ABC AND THE BROOKINGS INSTITUTION

OPPORTUNITY 08

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PANEL ONE:

Moderator:

DEAN BORG
Senior Producer and Public Affairs Reporter
WSUI Public Radio, Iowa City

Panelists:

WILLIAM ANTHOLIS
Managing Director, The Brookings Institution

MICHAEL O'HANLON
Director, Opportunity 08
Senior Fellow, The Brookings Institution

DAVID SANDALOW
Energy and Environment Scholar, The Brookings Institution

PANEL TWO:

Moderator:

DEAN BORG
Senior Producer and Public Affairs Reporter
WSUI Public Radio, Iowa City

Panelists:

STEVEN FALES
Associate Director, Office of Biorenewables Programs
Professor, Department of Agronomy
Iowa State University

JOHN MIRANOWSKI
Professor of Economics
Director, Institute of Science and Society
Iowa State University

TONYA PEEPLES
Associate Professor, Chemical and Biochemical Engineering
University of Iowa

JERRY SCHNOOR
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MANI SUBRAMANIAN
Director, Center for Biocatalysis and Bioprocessing
Professor, Department of Chemical and Biochemical Engineering
University of Iowa

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.P R O C E E D I N G S

MS. BENZONI: Good evening, everyone. Thank you all so much for being here tonight. I want to thank you all on behalf of the University of Iowa Lecture Committee and the Office of the Vice President for Research for coming here to engage in this forum on energy and national security.

Before we begin, I'd like to remind you all to turn off your cell phones and also to refrain from any flash photography. Now, as Iowans and Americans, biofuels and our continuing search for sustainable energy are vital topics. Energy has the power to shape not only our national economy and policies, but our local ones, as well.

Politicians across the country are feeling pressure to make changes in how we deal with energy. And this, in part, is thanks to the group of intellectuals and advocates that you will hear from tonight.

Moderating tonight's discussion is Dean Borg, the current senior producer and correspondent for WSTY at the University of Iowa. Mr. Borg's involvement with news reporting spans more than 30 years. As an Iowa alum, his experience ranges from contributions to national public radio, directing WMT television and radio in Cedar Rapids, Iowa, and reporting from South Vietnam during the Vietnam War. Please join me in welcoming Dean Borg.

MR. BORG: Thank you. It's a pleasure to work with this group here this evening. Kelly and I were just, before we walked out here, comparing backgrounds and families and so on, and she's familiar with my home area.

She asked, where are you from originally in Iowa, and I told her the northern Iowa area, and she right away said, well, she had some family and linkages there, and that sort of reminded me of the significance of our discussion here this evening, because when I go back up to northern Iowa, and many of you who have driven that I-35 corridor, north from Ames, know the landscape there has changed just in recent years.

Off to the west, it's completely white with electrical generators. In fact, some of my relatives in northern Iowa earn more now from the electrical generators that have been erected on their farm land than they do from farming itself.

Another thing that strikes me and I recall from northern Iowa is that owners of farm land there now are often -- are soliciting those who they know are in the confinement to the livestock confinement operation business to, the land owners say, I'll sell you some property of my farm land if you will build a hog confinement operation on my property and that I can have the waste for fertilizer, because that among farmers right now is known as liquid gold, and it's much cheaper than putting commercial fertilizer, which, because the base of commercial fertilizer is derived from oil and petroleum, that expense now makes it far more efficient for corn producers in that area to have a ready source of livestock waste rather than to buy

commercial fertilizer.

And just this morning, as I -- I had an early morning stint this morning because we're in our fund raising week at Iowa Public Radio, and so my day began actually about a little after 3:00 this morning, but as I was driving into Iowa City or driving toward Iowa City, I noticed that gas prices had gone up very dramatically in the last few hours.

Then I spotted the station as I drove by that was still 20 cents lower than some of those that I had just passed, and I made a -- at that time of the morning, nobody else is on the street, and I could make a quick u-turn, and got back to that station, which was locked up, but the pumps were lighted, and I filled up with gas that was 20 cents a gallon cheaper.

All this just goes to say, hasn't Iowa changed, haven't our priorities and our thinking changed. I could, and you could, too, go on with stories of why we are here this evening and why we're talking about what we are. I'd like to -- as I introduce our panel here, before we do, I'd like to have Bill Antholis, who is the managing director of the Brookings Institution, just give us an overview of Brookings, would you do that, please?

MR. ANTHOLIS: Sure; well, first, on behalf of David and Michael, I just want to say how delighted we are to be here. This is really an exciting event for us. Michael is the Project Director of Opportunity 08 and he'll talk about that a little bit in a few minutes.

But a big part of our life at Brookings is spent inside the Beltway in Washington, and all of us have been talking about getting out, and getting out and talking to influential people around the country. And right now, particularly at this time, the four year cycle, there's nobody more influential than the people that we're looking at, that is you.

So we're thrilled to be here, and we're also thrilled to be here because we hope to learn a whole lot. Just three words about Brookings. If you go to the Brookings web site, you will see three words next to Brookings right now, and those words are quality, independence, and impact.

There's been a lot of discussion in the last ten years or so about what think tanks do, who they are. At least for Brookings, we see a very politically polarized landscape out there, and we see it as our job to do those three things; one is to provide really quality research to help elevate the debate in the country; two is to be really independent.

We have Democrats and Republicans and Independents at Brookings. But everything at Brookings starts with a question and ends with an answer. We like to say that the thing that we don't want to be is Jeopardy, where the answer gets posted on the board and the contestants sort of scramble around to try and figure out what's the right question that matches up with that answer. We start with questions first, then come to answers, and that sort of embodies our research.

But the last thing is, you know, we see our partnership relationship

with universities as -- university's goal is to teach students and to pursue research, wherever the research goes. For us, we share the value of educating the public and doing quality research.

But the main output that we have is not teaching students, but trying to have impact on the public policy debate. And that means getting our research into the hands of policy makers and influential people, and as I started by saying there's nobody more influential right now than you all.

So we're thrilled to be here, we're thrilled to have Dean as our partner and moderator in this, and both the University of Iowa and our representatives from Iowa State University here tonight, it's a great thrill.

MR. BORG: Bill spoke of the Opportunity 08 project, and the director of that is sitting right immediately to my left, and I'd like to introduce him. He'll give just a bit of an overview of Opportunity 08, and then we'll begin our panel discussion here tonight, because he's the first one of our panelists here who will speak. He's Senior Fellow at the Brookings Institution, he specializes in isn't this significant, a rock in North Korea, homeland security and defense issues, and as I said, he's the Director of the Brookings Institution Opportunity 08; Mike.

MR. O'HANLON: Thank you, Dean, thank you all for being here, and we're delighted to be working with the University of Iowa and Iowa State colleagues, and you'll hear from them soon. I am a national security specialist. David Sandalow and Bill know more about energy.

I just want to really leave you with one opening thought about energy. Before I do, I will say a word about Opportunity 08. We have decided that we really need in this presidential season to build on the tradition of non-partisanship and independence that Bill Antholis mentioned. And so I hope you'll find some of our materials of interest at Opportunity08.org.

We have people like Dick Thornburg and Warren Rudman and many other scholars, some at Brookings, some from the broader policy community or on our Board of Trustees, or otherwise involved with Brookings writing for this project. Some of the most important issues we address have to do with energy. Again, I'm not going to talk about ethanol, you know more about that than I do, my fellow panelists know a lot more about it than I do. What I want to say is, from a national security perspective, what can we realistically hope that energy policy will allow us to do in the next one to two decades, to give us a little bit more of an ability to distance ourselves from the turbulence and the troubles of the Middle East region in particular.

To what extent can we increase our own options for national security by mitigating our dependence on foreign oil? I'm struck by the fact, along the line of prices. Dean talked about finding a deal saving 20 cents a gallon.

But I think all of you know that at a time when we're importing more than 12 million barrels of oil a day, if you do the math, 12 million times $85 a barrel, we as a nation are importing more than $1 billion of oil a day. So the economics of

this -- that math I can do. I'm not enough of an expert on energy to do much more than that. But $1 billion a day is staggering.

On top of that, I'm not even talking about the amount of money we spend in military preparation, to have a capacity to help stabilize the Persian Gulf, and of course, I'm not even mentioning the ongoing daily cost of operations in Iraq. If you add those two things together, estimates vary, but that's roughly another half billion dollars a day. So our energy habit, by this very crude math, is a billion dollars a day worth of imports and a half billion dollars a day worth of military expenditure in one form or another. Now, I do not want to over-dramatize how much we can reduce that simply by going towards alternative sources of energy. And I think our panelists tonight will give a very sober accounting of what's feasible and what's not feasible.

But I would like to present this thought: wouldn't it be nice if, in a current standoff with Iran—which produces about four million barrels of oil a day, roughly five percent of the world's total—wouldn't it be nice if we, the world, had the capacity to tell Iran, we're not going to import your oil anymore until you stop trying to build nuclear weapons and supporting terrorists and shipping weapons into Iraq that are killing one to two Americans a day on average? Wouldn't it be nice if we felt we had that luxury or that liberty or that policy leverage? But you know what, we don't, because we're already tired of escalating oil prices, we're tired of spending 3 or 3.25 or 3.50 a gallon at the pump, and as a result, Iran, which has this complete

dependence on oil for its national economy, almost has the upper hand on the oil issue with the United States and the other industrial democracies.

