the other crises you have got to deal with.

But the point is, the Strategic Petroleum Reserves are inadequate to a severe situation, but they give us marginal protection, they give us political leverage with Saudi Arabia and other producers, and so it is in our national interests to preserve this asset and to have it available.

Now, it is caught between two forces that argue about it, the use it or the lose it folks. The lose it people say it is silly for us to spend all this money, and it is not worth it, so let's lose it, it's an easy source of revenue obviously for a while for the Federal Government, and since we have passed our golden age of 10 minutes of having a balanced budget in this country, this will

become an intense argument. Mind you, we never balanced the budget while I was there, so I don't pretend it is simple.

But the other part of that is the use it, those who advocate, well, let's use it as a way to modulate prices and whatnot. In my view, only in the extreme circumstance should we do that. I agree with Dan Yergin and this administration, and a number of other people that this is a strategic tool, but it is a cost worth bearing.

Let me turn to the third proposition. We heard all day from the economists, and someday I hope economists will step forward and actually support in the political arena the internalization of costs that they believe is what we ought to be doing.

Excuse me for expressing some skepticism. There are those who do. But the two external costs that we probably don't internalize in price most obviously, one is the cost to us. The protection and the promotion of the international oil market clearly has some implications for our military budget, some implication for our foreign policy and foreign aid budgets.

I don't pretend that people can sort that all out and know exactly what it is. I just know that if we have a reasonable case to be made for, you know what, we ought to have a little tax on oil to help offset that cost to the budget, so in two years or three years when finally people get past the notion that they can escape all taxes and all expenditure cuts, and they start having to deal with the deficit, this might be a fruitful place to look for this tax.

I don't put a lot of hope in this. I just think it would be smart for the country to say this is an external cost, a portion of which ought to be borne on, and its value, I think is a smart way to go.

The second internal cost, I think is both more politically realistic even though that is not what you gather from other speakers today, and that is I think on climate change. The United States is getting close and will in short order decide that it needs to establish at least a modest path on carbon restraint in this country.

We could argue, I could build a case for that if you want me to. I think it's coming. I think industry has decided, they more and more recognize they need the certainty of guidance. They are making huge investments for long term in this country, a number of which could be undermined by a sudden change in policy in this country. There are just lots of reasons.

We need to establish that path to help guide private investment, and frankly, because it is so difficult at the federal level to guide your research budget and your other kind of policies as the energy bill illustrates, and it is not the first time this problem has come up, that if we had some direction on that, it would give some guidance to where you need to invest the federal dollars as well.

My suggestion is one that has been floating around a lot, is that we got to a cap and trade system with a safety valve, and we would probably start modestly and up.

Safety valve means you sell credits. It's a predetermined cost that you are placing on the economy, so if you don't have enough credits to meet the cap, you can go in and buy them from the Federal Government at a set level.

If you are intent on making a certain goal or compliance, this is not a smart thing to do, but if you are intent on getting a process in place and getting some shadow costs in the marketplace for what carbon costs, I think we will do this unilaterally, by the way. I don't think we are going to just turn the politics upside-down from where we were before.

You have to have the international agreement first, you have to have everybody doing it first. I don't think we will do it very strongly. I think we will do it modestly and then we will work on the engagement. So, I would internalize cost there.

Third, as a part of internalization of cost or what I would call as a part of making the market work, the oil market in the United States does not have a very good demand response proposition to it, because it is so focused in transportation, and to be frank about it, even these $2.30, or whatever it is now, we may not see a lot of market response to that price level unless it is sustained for some time.

So, I think we have to take very seriously--which we have partly underway in this country--ongoing research and development of the Federal Government and assistance with companies to advance technologies and alternatives and in efficiency, but that never guarantees it is utilized in the commercial marketplace, and regrettably we didn't do anything about it in 1992 under the theory that lots of technologies were coming in the marketplace, it was

easier for us to do nothing, and those would transform the landscape anyway. The market is doing it, why should we mess with it.

Well, as one of the speakers alluded to, the fact was that the technologies came in, they are using lots of automobiles, but, of course, they are more power now, so you climb Mount Everest in your Hummer, and everybody wants to apparently. I don't believe they do, by the way, I think that is a bunch of baloney.

But the fact is we can have a lot more power and a lot more choice in consumers, and we can also have a lot more fuel economy, so we are going to need some kind of CAFE adjustment. It doesn't have to be the extreme, we should give companies lots of time.

We just need to keep the direction headed in the right way, and it is not enough to have one group of cars that are affected. We need a fleet that can do lots of different things.

I appreciate your reference to national academy studies. Excuse me, I am taking longer than I meant. Let me just go the fourth, and I am not even going to spend much time on that.

We have heard a lot about technology policy development. Obviously, there is a lot of things we have to do, but let me suggest to you the hard part here is--the hard part is making the decision of how you are going to compensate for that low cost of oil and gas prices in the marketplace.