So what I'm proposing to you, and I'm happy to go into this in more detail later, is that we do have the ability, if we can even mitigate our national oil dependence by a few million barrels a day over time, and if other western industrial economies, and China, and Russia, and India can do the same, collectively, if we can do that, we begin to have a world in which a crisis in the Middle East does not have to present us with the options of doing virtually nothing or doing a bombing campaign, that we actually can use economics as leverage to help our national security rather than to have President Ahmadinejad, or whoever else your favorite dictator of the day may be in that region or elsewhere, with the upper hand over us.

So I think that much national security leverage, that much national security improvement in our position we can aspire to. There are policy goals and policy tools and policy objectives that we can pursue that I think would get us to the point where in a future crisis some years down the road perhaps, but not right away, but not too far off, we actually can turn the tables a little on just who needs that oil trade the most. That's my opening motivational comment. I look forward to seeing if I'm right, whether David and others would be able to point the way towards finding at least some substantial percentage of our liquid fuel requirement from alternative sources of energy. Thanks.

MR. BORG: There's a new book out significantly, it's called

Freedom From Oil, and our next speaker is the author of that book, David Sandalow. He's a Senior Fellow at the Brookings Institution, with special expertise in energy and the environment; David.

MR. SANDALOW: Thank you, Dean. You know, if I didn't feel like drinking water tonight, I could ask for soda or orange juice instead. If I didn't feel like a hamburger afterwards, I could go get pasta or vegetables. But let's just say I wanted to leave here and wanted to travel about 50 miles and I didn't want to use petroleum, I would be out of luck. And in my view, that is the fundamental problem that we face.

We have a transportation infrastructure that relies upon petroleum for 96 percent of its energy input. Now, we grew up with that, our parents grew up with it, our grandparents grew up with it. We think it's normal, but it's actually deeply abnormal to have a global transportation infrastructure that relies completely or almost completely on one fuel.

And I think if you start unwrapping some of the national security and environmental and economic problems associated with this problem, the most important fact is that, and we need to build cars and trucks that run on fuels other than petroleum, and it's not crazy, it's something that can be done.

So I'm going to make just four quick points in opening; the first one was that, that the single most important problem we face is the lack of substitutes in the transportation system. The second point is that biofuels can be a very important

part of the answer. And we've already seen this big explosion of corn based ethanol in the past couple of years, a few points about that. I believe in corn based ethanol, I think it's got an important role to play in our solution to this problem.

I will say, interestingly, when I started writing this book, *Freedom From Oil*, about two years ago, almost everybody I talked to was in favor of ethanol. The pendulum has swung. Ethanol is no longer the teacher's pet of the nation's energy debate. I probably hear more criticism than I do support for ethanol around the country today. And I think that the second panel tonight is filled with experts who are going to get into these issues at a level of technical detail that none of the three of us have the ability to do.

But I'm a believer in ethanol. I think the pendulum has swung pretty far and there's a lot more criticism out there. I think, in particular, that corn based ethanol can be an important bridge to cellulosic ethanol.

I suspect a lot of people here are deeply familiar with this issue, that we need to build up an infrastructure that will take ethanol in this country, and that ultimately cellulosic sources are going to play the most important role. There are a lot of challenges, for sure, with cellulosic sources. There's one other point on biofuel, before I move on. One of the real challenges building a biofuels infrastructure is that it takes place everywhere from the farm to the car. And there's no single company that's vertically integrated all the way across the value chain. And so I think, and I'd like to hear from you all whether this is correct, that what's

happened in the past year or two is, we've focused on one part of that value chain, which is the building of bio refineries and actually generating more ethanol, and we now have a temporary market problem because we're about to have more ethanol on the market, but we don't have the gas stations to dispense it at E-85, and we don't have the cars that will take it because we're on flex fuel.

So what we need to do, and what I called for in my book is, we need government to step in I think and insist that we build gas stations that dispense ethanol. And what I propose is that half of the gas stations owned or branded by oil majors be required to have at least one ethanol pump.

My research says about $4,000 per station to do this. It's a rounding error in the context of the profits of the oil companies. But I think we need government to insist on it. And we need government to insist that all cars are flex fuel over the course of the next decade. The American car companies are actually moving pretty quickly in this direction, but I think we need to make sure it happens very quickly. So that's biofuels. A third point I want to make is that plug-in cars are a huge part of the answer here. If you wanted to figure out one thing that would make the most difference most quickly, it would probably be making cars that connect to the electric grid. And we had this whole huge infrastructure for generating electricity in our country; it actually does us very little good in terms of getting off of oil because our cars can't connect to it.

Right now, as I've already said, 96 percent of the energy in our cars

and trucks is from oil; only three percent of the energy in our electricity sector is from oil. The single best thing we could do is to make cars that connect to the electric grid. And people often ask me, can it be done, for years I've been saying yes, now I can add to that statement, I've been driving one for the past month, it is fantastic.

I have a -- it's a Toyota Prius that's been -- they've taken out the spare tire and put in a litheon battery and a plug. And I go home every night, it's -- I'll tell you what, when these things are available, everybody is going to want them. I plug it into a regular extension cord in my garage, charge it up, it goes about 30 miles without having to use gas. If I accelerate quickly out of a stop light, it'll use a little bit of gas, if I go up a steep hill, it'll use a little bit of gas.

But we've been driving out -- I was getting -- it has a great gauge on it. I was getting about 150 miles per gallon on this, and so I talked to the guy who owns this car, and he said, 150, I've done much better than that. So we went out driving, we drove seven miles, we used -- the gauge did not even register a tenth of a gallon of gas on this thing. It said 343 miles per gallon. And by the way, so plug-in cars. By the way, you can combine these two things. I mean you could make -- that is, electric cars and biofuels.

You could make, and we have the technology today to make a plug-in car that takes E-85, and if you did that, you know, multiply my 343 miles per gallon times about five in terms of miles per gallon of petroleum, we're talking 1,500

miles per gallon of petroleum. I mean this is doable today, it just -- we can really do this.

So my fourth point quickly is, I think this is an issue that unites Americans. And, you know, just -- about a year ago, a little bit more, I had lunch at the Brookings Institution with Newt Gingrich and about 30 other scholars there, and you know, Newt Gingrich, right wing republican, prominent for several decades, and I asked him, what should we do about oil dependence, and within a few weeks I had dinner with Howard Dean, and I asked Howard Dean the exact same question, what should we do about oil dependence, and those two men gave me basically the same answer, and those men are not identical twins, let me tell you.

I mean both Newt Gingrich and Howard Dean told me, this is a huge national security problem that we have to address, ethanol is a big part of the answer, we need a Manhattan Project to have research effort in order to solve it, and we need to improve the fuel efficiency of our cars. About 90 percent of the American public agree to this. I think this is a huge slow pitch softball waiting for the next president to hit out of the park. That's my opening, I'd be happy to take questions.

MR. BORG: And we will pursue those topics as we go along. Thank you very much, David. You've heard already from Bill Antholis. I told you that he's managing director of the Brookings Institution, speaking with him early. He said, I'm a non-specialist, I have a broad spectrum of interest, and I'm glad that he agrees with what he had told me earlier, he's shaking his head yes.

But one thing that I found very interesting is that he was at Kyoto, Japan during the negotiations there, and so he can give us insight from those negotiations and the special expertise that he has in subjects ranging from climate change, to democracy promotion, to emerging markets, and U.S. foreign policy. So I'll just let you take it from there, Bill.

MR. ANTHOLIS: Well, thank you. I mean I feel very much at home. I gather that I -- I know that the University of Iowa is the liberal arts university for the state, and I am a pure liberal arts person. My interest in climate change -- well, my interest in climate change is, I was appointed to work on climate change policy when I was at the White House, and I didn't know much about it. I came to understand that it is probably the most complicated issue that the country faces. It is more complicated than health care, and I must say that I'm pretty baffled by the health care system in the United States. Climate change is even more complicated. It brings together science, economics, politics, and diplomacy. And inasmuch as it corresponds with the national security agenda in the United States, also plays into a lot of those geostrategic issues.

That said, I think climate change has gone from ten years ago being something that was thought of as the fancy of our then Vice President, Al Gore, to now being something that the entire world is very focused on as a challenge. And I think it does actually span across both political parties.

All of the democratic candidates and nearly all of the republican

candidates have acknowledged that climate change is a critical challenge facing the country. I think there is a real question about how much and how far candidates from both parties are willing to go.

The political salience has certainly risen quite a lot. And if you lay it alongside the energy security challenges that David listed, there is obviously an enormous amount of overlap. That said, there are some real potential divergent points on climate change and energy security. Eighty percent of what you would try to do to get this country free from foreign oil, or at least give us a range of choices, would be really good for the climate. Twenty percent of them might not be so good. So, for instance, there's quite a lot of debate about whether or not -- there's no debate that if we tried to get some of our oil from coal, that that would be another alternative to importing foreign oil. Or if we did more drilling for oil domestically, that that would be an alternative for foreign oil.

But the consequences of both of those things for the climate are really questionable, in fact, probably detrimental. There are a number of things that we really should try to do with respect to climate change that would be neutral with respect to trying to get off of foreign oil.

So, for instance, well, I don't want to use up the two minute time period, we can get into it in discussion. Anyhow, we've got these two overlapping sets of ambitions out there, one to be energy secure, the other is to get away from greenhouse gas emissions. And what I think is really important in the next set of

years is, the United States first solve this at home.

I'm one that, particularly because I don't have future political ambitions, I'm not interested necessarily in serving in a future democratic or republican administration. I think it's easy for me to look back ten years ago and say we made a mistake a Kyoto. Our goals were absolutely right. Climate change, we were ahead of ourselves ten years ago in seeing this as a challenge. And more or less, the framework that was put together in Kyoto was the right way to go. But we didn't have the American people behind us. And I think the next wave of addressing climate change has to start at home. The United States has to have an ambitious, self-directed program to reduce our greenhouse gas emissions.

We have to see ourselves as a leader in the world on acting on this issue before we can reengage fully in the international negotiations. It'll be good for the climate, it'll be good for us, particularly as it relates to energy security for the most part, and it will also be good for American leadership more broadly. It will show that we're willing to get out there and do something.

Oh, and it will be good in one other regard; there's an enormous industry out there, and you've seen it all here in Iowa in biofuels, but it extends beyond that to things like solar, and wind, and geothermal, and other forms of alternative energy, energy efficiency. There's an enormous business opportunity out there that if the United States turns its whole economy toward, we really can -- we can do well by doing good.

MR. BORG: And what is that enormous opportunity?

MR. ANTHOLIS: Well, I'll just give you one example. Energy efficiency is the most often talked about low hanging fruit. The people most interested in energy efficiency right now are Wall Street bankers, because essentially the same kinds of things that they've done that have made everything from mutual funds and hedge funds and other things, they have figured out how to take complicated investment decisions and package them and make them easy for people to consume.

Well, that's what energy efficiency is really. I mean everybody looks at those funky compact florescent light bulbs, once they get the color on those things right, which they've more or less done, the real challenge is, why should I pay $6 for a light bulb now when I can go get one for 30 cents. Well, the easy answer is, in two years, that light bulb pays for itself.

But the math is so hard for somebody to make. And what the Wall Street people have figured out now, and it is something that we not only can do here in the United States, we can sell everywhere in the world is, I can package this up in a way where you just pay me that $1 a month that you were going to be paying to your electric company to pay for that old musty light bulb and I'll give you the darned light bulb free. But you just keep paying me every month and I'll take the profit on that. And we can take those kinds of vehicles, and it's not just that, it's everything from the plug-in hybrids that David's talking about, and we can market

that stuff around the world.

MR. SANDALOW: This is the biggest economic opportunity of our time. And, you know, don't listen to me, a guy who works at Brookings, listen to the CEO's of the two biggest companies around, General Electric and Walmart. I mean General Electric, which I believe has the biggest market capitalization in the world, has launched a program kind of as its flagship program, which is all about -- they call it Eco Imagination, it's about making profits off of the clean energy future, and it's all across their product line, and their CEO, Jeff Immelt is pushing it, and I've heard him say, he says, you know, I'm the CEO of a public company, I don't get to have hobbies, so for me, this isn't because I like granola or backpacking, it's because I'm going to make my shareholders money, and if I weren't doing that, my board would ask me to -- would show me the door.

And then Walmart, which has an aggressive program of cost cutting. Somebody told me that they've got a whole system now where they can see where any refrigerator door in the Walmart empire is left open and is wasting energy or something like that. That may be a pocketful, but they have an aggressive program right now to save their customers and themselves money by cutting energy. Silicon Valley is exploding right now with money for clean energy investments. This is the opportunity of the next several decades.

MR. BORG: Do you all -- you're all from the Brookings Institution, do you all agree with each other, or did you hear some things here tonight that you

sort of question? National defense, that's your specialty, Mike, what did you hear here that maybe you don't quite agree with even though you're from the same institution?

MR. O'HANLON: Well, I don't have too many differences, but I'm still trying to sort out -- Bill Antholis has actually posed one of the great debates, and he has a view on it, I'm not necessarily of one camp or another, which is, how do we limit carbon emissions.

I suppose there are at least three ways, since I don't understand the issue as well as he, I should be quick, one is a cap and trade system, where anybody who's producing this stuff has to, as we do with certain kinds of pollutants, you know, buy permits to do that and then you can trade, that's one system.

Another system is an outright tax on anybody producing carbon with any mechanism. And a third is to go sort of technology by technology and try to find subsidies or market mechanisms on an individual basis for an appliance, or a light bulb, or a car, and try to inform ethanol production, try to encourage that kind of alternative market.

All I know is that all three of these sound pretty good to me, but I'm not enough of an economist or a technologist to be sure yet which one is right.

MR. BORG: Bill --

MR. ANTHOLIS: I mean I've read David's book in manuscript form, and I even went out and bought my own copy, and I've been encouraging my friends

to do so, in fact, they're on sale right outside. There are things in David's approach that I'm not as sold on. For instance, Mike touched on this, one is a carbon tax as opposed to cap and trade. I don't want to give away the punchline of David's book, but let me just say that I'm not in favor of a carbon tax.

And the reason for that is that I think a carbon tax sets a price on the use of carbon. And a cap and trade system would also do that. But what a cap and trade system does is say, you can only emit so much carbon, whereas on a carbon tax, if people were willing to pay the tax, they can still keep putting the stuff up there.

And I think it's very important for Americans to look at and become familiar with the fact that at some point we just have to stop putting the stuff up there. And the real test I think for presidential, not just candidates, but for presidents and congresses down the line are, are we willing to live by a cap that we set for ourselves.

I'm always reminded of when I was in college and there was a lot of concern about the federal deficit growing. There was the Graham Hollings Deficit Reduction Act. And they had all these essentially benchmarks for what would happen if we exceeded the deficit in years into the future, and Congress kept repealing them, until finally in the first two years of the Clinton Administration, they were able to make real progress and set the deficit on a course downward and we were actually showing surpluses for a while.

The real question looking out into the future is, are we willing to set a cap and live by it. And I would rather have the debate be there and the policy discussion be there even if, quite frankly, a carbon tax got people moving more quickly.

I want the security of knowing that that carbon number is going to come down. And one of the real questions there is, nobody really knows, and you know, people can't tell you to an exact degree if we have this much carbon in the atmosphere, how many degrees of warming is that going to lead to.

There's still a little bit of scientific uncertainty around it, but it's not a whole lot. And we should be focused on the fact of limits, and if anything, be probably ratcheting even further down from the limits that we would be setting now.

MR. SANDALOW: Dean's going to have a hard time getting disagreement, because I actually agree with that, and I don't say anything different in the book. I think -- there are these two basic -- we'll try to find something. There are these two basic, you know, kind of ways of controlling greenhouse gases or heat trapping gases, often the cap and -- and in many ways I think it was more of a cultural thing, which one to choose. You can use either one. In Europe, they're very used to high energy taxes. The publics don't really object when they enact high energy taxes. The same is not true in the United States of America. And, you know, I do quote somebody in the book who is now at a think tank, but served in Congress for 20 years saying, these are lovely ideas for higher taxes, but nobody who needs to

face the voters for their job ever supports them.

But interestingly in the United States, we have a very successful set of experiences with these so called cap and trade programs. We use them to control acid rain. The first President Bush signed the Clean Air Act Amendments of 1990, which had a cap and trade program for acid rain, which was extremely successful, and we've had other ones, too.

So I think in the United States we're much more likely to use a cap and trade program. And just one quick observation, it's wonderful to be having this discussion about how to do it as opposed to whether to do it, which is what's dominated too much of the dialogue over the past several years.

MR. O'HANLON: So I'll push Dave a little further. Did we make a mistake in Kyoto, did we go too far?

MR. SANDALOW: Now, Bill and I, by the way, we spent ten days together in Kyoto, we slept about a total of ten hours I'd say. Some day --

MR. O'HANLON: Not together.

MR. SANDALOW: No, not together. Some day we're going to go -- I'm going to go back to Kyoto and see temples. I've never seen temples. I think it wasn't perfect. I think that -- yes, I mean, clearly, there's a set of -- there's an agreement there that moved the world forward, but there are lessons to be learned. And I don't think that it's surprising that any agreement on as complicated a topic as global warming would kind of -- the first toy out of the box would be something

other than completely perfect.

MR. BORG: Bill, was your question, though, the United States making a mistake in Kyoto?

MR. ANTHOLIS: My view of Kyoto was that the United States made a mistake not actually on the ground in Kyoto, we had sort of painted ourselves into a corner. But in the lead up to the Kyoto, I think we structured an international negotiation in two ways. And at the time, we were kind of aware of that, but we had already put ourselves in the box.

We structured an international negotiation that was, quite frankly, impossible. And we realized that impossibility about five months before Kyoto, four or five months before Kyoto, when the Senate said to us, 95 to nothing, that if you do two things in Kyoto, we will never ratify the Treaty, one is, do something that would cause economic harm to the United States. We actually -- what we didn't, Kyoto probably would not have caused major economic harm. In fact, the rise in gas prices that we've had in the last ten years, even with a constant dollar, is much more than the cost that would have come out of trying to meet Kyoto.