You may complain or we may complain about the cost of that, but I can assure you that if you want real technologies to enter the marketplace

in significant ways and make a difference, we haven't seen a lot of that happen unless the price of the current fuel goes up.

So, we have to decide selectively how we are going to put public resources in, to bring into the commercial marketplace the demonstration of the technology beyond the R&D stage, not an easy question, but I think we can do some of that without breaking the bank.

With that, let me just conclude with one comment about where we sit internationally. We obviously, as a world leader, our military power matters, how our diplomatic skills work matters, how our economy flows matters, but I would suggest to you also that we had better be focused on that we are now the big dog on the block, and that has brought on some things that a lot of Americans don't like.

Some of it, people will say we inflicted on ourselves, some of it is just the natural result of being the remaining huge power, but let me suggest to you one of the arguments you increasingly hear, and I think if we are not wise, it is going to intensify against us.

That is that we over-consume our share of the natural resources of the world. We over-pollute our share meaning that is in carbon, because we are actually pretty good on other fronts, unless we are willing to take some steps, and we are very careful about, well, we don't think we want to drill off of Pensacola because, gee, it's 100 miles out and who knows, that might keep two tourists away from the shore, the tourist interest there.

But we are quite happy to have that happen somewhere else without environmental constraint. In other words, we are exporters, we are just a little too good for everybody else.

I would suggest to you that these things are not things that are going to fundamentally shift the international politics, but I don't think it is where our grandchildren want America to be.

[Applause.]

MR. GRUMET: Thank you.

You have asked a number of questions of us, and I would like to just kind of close this out by asking a collective question of you. The synthesis that I would propose, it Phil and Bob were for the moment one person that we have heard, is that we need the government to try to rationalize the transition towards a future electricity market, there needs to be reforms to the current CAFE system. There needs to be I think a reasonably aggressive program of technology advancement that has the government playing a hand in promoting clean coal and hydrogen and advance nuclear power, and there needs to be some kind of leavening of those technologies to market through the imposition of a market signal, whether it be through carbon or through internalizing the cost of security.

So, what do you think? Would anybody like to comment on that, ask questions about it, or is it time for the boxed line? It is hard to tell at 4:38 in the afternoon.

Does anybody have any closing questions or thoughts?

MR. GOODMAN: I am Mark Goodman again.

On the subject of import dependence and import shares, sure, it would be great if we didn't have to import any oil, if we did it eventually, and not in a way with everybody else doing it in a way that would destabilize the economies and societies of the many developing countries that are oil exporters.

We have a higher oil import dependence now obviously than we did in the '70s. We see supply interruptions and yet they have a lot less economic impact now for a variety of reasons. The biggest in terms of volume of interruption, you know, the biggest disruption we ever had was in 1979.

At that time, England, which was a net exporter of oil and of energy overall, had the largest recession of the industrial world. Japan, which imported 100 percent of all of its energy, avoided a recession all together.

People from Argonne Labs have charted, as we saw a sort of summary chart going back, but if you look at the history of oil price shocks since the advent of petroleum age, and they go back that far, in the U.S., we have had some sort of a recession after each price shock including that period of 50 years when we were supplying the rest of the world with oil.

The economic costs to use of oil price shocks are virtually unrelated to the level of oil that the U.S. imports, and we shouldn't kid ourselves about that.

It seems to me that when we talk about energy security, there is three dimensions to energy security. There is what everybody associates with it is security from these price shocks, which I think in retrospect we can see aren't really threats to our security at all.

Moreover, they are really a part of the functioning of the normal commodity price cycle that you see for all commodities, and what happened in the '70s was we didn't understand that, we went crazy, we overreacted, you know, not only with conservation and with alternative energy, but particularly with major new supplies of non-OPEC oil, Alaska North Slope, Mexico, North Sea, all coming, bunching on the market at the same period of time.

The result was a glut, depressed prices for a decade, the loss of any progress we were making on efficiency, although that happened with a lag, the gutting of much of our energy industry in the Southwest followed by depression in the real estate industry in the Southwest, and the savings and loan industry in the Southwest, which then threatened the savings and loan industry in the rest of the country. It is important that we put these things in perspective.

The second dimension, which has been talked about earlier, is the threat of a cataclysmic supply disruption, which would be a real threat to our security, and it is something we haven't seen yet, and the policies for safeguarding ourself against that are very different than any policies we might take to try to stabilize prices in the market, and in some ways, they contradict each other.

The third dimension would be long-term sustainability. Again, the policies that would promote long-term sustainability, not only aren't the same policies, but can be in conflict with policies of these other.

We need to develop an analytical framework for understanding energy security within its various dimensions, what are the relationships

between them, how can we prioritize between them and reconcile these objectives and the measures that we would take to do that.

Unfortunately, in 25 years since the Department of Energy was formed for the purpose of addressing energy security, it has never attempted to do that, to the best of my knowledge, and I am not sure that really anybody else has.

MR. PIZER: Billy Pizer [ph], Resources for the Future. I am an economist. I guess I wanted to ask you guys both an economics question, somewhat divorced from the problem.