But the thing that we didn't do at Kyoto is, we didn't include developing countries in the same way that we were willing to make commitments, and that's what the Senate told us we couldn't do. So we came out of Kyoto with this mangled phrase that said, we wouldn't submit it for ratification until there was meaningful participation from key developing countries. It was thought up in one of

our pre-Kyoto late night sessions, and we were sort of stuck by that mantra.

But we essentially negotiated an international agreement that we never could have sold at home, and we put ourselves in a position to do that. So in the next post-Kyoto phase, one of the things that I recommend in the Opportunity 08 paper that I wrote on the project that you can get outside if you'd like, is that essentially what we do is, we first act in the United States, and then we get a small group of countries together.

The model should be 50 years ago. We set up something called the General Agreement on Terrorist and Trade, the GATT, it was the predecessor for the WTO. But 50 years ago, we did it the wrong way, too. We first negotiated an international trade organization that the U.S. Senate said, we will not agree to because it undermines U.S. sovereignty. Very similar claims to peoples' concerns about Kyoto. So we went back to the drawing board with a small group of countries, mostly Japan and Europe and a few others, and came up with an organization that still had commitments, but they weren't treaty obligations, they were done through this general agreement framework.

It didn't require 67 votes, it only required 50 votes. They get renewed, you know, essentially you went back to the negotiating table every four or five years, and you didn't treat it like the Constitution, you treated it like law. And that's what I'm arguing on the climate change. We should start with a small group of countries and have an agreement that can be revised on a regular basis.

MR. BORG: Just a quick one and then I want to go to questions.

MR. SANDALOW: Well, I was going to prefer a controversial idea, which I thought -- I could see if I could get my panelists to disagree with me.

MR. BORG: Go ahead.

MR. SANDALOW: Before I do that, I wanted to recognize somebody in this audience who has been a real leader on -- I'm almost sure she was in Kyoto with us, although I'm not 100 percent sure. I know that she and I were in Oslo together when Mongari Matai won the Nobel Peace Prize, and maybe we'll see each other again this December. But Anna been a real leader on this issues around the world and definitely deserves a big round of applause. Now I'll say something controversial.

MR. BORG: Well, I want to -- because our time tonight isn't unlimited, and I have more questions that I could pose here, but I know that you have them, too, and I want to recognize now the person who's done an enormous amount of work in putting tonight together. She's Chair of the University's Lecture Committee, Sharon Benzoni. And, Sharon, if you would come to the microphone, and I know that you have some introductions to make, and then also some questions that have been submitted; Sharon.

MS. BENZONI: Thank you, Dean, and thank you all for joining us tonight. The University of Iowa Lecture Committee has compiled some questions from organizations in the university community and the greater Iowa community,

who have very strong interests in energy policy and the future of renewable energy. And we are, you know, very honored to be asking some of those questions on behalf of these organizations.

Let me just also say that after we have finished asking these questions, we will open the mikes for audience questions, and we really, you know, will be jotting them down as you go, so thank you.

SPEAKER: Good evening. How do politicians and the media help define how Americans think about energy today?

MR. BORG: And would you repeat the question again so we can have a chance just to ponder it?

SPEAKER: I apologize. How do politicians and the media help define how Americans think about energy today?

MR. BORG: How do politicians and the media help define --

SPEAKER: How Americans think about energy today.

MR. BORG: Yes, how Americans think about energy. And a very relevant question, because public perception is key in political support. Do you want to address something on that, Mike?

MR. O'HANLON: I think I'll pass. But I wanted to say, there was a question from Al Gore, I was getting on my cell phone, I don't know what your rules are in taking calls. But actually, he texted it, it was more of a rhetorical question, it was, Antholis, do you really ever think you're going to get any job in Washington, so

I just wanted to get that one on, but I'm going to deflect the question.

MR. BORG: Okay. Bill, is that your --

MR. ANTHOLIS: Yeah, well, I think this is actually a terrific question. Both this question and Mike's comment is terrific. You know, there's -- I think three dramatic things have happened in Washington on this issue, particularly about the way politicians talk about it; one is Al Gore and Kyoto. For years, Kyoto was a dividing rod in Washington. You could take the rod down the middle of the road, and if you said the word Kyoto, democrats would say it was the wrong thing for the Bush Administration to walk away from, and conservators would say, oh, that was Al Gore's great fantasy.

And it was a way of dividing the public, which we've seen a lot of, and as I mentioned earlier, people at Brookings have really paid quite a lot of attention to. Fortunately, I think the political discourse has gotten beyond Kyoto, where you've now got republican candidates across the board saying that climate change is a challenge to be addressed, and they may still have fun saying, I don't want the Al Gore/Hillary Clinton approach of socialized climate care, you know, and you'll get that kind of rhetoric from the conservative side.

Even from someone like John McCain, who has been a real leader on climate change, he will still say, I don't want an overly government driven approach, I want markets to let markets work. But what he's for is a cap and trade system, and his cap and trade system differs in very small degrees, and not in kind from the kind

of cap and trade that John Edwards or Hillary Clinton or Barack Obama or Joe Biden would do, with Chris Dodd being the only person that's actually really advocating a gas tax. So I wouldn't follow -- I mean I guess the point is that there will be rhetoric around the issue, but people can look beyond that and see the substance of the issue, and the substance is, is it a challenge, is it a priority, and are there one or two key big policies and a bunch of other more targeted policies like biofuels that can help address the challenge.

MR. BORG: David.

MR. SANDALOW: Two points; first, in general, our political dialogue has become breath-takingly content-free. It's just a fact, it's unbelievable. To the extent that there is political dialogue, there are seven second snippets on the nightly news, and if the candidates are fighting with each other, that's what's going to get the attention. It doesn't matter what the content is, you know, it's what's the latest tactical foray. So that is probably a depressing fact.

What is encouraging to me is that in at least a couple of states in the union, for a short period of time, the voters actually have an opportunity to engage the candidates on substance, and you, my friends, are those fortunate people. So I really hope that you will use the really rare opportunity you have to engage our leading politicians in substantive conversations for the next few months.

MR. BORG: I think the basis of the question is, and you're addressing it, but I would take it just a step further. I think the question also says, are

Americans sufficiently informed, concerned about energy in order to consider a political option or candidate.

MR. SANDALOW: I think that -- my answer would be, I think Americans are almost sufficiently concerned. The polling date is pretty compelling. You know, an overwhelming majority of the American people think that our oil dependence is a serious problem, and you know, you see it when you go to the pump, and you see it in our geopolitics. No, they're not sufficiently informed, and that's partly the problem of our media today.

MR. ANTHOLIS: And I think one real question here will be, if gas prices continue to rise, that may be a good thing for the United States. Will voters come to see that? Will they ask politicians, what are you going to do about high gas prices as opposed to what are you going to do about our dependence on foreign oil, or what are you going to do about the climate?

MR. BORG: Sharon, I'm waiting for the next question. And just before you do ask that, can I ask one here? We haven't heard from you recently, Mike, and I just -- just quickly, do you lie awake at night worrying about homeland security, national security, because of our thirst for petroleum?

MR. O'HANLON: Yes, and the reason is somewhat indirect, the reason is because there is a political culture, with all due apologies to the many great people in this part of the world, in the broader Persian Gulf/Middle Eastern region that needs improvement, to put it bluntly, and oil is part of the problem. Oil is part of

the problem, and our inability to proudly -- to reform, to put pressure on the Iranians, not to mention even the great problem of Iraq. But that fundamental structural problem is part of what feeds this dynamic, whereby we cannot use leverage against the more serious violators of international norms, and some of these economies are artificially propped up by oil, which is sort of an opiate for an economy, it's not a healthy way to build an integrated economy.

And that's -- in turn, what I think -- people have pointed out in the literature in international relations that terrorism is not a product of poverty, per se, but I think it is a product of broken societies that don't offer opportunity and the sense of purpose to many of their citizens.

And I think many of the -- if you read the 911 report, many of the stories of many of the hijackers, many extremists over the years, they're not typically impoverished people, but they're people who lost their sense of, you know, a constructive path within their own society, and then they found an outlet via terrorism for their embitterment, and that's the dynamic that I worry about in the context of oil.

MR. BORG: Just a quick follow-up question before we take -- of what value is the strategic petroleum reserve, it is really meaningless?

MR. O'HANLON: David I think knows the numbers better than I. If I'm recalling, it is something on the order of a couple months worth of energy consumption for the United States, which means that it's meaning full for certain

specific kinds of crises, but not when you have to face a structural problem like President Ahmad Nashad in Iran.

If you want to have the option to basically go to our allies and China and make a serious case that we should start trying to cut off the world's oil trade with Iran, it's going to be a very hard sell under the best of circumstances.

But right now the strategic petroleum reserve does not protect us against that kind of consequence, because it would only help us for a couple months. You need a more fundamental change in the nature of the energy portfolio to do that.

MR. BORG: Thank you. Yes, a question.

SPEAKER: My question is from Iowa Global Warming, and they ask, addressing global climate change will require international, as well as national leadership. If you were president, how would you work with the international community on this issue? And as a follow-up, what leverage would the U.S. use to persuade the rest of the world to adopt its ideas for solving global climate change? And by global climate change, I mean global climate change.

MR. BORG: David.

MR. SANDALOW: Climate change leadership begins at home. The best thing we can do to get the rest of the world to act is to act ourselves. And so the first thing the next president should do is exert real leadership to make sure the United States enacts a cap and trade program that limits -- and gases. Once that is in place, then we're no longer, you know, the alcoholic at the bar stool preaching

temperance, right. You need to have credibility, and I would take that forward.

And I would look to the world trade regime as a model and use lots of different forms. In some ways, what we tried to do at Kyoto was to, as Bill was saying, leap over kind of 50 years and go immediately to something which is very difficult.

I think I would pursue those types of efforts, but I would also do bilateral agreements. U.S. and China together are about, what, 40 -- 45 percent of global emissions. If the U.S. and China could come up with a bilateral deal that had an impact on emissions in both our countries, that would be huge. So do bilateral deals, regional deals, global deals.

MR. BORG: Next question.

SPEAKER: This question comes from the Iowa Renewable Energy Association. They ask, to what extent does the rising demand for oil from rapidly developing countries like China and India create greater potential for armed conflict as supplies fail to meet increasing demands?

MR. BORG: Michael.

MR. O'HANLON: Well, I'll repeat the point that it makes it harder to convince China to pressure Iran. So we're bad enough; our inability to deal with that kind of a consequence is bad enough, on top of that you have the likelihood that China would just say no way.

Russia might like it, by the way. There should be scenarios by which

you could tell Russia, one of the world's top three oil producers, that this scenario, you know, could make them some more money by driving up oil prices. But it's not going to be nearly as appealing for China.

In terms of military confrontation between the United States and China, I'm not worried about the energy problem directly effecting that likelihood. I think the only real plausible cause of that kind of a confrontation is over Taiwan, and that would not be first and foremost an energy issue.

So I think it has more to do with how we pressure countries like Iran, which could themselves become threats to the whole system.

MR. BORG: I'm going to ask if any of you remaining here on the panel have comments on that. And before I do that, though, if you have a question here in the general audience, will you please move to a microphone right now, and then I'll take your question next after we hear your comment.

MR. ANTHOLIS: I think one fascinating place of not probably on military conflict, but we will really see a struggle -- well, there are three places where there will be some sort of a struggle for resources, Africa, Latin American, and the Arctic.

Africa and Latin America, China and other emerging countries was asked a question, really looking at those places, they've been places that the United States and Europe, to some degree, have both ignored in terms of really investing in the economies and the societies.

And China, in particular, sees real opportunities in both places to take advantage of strained political relations that those countries have with the U.S. and Europe, and have opportunities. And so we will probably see some political battles in those places.

The one that's fascinating to me is the Arctic, and it's ironic. As a result of global warming, the Arctic ice cap is starting to melt, and that means that that whole part of the planet is open for exploration in a way that it wasn't. So Russia sends a submarine to the base. There's a land grab going on, and it's at the sea floor underneath the Arctic ice cap.

And it's fascinating in two ways from the energy economy; one, their energy resources under there, ironic enough, by putting greenhouse gases into the atmosphere would help melt the Arctic ice cap, which makes us able to explore for more oil. The second thing is that it's opened up the Northwest Passage as a way to get shipping tankers from say the east coast to the United States, to Asia. Now you have to go, say if you're out of the Port of New York or Boston, all the way around Florida, through the Panama Canal, and then back up to the central part of the northern hemisphere, to China or Japan.

But if you simply scooted around Nova Scotia and across the top of Canada, you probably cut your travel time by a third, and that's ironic. And now we're going to have ships filled with oil perhaps, making the Exxon Valdese that happened 12 -- 13 years ago a more likely situation again. So I just sort of raise that

as another place where we might see again, not probably armed conflict, but certainly political tensions.

MR. BORG: Yes, a question.

SPEAKER: You were talking about your being at an educational institution, and I think that's something which we are not dealing with on a national level at all. The production of oil in the last two and a half years has bounced along pretty much flat at 84 and a half million barrels per day, a billion barrels per day, pardon me. We don't hear that, we hear projections that's going to go on, you know, and even the government numbers are projecting a lot higher. You know, we read in the *New York Times* this last summer that the plastic bottles, the petro-chemical going to plastic bottles for water, and by the way, try the Irish City tap water; 20 years ago I'd say don't touch it, but now it's okay. They would fuel 100,000 cars per anum. We are not looking in the mirror, and nobody is addressing that. We'll make you a deal, we'll give you -- we'll either increase taxes or give you a tax rebate, this kind of shuffling the cards, we're not looking in the mirror.

I'm as guilty as anyone. I drove over here, I got here, and I see that my neighbor is in the audience right next door. We could have come over in one vehicle. The trains in Europe, the bicycles on sidewalks, you know, special areas for sidewalks --

MR. BORG: I think David Sandalow probably is best qualified to comment on that. And thank you very much for your comments. David.

MR. SANDALOW: Thank you. You know, I think you make some really good points. And there's so much more that all of us and each of us can do to help solve this problem. And one of the things I write about in my book is telecommuting. The data is incredible on this.

Companies that institute aggressive telecommuting plans have happier workers that are more productive. And it's happened kind of constantly. And there's been some effort in this direction, but not that, you know, we could do a lot more, and it saves oil and helps to make a dent in the problem. So I think there's a lot we can do. I don't think, though, that this whole agenda of ending oil dependence and solving global warming is about being inconvenienced, and I think that's a really important point. We can build cars, as I was saying earlier, that get 1,500 miles per gallon of, you know, petroleum, and so I don't think we need to feel guilty doing things.

I think we can use American technology and know how to help solve this problem, and I think we're going to, and I think a lot of people are going to get rich doing it.

MR. BORG: Next question.

SPEAKER: Gentlemen, thank you for appearing here tonight. I wanted to play devil's advocate for a moment on the central premise that I've heard on tonight's discussion, and that is in the security debate -- the national security debate that's happening. World trade is often titled as a possible solution. Countries

that trade together do not fight with each other. And yet energy is approached very differently.

You've heard a lot of presidential candidates emphasizing national independence. Is it not a possible solution for a greater economic integration with the rest of the world, even in the Middle East?

MR. BORG: I know David wants to answer. Bill, do you have a comment?

MR. ANTHOLIS: Yeah, I do. The paper that I wrote on for Opportunity 08 actually looks at the climate regime along side the world trade regime. And I think there actually is both confluence and potentially competition between a pro-climate agenda and a pro-trade agenda.

I think trade is something that can help on energy issues. But, for instance, one thing that we could do is lower our tariff for importing ethanol. Now, that may not be so popular here in Iowa, because, you know, it's a lot cheaper to make ethanol in Brazil than it is here in Iowa, but I think that would actually help a lot.

The challenge that you raised as it relates to our -- Michael O'Hanlon actually has the great statistic about our deficit. Our current trade deficit is sort of half fueled by the amount of oil that we import. So their trade actually isn't helping us very much, it's a bad dependence of trade.

But there are other dependencies -- there are other trading

relationships that we could set up, ethanol is only one. You know, trading in these kinds of markets for efficiency and things like that. And also, carbon capture trading, that is carbon emission trading, globally, it's one of the things that we established at Kyoto that I think is valuable and something that we should continue to pursue.

MR. BORG: Post script, David.

MR. SANDALOW: That's fine.

MR. ANTHOLIS: Okay. Let me say very quickly, and I'm not as good on the map on this as some people, but we're importing about 12 million barrels a day now, that's projected to go up to 20 million barrels a day by 2025, we're not going to stop the trade in this stuff. We will do very well if we can cut that 20 million barrel per day projected figure in half.

In other words, if we can keep more or less where we are today, maybe do a little better, but if we're in the 10 to 12 million barrels per day range, we'll be doing very well in terms of broadening our energy portfolio. That would be a huge accomplishment, and that's not going to lead to an end of global oil trade.

MR. BORG: Sharon Benzoni.

MS. BENZONI: We have time for one more question from over here.

SPEAKER: Well, I wanted to follow up on something that was mentioned in the beginning and just was a recent question, things we can do here at

home in terms of changing policy or infrastructure or cap and trade. David, you mentioned transforming the transportation infrastructure at first, talking about changing the type of vehicles we drive or the fuel, and I was wondering, how feasible is it, because to change the transportation infrastructure in terms of having more buses, trains, or other more communal forms of transportation rather than, you know, two tons of steel per person driving, is that feasible, could that help like the new economy Bill was also talking about, kind of --

MR. SANDALOW: Yes and yes, and I'm glad you asked, since it hasn't really come up so far. Federal policies in this area have been bizarre for the past several decades. We subsidize new road construction much more than we subsidize mass transit from the federal government.

Not only are the percentage reimbursements from the federal government higher for road construction than mass transit, you have to prove more in order to get your money if you're doing a mass transit project, so that needs to change.

We need to level the playing field so the mass transit is at least equal with new road construction. You know, there's very interesting data on this, too, you know, quickly. Amazingly, building more roads does not necessarily reduce traffic jams. And I mean the data on this is quite compelling. If you build a wider road, people will come and use it more. And there's pretty compelling stuff here.