It seems like there has been a lot of discussion about the security and climate change concerns that exist regarding energy usage, and both of you guys have kind of talked about the long-term need to either move off of oil or move off of fossil fuels to protect the climate.

Both of you have kind of articulated or it has been articulated during the day, two different approaches. One is kind of pricey externality and let the markets rip, the other is focus more on bringing forth the technologies through R&D.

As an economist, I can cite failures in the R&D market, I can cite failures in the market for the externality whether it oil security of climate change. I guess what I am curious about is when you guys are weighing the relative merits of these two things, either raising the price of the externality oil security or climate change versus subsidizing the technologies, how do you weigh the relative importance of those two approaches, how do you balance that?

MR. McNALLY: Easy question from my former colleague. Thank you so much, Billy.

I think you have to make an attempt to calibrate the approach to the need based on what the science you believe tells you and where the political support for the policy measure is.

I would, in my hierarchy, say that the first approach, price externality and let her rip is the serious, high-octane approach, if you will. Subsidizing research is less politically difficult, I think less intrusive in some ways I think, and a broad of a measure, easier to get done.

I think in the case of climate change, with all due respect to the scientists, and I am not one, my sense is that understanding of the science, the risks, the costs, and the benefit of different approaches is more consistent with the second approach, which is subsidized technologies that have other benefits that are politically more understood and accepted, such as energy security and public health.

The science around sulfur dioxide, mercury, nitrous oxide, lead, I think is a lot firmer and harder, and permitted these other kind of more aggressive--either regulatory or market-based approaches that we have taken.

I would just submit, as a reality, that the science and the public will to do the same type of thing in climate is not there. I would just observe, you know, take a look at Social Security. We can calculate with fairly good precision the net tax burden we are putting on children right now for failing to address the long-term imbalance in our Social Security.

One of the most irrational things I think for any society throughout history to do is to disadvantage and harm its children's future, yet we persist in talking for years and years and doing that, and if we can't even get around to fixing Social Security, we are having so much problem getting a multi-pollutant bill done on pollutants that have known and much more scientifically understood and believed health impacts.

Thinking that there will be a consensus to take that first more robust approach I think is a bit difficult, but that is what you are always trying to do is to calibrate it.

MR. SHARP: The first thing, if you never get agreement of what the goal is, you are way ahead of the game in American politics, because, first of all, we just almost never agree on goals, and if you can get that, that is the first and foremost thing, because at that point, then, I get pragmatic and I say, well, my economist friends tell me the best thing would be a tax as a way to internalize externalities, and we might get a fourth of what we think we ought to have by tax, and then we do it the rest of the way.

The truth is we Americans have had such a luxury politically and economically of being able to disguise cost, do all kind of inefficiencies that other societies haven't. I don't see how we are going to grow our way out of that.

I mean people are sort of shocked and offended by the energy bill and with good reason. What it shows a lack of is what is the goal. It is just not clear. I am not talking about what the administration proposed, I am talking about what the Congress did, and I had been there, it wouldn't necessarily have been any better, that is not my point.

The point is, is that what it reflects is the absence of an intellectual or political discipline in the society about what we want to accomplish. One of the reasons for this commission is they might be able to identify what some of those goal are.

But I would argue that in the end, most of it is our qualitative judgment, and while I don't disagree with Bob about trying to calibrate these costs, I think John Holdren made it pretty clear, we are taking risks whether we know that they are for sure or not with our grandchildren if we just do nothing.

I think Bob would agree with that. I think that we have to push the technology, but I tell you, we have spent, people do not realize this, for half a century, billions and billions of dollars in research on technologies, and coal gasification, all these things, nothing new about those.

We were thinking of doing a [inaudible] plant in this country, as they did. That is South Africa's thing years ago. The catch is it is more expensive than just buying the oil out of the marketplace, or gas out of the marketplace, and you have got to make up your mind, if you are serious about this, is just having the technology work isn't good enough in an economy like ours.

There is no evidence the economy will jump to just adopt a whole new technology or a whole new fuel. I don't seen that evidence. Maybe economists will show it to me, because it is always up against the existing infrastructure and up against that.

So, it is a big price, it's too mushy for an answer for your thing, but I think we have to drive harder on some of these goals on the environmental

side, and I think we will. I think one of the results of where we are politically in this country is we are coming back to recognizing that we have to do more.

MR. GRUMET: Other questions?

I think I can sum it up in part in response to Billy's question. Our commission is doing some research looking into what might be the interesting synergy between the combination of an inadequate technology policy and an inadequate price signal, but that the notion that two modest measures in both camps might actually produce results that are greater than the sum of the parts.

It has been a real pleasure to have the opportunity to be with you today. I want to thank very much Brookings for hosting this event, and the American Enterprise Institute for joining with us.

Thank you all and for the stalwarts, I hope you stay around a little longer.

[Applause.]

[Whereupon, the conference concluded.]