Somebody said that trying to solve traffic problems by building more

roads is like trying to lose weight by loosening your belt, it's the same thing.

MR. BORG: So, David, why aren't presidential candidates talking about mass transit?

MR. SANDALOW: I believe some of them are. I think if you go to the, you know, the plans, you will find people talking about mass transit. It's pretty popular in some places.

MR. BORG: What I hear mostly is, you're in Iowa, we support ethanol production.

MR. SANDALOW: I believe that. But I guess exclusive I think is some of the support for mass transit that's out there.

MR. BORG: Well, I'm talking about presidential candidates campaigning here. Well, I'm sorry that we really have to conclude this portion. And we have another panel who are going to be gathering here in just a moment.

But our thanks to Bill Antholis on the end, and David Sandalow in the middle, and Mike O'Hanlon here right on my left, and thank you very much for your questions. And I wish that we could have gotten to more of them, but we've had some good insight here this evening.

SPEAKER: Thanks again for being here tonight, guys, we really appreciate your engagement. Well, as we're switching over to the second panelists, I wanted to pull a plug for the Lecture Committee and talk about -- for some reason the mike always squeaks around me. I wanted to talk about our upcoming lecture

series for this next year. Some of you may have gotten this nice little handout passed to you when you were walking in the building today. It actually has my lecture series on the back if you want to follow along with me here. I wanted to talk about the next one that's coming up, it's November 5th. Joshua Wolf Shenk, a very popular author, is coming to speak regarding his book, *Lincoln's Melancholy*, a book regarding the supreme depression that Abraham Lincoln faced at his presidency.
I really recommend reading the book, it's a great read, and I recommend coming to the lecture.

The second lecture that we're going to have is January 28th is Daniel Ellsburg, infamous for releasing the Pentagon Papers. He will be speaking at Hancer Auditorium on that date. I really recommend coming to see that one, as well, it should be a good show.

Marjane Satrapi is coming on April 6th. She is the illustrator of the graphic novel, *Persepolis*, another book that I recommend you picking up and reading, as well. And finally we have on the schedule Louie Gib. We do not know quite yet what date that she is going to come, but she has actually won the three P's in journalism, the Peabody, the Polk, and the Pulitzer, so we're really looking forward to her presence here, as well.

Well, again, thank you all for participating with us in the first panel. We have another panel who Mr. Borg is going to introduce them, as well, and they're going to talk about more of the specifics of ethanol and the technology behind that.

So thank you again for coming tonight.

MR. BORG: Thank you, Kelly.

SPEAKER: Thank you.

MR. BORG: Our next panel is a sprinkling of University of Iowa and Iowa State University specialists. And I would ask now that they would come to the stage, and we'll get ourselves underway. I know I saw them get up and leave here just a moment ago, and I thought someone was leaving early, and I saw it was our panelists who were leaving, I hope to get ready. And I know that they probably are in what we call the green room and preparing to come up here right now. Derrick, is that where you're headed? Okay. Actually, we could have taken a couple more questions.

(Pause)

MR. BORG: Ms. Peeples with us. I think I'm going to begin here, just to conserve time. And Mani Subramanian is a University of Iowa Professor of Chemical and Biochemical Engineering, and he directs the University of Iowa Center for Biocatalysis and Bioprocessing. Mani, I'd like to have you give us a little bit of thesis on which you will be speaking tonight.

MR. SUBRAMANIAN: My background is biotechnology. I really want to communicate three parts on this area related to biofuel. The first one is, I want to give you an idea of the magnitude of the problem, changing from an oil based economy to a non-oil based economy. And I don't want to quote any numbers

in terms of how many barrels of oil we import. But to give you an idea, three percent of the oil feeds $1.3 trillion chemical industry. So you can imagine what kind of a problem it is to change that economy.

And my second thought with respect to biofuels is, currently we are doing the entire business on oil insecurity, we are doing it based on politics and policies, and I wonder when it will transition into a market driven economy, that's when we start to see the fruits.

The third point I want to bring up is the technology part. This is one area where technology can have an impact from one end to another. A farmer can breed crops specifically for ethanol, or for any other biofuels for that matter, or chemicals. And you can find different ways to process these things. All of these are major improvements one can make.

And then one can find ways to convert these into soluble sugars, which are very important, and one can make enormous improvement in that area. And then how to ferment these into ethanol. You can make enormous improvement in that area, create new organisms and new ways of doing it, and then recovering the product out of that. So end to end, you can have an impact in improving this area. And then you can also produce a biobased gasoline that is possible, biobesalism example, but you can also generate green gasoline, as it's called. So these are the areas, particularly the last one that I will touch upon.

MR. BORG: Okay. And I'd like to call upon your colleague here,

Tonya Peeples, to speak next. She is here at the University of Iowa, as well, a Chemical and Bioengineering Associate Professor, she's a researcher serving on the Executive Committee of the Center of Biocatalysis and Bioprocessing. She is a member of the state of Iowa's Energy Center Advisory Council, and she also directs the Ethnic Inclusion Effort for University of Iowa Engineering; Ms. Peeples.

MS. PEEPLES: Thank you. I think the point that I want to emphasize is what's really required to address this problem, and think about it in terms of looking at our strengths, our weaknesses, and the opportunity and threats in this area. I think one of the things that we're really concerned about is captivating the imaginations and getting people, Americans, to really appreciate this as their issue and the thing that we want them to be invested in.

And I think what's really needed if we want to make this a problem that we face -- we direct energy to at home is that we need to think about the brain power that we need to have for American people to be able to work on this.

We need people who are making decisions and people who are addressing these problems to have an appreciation for the constraints. So one of the things that we really need is a sustained research effort that is going to help us get a sustainable situation for energy independence. I come through this from my own experience starting as a PhD student. I was working on a clean coal technology project back in the '80's, and -- late '80's, early '90's, and the funding was coming from the Electric Power Research Institute and also the Department of Energy.

And so we were focused on it then, and then there is a period where funding goes away and you're doing other things. And so we keep changing our focus. And I think if we had sustained research going on, then when we need new technology, the innovation part is there.

So I think one of the things that we need to think about in terms of our strengths, weaknesses, and our opportunities, and the threats, we have strengths, and that we have wonderful institutions, and we have opportunities, and that we have an imagination that we can capture from people, and what we need to worry about in terms of our weaknesses and threats has to do with our focus on really trying to address these problems.

MR. BORG: And, Tonya, your comments lead me into, because you touched on the economics and the money going away and the research money going away and the economics of really implementing what we do want to do.

MS. PEEPLES: Yeah.

MR. BORG: So let's turn now to John Miranowski. He's from Iowa State University, he's a Professor of Economics and Director of the Institute of Science and Society. He's a real pioneer in alternative fuels. Think about this, 14 years ago, the U.S. Department of Agriculture awarded him its distinguished service citation for biofuels program development, and he had already spent about 30 years in the field then. So, John, comments.

MR. MIRANOWSKI: Thank you. I see four key issues that we

face; one is, we need, based on what Mike and David were saying earlier, we need an alternative liquid transportation fuel to reduce our oil dependence. At the present time, the only alternative is corn based ethanol. It's not a silver bullet, it's not going to solve the whole problem or make the problem go away. But it helps us through a transition right now to a viable substitute for alternative liquid transportation fuel. And that's basically the key where corn based ethanol fits in.

From the work we've done at Iowa State, we can go to blending ten percent of our gasoline without creating any significant problem. We will be there easily by 2015, probably by 2010, unless things back track a little more than I expect.

MR. BORG: You'll be where, you will be there, you said?

MR. MIRANOWSKI: We'll be at 14 to 15 billion gallons of corn based ethanol. We can do that in a number of ways; one is, this is assuming, again, that crude oil prices stay at $60 a barrel or above, and ethanol excised tax stays in place, credit stays in place. But the big thing I see is that we can make a significant contribution to doing that.

Now, the industry also has some other significant benefits. It creates a lot of jobs in rural areas, it leads to a healthier farm economy, it leads to a lot of local investment, something that, particularly in Iowa, we need.

On the down side right now, we see ethanol prices falling, and they're falling relative to gasoline. And what is the source of this problem? Well, the source of the problem, in large part, is that we produce most of the corn based ethanol in the

mid west, and our consumers, at least with the ten percent blend, probably 90 percent of them live within 100 miles of each coast.

MR. BORG: Is that an argument for importing from Brazil?

MR. MIRANOWSKI: You can make that argument for importing from Brazil. But the big point is, we don't have the infrastructure to move it from the middle of the country to the coast right now. And so what we have is an excess supply in the mid west, without the ability to move it out to the coast.

MR. BORG: John, I'm going to move on to your colleague from Iowa State. I want to come back to the many good points that you're making. But I want to move over to Steve Fales, because he is a Professor of Agronomy, and we're talking about ethanol being produced from corn or cellulosic materials. So, John, tell us what you -- not John, but Steve, you're a Professor of Agronomy, you're Associate Director of Iowa State University's Office of Biorenewables Program, I want you to pick up now where John left off.

MR. FALES: Sure, thanks, Dean. So I'm an agronomist, and not very many people know what agronomists do. I'll tell you one thing we're doing right now, we're worried about producing bioenergy and producing it so that it makes money for farmers and it's sustainable in the environment. And there's a bunch of us at Iowa State and other places around the world doing that right now.

I'd like to focus my comments on what is being called next generation biofuels, and that's precisely what has been mentioned earlier about cellulosics.

Clearly, ethanol is the logical first choice to replace petroleum fuels, but we cannot even come close to producing the amounts we need.

John mentioned 14 to 15 billion gallons annually as a target for corn based ethanol. We burn 140 billion gallons of gasoline in this country every year. So we're going to have to go beyond corn, without a doubt. It so happens that the compound that we're going to be relying on is cellulose. It's the most abundant organic compound in the world, so there's a tremendous supply of it there. So let's -- I'm going to frame a few issues briefly and then get to some specific suggestions for policy needs that I see and perhaps -- and some research needs.

Okay. So President Bush called for 35 billion gallons of ethanol by 2017 in the State of the Union message this year. Anybody guess how much assets could -- let's say we could have the 14 billion gallons of ethanol from corn, we're going to need 250 million tons of biomass to do that, okay.

To meet the DOE needs for the year 2030, which is to replace 42 billion gallons of gasoline, that's roughly one-third of the 2004 consumption, will require 650 million tons of biomass annually. There's some important questions to that. Where's all this stuff going to come from? Who's going to produce it, and for what price? And how is it going to get from where it's produced to where it's needed? What will be the environmental impact and the society impacts of this production system and harvesting system?

Now, biofuels can have a negative/positive effect on land use, soil

and water quality, and biodiversity, depending on the type of crop grown, what it's replacing, and the methods of cultivation and harvest. It's going to be tremendously important to devise feed stock production systems that are appropriate for the region in which they will be employed. For example, in the mid west, by increasing crop diversity with energy crops, a whole host of them, including parental species, we have an opportunity to mitigate some of the negative aspects of agriculture in the environment, namely loss of nutrients to the waters.

However, one caveat, it's important to realize that a biobased energy system brings about a new set of rules and a new set of risks. Look at the water flowing out of the sky out there today, that's not supposed to happen this time of year, at least not to that extent.

Instead of simply turning on the oil spigot, namely withdrawing resources from the bank, we will be relying on living, breathing ecosystems that depend on unpredictable variables such as weather and climate that are beyond our control.

MR. BORG: Steve, I'm going to move on, and I know you have some proposals, and we want to get to those, but I also want to hear from another panelist before we get too far down the way. And then what I want, and I've talked to the panelists about this, the points that you've raised, all of you, I want a discussion among you, and that's what you can expect before we get to audience questions.

Jerry Schnoor is a University of Iowa Professor of Civil and Environmental Engineering, he's co-Director of the University of Iowa Center for Global and Regional Environmental Research. Jerry, your premise here tonight, and then you can pick up anything that you've heard here and start the discussion, if you will; Jerry.

MR. SCHNOOR: There's an advantage to going last. I can't say that I disagree with anything that I've heard, especially from my good colleagues at Iowa State, from John Miranowski and Steve Fales. I just had the opportunity to chair a committee in Washington for the National Research Council called the Water Implications of Biofuels Production in the United States, and I learned some stuff from that, that was a good experience.

We're sort of in a unique time, it seems to me, with the political campaign, and I think that's why our Brookings colleagues are here, as well. There's a great convergence that's taking place politically, I think, and that great convergence is that for the first time, people in America anyway, and we've been a bit slow, recognize that there's a need to reduce our greenhouse gas emissions, that climate changes are very serious.

MR. SCHNOOR: I learned some stuff from that. That was a good experience. We're sort of in a unique time it seems to me with the political campaign, and I think that's why our Brookings colleagues are here as well.

There's a great convergence that's taking place politically, I think.

And that great convergence is that for the first time, people in America anyway, and we've been a bit slow, recognize that there's a need to reduce our greenhouse gas emissions, that climate changes are very serious problems, global warming is coming to the front of the stage, and people are willing to perhaps do something about it.

At the same time, there's a convergence of this energy security issue. And the two, of course, go hand in hand. They have -- they can have -- if we're clever about it, as our friends Bill and Dave said in the previous panel from Brookings, if we're clever about it, we can actually create opportunities out of this, improve our greenhouse gas emissions, bring those down -- after all, that's mostly from burning fossil fuels -- and at the same time, improve the energy security.

If we could soften demand for oil, for example, prices would become weakened. We could bring the cartels to their knees, so to speak, in terms of energy security if we began to get serious about reducing our demand for oil and at the same time reduce our greenhouse gases.

This panel talked about biofuels, and as has been said by John and Steve, biofuels in this country right now means ethanol coming from corn. And that's not the way we're going to do it in the future. It simply can't be done. There's not enough land. The President's goal of 35 billion gallons a year by 2017 -- this year, we'll produce about 6 billion gallons in this particular year, so

we'd need to increase that 6 times.

This year we've got about 90 million acres in corn out of 450 some million acres in total agriculture nationwide. In order to grow that much biofuels, 35 billion gallons a year, you'd need to have double the amount of corn acreage, another 90 million acres. We simply don't have it.

MR. BORG: So, basically, you're raising the same point that Steve said is where's it going to come from?

MR. SCHNOOR: It's got -- the -- our committee said, for example, that there's got to be a technology breakthrough -- technology bridge, either fermentation from cellulosic biomass and/or from a chemical conversion.

MR. BORG: Jerry, I'm going to -- Monty, I've whispered in his ear here, and I had him listening for points of contention, so I want him right now to say what did you hear, Mani, that you don't agree with?

MR. SUBRAMANIAN: So, I think one point that I want to bring is the problem of water and the problems related to pollution and you know, environmental impact is there with the oil industry as well. I mean, we have lived with it. The question is as we transition from one end to another, how do we mitigate it.

I know we are going to have these problems. So to me, from that standpoint, I haven't seen a lot of things being addressed. And that is one area that I want to bring up. I mean, it's not all bad. I mean, there are good things,

and we're going to have bad things with that.

MR. BORG: Are you asking Steve that or --

MR. SUBRAMANIAN: Yeah, Steve, you know, so --

MR. FALES: What's your question?

MR. SUBRAMANIAN: My question is we know the same problem exists with the oil-based economy as well. So, as we move into the bio-based economy, how do you see these two problems in terms of pollution, in terms of issues related to water, in terms of agronomy and so on?

MR. FALES: Well, yeah, I think one of the things that's being -- complaints against ethanol is it's causing farmers to grow more and more corn, use more and more fertilizer and so on and so on. If we have significantly more corn acreage, yes, that's going to happen.

But, our agricultural system right now in the state of Iowa is by no means what I would call sustainable as it is. And so, I think we have an opportunity here by plugging in where appropriate the elusive third crop for Iowa. We can talk about this, Craig, for I don't know how long. We've not been able to find that third crop that can be grown on the ground at times when we have water events like this in the fall and spring that will actually improve the situation.

So, I think if done right, there is tremendous opportunity for the bio-industry to make our agriculture more sustainable.

MR. SCHNOOR: Dean, Steve's referring to, of course, cellulosic crops, maybe switch grass or replanting the prairie grasses that we once had. We could even use yard waste. You could use mixed feed stacks, sawdust, poplar trees, willows. And all of these are perennials, which hold the soil in place unlike like an annual row crop and require fewer inputs than corn.

So, that is the big hope. But also, a lot of people think that in terms of the Midwest here, these crops will likely be grown where the land is cheaper and rainfall is more plentiful. So, quite likely, it would switch probably down to the Southeastern part of the United States --

SPEAKER: Right --

MR. SCHNOOR: -- in second-generation ethanol.

SPEAKER: Exactly. My colleague, John and I have had discussions about this. And farmers are going to plant alternatives to corn and beans if it makes economic sense for them to do so.

SPEAKER: Before Jerry commented, I was going to say growing those kind of crops is that what you want rich Iowa farmland growing, and that's really the basic question that you're raising.

SPEAKER: Right. No and that's the thing. If it's poor land, maybe if it's in the south and so forth, maybe if we're using waste products, it makes sense. But in Iowa and the Midwest, where you've got land right now that's returning $250 net returns in corn, it's very difficult to figure -- I mean, to

justify switching to switch grass that may have delayed dormancy and take four years before you have a full crop, the opportunity costs using that land elsewhere is -- to me, is very serious.

We could go in the longer run, probably 20 to 25 to 30 billion bushels -- I mean, 30 billion gallons of ethanol from corn without a huge disruption of the system as well. And I think that's something to give some serious thought to. Meeting that 35 billion gallon goal, unless we can change the economics of these biomass crops, is going to be very difficult.

MS. PEEPLES: I think there's a point though that we need to also be careful about putting all our eggs in one basket and focusing on ethanol as the product. There are other things that you can make. If we can go to make green gasoline, when we're making hydrocarbon fuel from biomass and we're using every part of the corn, not just the starch, but we're also using the cellulosic that comes form corn and we're thinking about how we can sustainably do that, I think we need to be thinking about the five to ten year picture versus the ten to fifty year picture, where we're waiting for that technology to develop that allows us to have even more flexibility. So, we're not just talking about ethanol.

MR. BORG: Is that technology -- is that pie in the sky our -- is it wishful thinking? Is it Pollyannaish that we can move quickly from or even over a short period of time from corn-based ethanol to cellulosic materials?

SPEAKER: Dean, let me try to respond to that. I think we really

have to take ourselves outside of the box in thinking about biomass in a longer-term sense. And I'm not meaning in the next 10, 15 years, because I don't think we're going to have, with current economics and current technology, we're going to have something that's viable in 2015 unless we're willing to subsidize the living daylights out that, probably to the tune of a couple dollars a gallon to make that competitive with corn-based ethanol or gasoline.

What I see in terms of our thinking of this though is the areas like Mani is working in, where maybe we ought to be thinking of growing corn in a different fashion, corn that would produce a lot more biomass as well as green. It might be closer growing. It might not have -- you know, we're talking about 300 bushel yields. Is that going to be on the same kind of corn we're growing now or is it going to be something totally different in the process?

We need to be thinking about how we process it. There's probably a dollar a gallon charge of transporting and storing the biomass that you're going to make into fuel. And so, one of the things we need to be thinking about is, is there a different way of handling it? Is there a better distributive production system that we might use, that we produce a bio-oil that then we refine at some central refinery facility to make that a viable alternative?

And I think there are a whole range of other things that we can throw into this mix that make a lot more sense. Because when we look at a lot of the switch grass crops, the miscanthus, sweet sorghum, and stuff like that, all of

these aren't going to resolve the nutrient problems that we're going to have and other problems in the process.

And so, you know, the other thing I think about is when I'm looking down the road at biomass fuels, I agree with Tonya. You know, we lose a third of the energetic value with ethanol relative to gasoline. If we can go to some bio-butanol or some other product, we may be able to maintain that. And so again, the whole processing thing comes in in a big way that we haven't been thinking of.

MR. BORG: What I'm trying to discern from what all of you are saying is if someone asks me to invest in a new ethanol plant some place in Iowa, would it be a good investment right now?

SPEAKER: Ask him.

SPEAKER: I'd have to say that there are a number of them that are starting to stop construction. Some are talking about shutting down. You know, the industry has expanded extremely rapidly. And the infrastructure to move the ethanol has not. And that is a short run crop. There are going to be some shake-outs, but I see the industry continuing to grow into the future. And when I was using 2015, 2016 as a point, I mean, I think by that point we've got the problems worked out. In the short run, though, there are some serious problems right now.

MR. BORG: I listened yesterday to Barack Obama making a

campaign speech up just outside Cedar Rapids, and he outlined in his world of elephants speech there in a farmyard in the rain, so it may have been cut short I'm saying because of the rain and not fully -- but what I heard him say as it relates to ethanol, "If I'm elected president, I will have" -- and I can't give you the numbers of billions of gallons of ethanol from cellulose by 2012 that he would propose having because there would be a subsidy and an all out production emphasis on that.

I see you are a bit wincing. Do you want to comment on that goal? Not to endorse or disparage that particular candidacy, but is that realistic?

SPEAKER: I think that was 1.2 billion gallons I believe that was the figure --

MR. BORG: Could be.

SPEAKER: -- which I -- to be honest, I agree with John, that's pretty unrealistic at this point, that amount. I think we're going to have to give it more time. And what I think beyond all that is, I mean, we don't know what the ideal fuel is going to be, what the ideal feed stock going to be, but we have to make a decision in mind that we're going to be independent of oil, period.

And we're at a point now similar to where the automobile industry might have been around the turn of the century where we didn't know whether we were going to have a steam powered car or a gasoline powered car or a turpentine powered car or whatever, and things sorted out. But all kinds of technologies

were being investigated. I think we now need to explore alternative technologies and recognize that this industry is in its infancy, and we need simultaneous improvements all the way from feed stock production to transport -- harvest and transport, and yes, conversion technology of all kinds.

Right now, my point -- my whole point has been that he focus in Washington and in the media is when you're talking about biofuels has strictly been on the conversion technology. We have heard very little about how this thing is going to work.

MR. BORG: And what is -- explain to a novice like me conversion technology.

SPEAKER: Conversion technology is taking the raw material, whatever it is, and turning it into the product you want, be it bio-butanol, bio-diesel, or ethanol.

MR. BORG: Uh-huh. Well -- Jerry?

MR. SCHNOOR: -- gasification process and you can use mixed feed stocks, which is a big advantage actually and then use catalysts to get the reformed product that you want.

MR. BORG: And it really begs the question that you hear over and over again. We maybe will hear it here this evening. Is the production of ethanol -- is it efficient? Does it take more energy to produce ethanol than we are getting out of it, number one?

MR. SCHNOOR: I'll take that one. Right now, the latest literature -- first of all, the industry has improved through time. Probably the median of most studies at the moment say that we get about 30 percent more energy out of the conversion of corn to ethanol than what we put in. We put in some really good energy sources, natural gas to make the fertilizer for the corn, generally, it's coal for the electricity for the plant or natural gas in some cases to produce the two.

So, we're using a lot of energy to get maybe 30 percent more. That's not where we want to be, and we'd like to be much more efficient. And I think it's going that way too and will go that way in the future, but thermal chemical conversion or new fermentation technologies will be much, much more sufficient.

What we have now isn't sustainable and people are beginning to object, I think, to the corn to ethanol. Because for every gallon of ethanol that you put in your flex fuel vehicle, it's using about four gallons of water. For every gallon of ethanol that you put into your flex fuel vehicle, you're throwing about 8 grams of nitrogen fertilizer down the Mississippi River to the Gulf of Mexico causing gulf hypoxia. For every gallon of ethanol when you fill up your flex fuel vehicle at the pump at a five to ten tons of soil per acre per year loss, which is typical for row crops in the Midwest, that's 20 to 40 pounds of soil.

So, when you pull up, you know, fill her up with good oil Iowa

soil. It's not sustainable. It's not going to happen that way. We're never going to reach the President's goal like that. And that's why, as Steve said, these new technologies need to come online.

MS. PEEPLES: I think there's some other things to think about too. When you think about producing ethanol and you think about the idea of bio-refining, what happens with oil when it comes in? We're getting gasoline, but we're also getting the precursors for these plastic bottles that we're drinking out of. And a lot of the plastic, the materials we're sitting on today are made from byproducts of petroleum.

And what we need is to transform the industry so that we have new platforms, so we're looking at different numbers of carbons in the molecules that are in petroleum that we're processing versus the number of carbons that are in the molecules from plants.

So, we want to have new technologies where we're adding value to the process, so not only are we getting ethanol out to -- as a benefit, but we're getting all the precursors and replacing petroleum in other places that we're using it. So, that's another point about what we can -- how we can get value out of the bio-refinery.

SPEAKER: I used the term transition fuel for ethanol earlier.

MR. SCHNOOR: Uh-huh, I agree.

SPEAKER: I totally agree with Tonya in terms of getting those

other products. We've got Nature Works Cargo subsidiary out in Nebraska that's producing plastic bottles that are commercially biodegradable. You've got a full range of fabric coming out of that process. Dupont now has sorona, which they're producing for carpeting to replace nylon. You can find that in the carpet stores already. This is something they're building a big plant in I think Tennessee or someplace. They use biomass to do that.

One of the things I see is that most of the dry mill plants, which are the technology we've invested in recently to produce ethanol is producing ethanol, BDGs, and maybe a couple of other byproducts. I think as the crush margins of the profitability of those plants falls, we're going to find more ways of skimming off more products that can be used in other processes in other products that come out of the system. If you look at the old wet mill technology that ADM and others use, there's a tremendous number of products come off those lines. And I think we're going to see a lot more of that happening and to restore profitability in the industry.

MR. FALES: I agree with everything that's been said by the way. I would like for a minute to come back to the energy efficiency issue because I think it's a vital point that comes up time and time again. We need to really understand that we're talking about fossil fuel energy efficiency, how much fossil fuel is going in, not solar energy or anything like that, so --

MR. BORG: You're talking about in the production of ethanol --

MR. FALES: Right, or any biofuel.

MR. BORG: Yes.

MR. FALES: And the point is compared to what? And if you compare it to the production of gasoline, which is 0.8, not 1.3, so you get 0.8 units out for 1 unit you put in. Okay, and that's true for all fossil fuels. They're less than one. Why? Because you're consuming raw material in the process.

MR. BORG: So, you're arguing that --

MR. FALES: It's an invalid argument to fault biofuels for having a low fossil fuel energy conversion ratio right now because of the industry is in its infancy. It's positive. And as John said, whatever we're producing it's going to get better.

MR. SCHNOOR: I disagree with Steve a little bit. It's not an unfair comparison. It's a measure of -- it is a measure of efficiency. It's how much energy content in the fuel that you make versus how much you put in. If we got less than 30 percent for ethanol, we wouldn't be doing it all, of course. We wouldn't be doing it.

So, the point is that we can do a lot better. And I -- if you ask me am I against ethanol as we're doing it now for corn, I'd say no. But, I view it the way that John Miranowski said, that it's a transition. We need this industry because energy security issues are here to stay. It's not going to go away.

MS. PEEPLES: And I --

MR. SCHNOOR: It's here to stay.

MS. PEEPLES: Just adding to that, all this life cycle analysis depends on how you draw the bucks, right? If you draw the bucks on how much money we spend going over to other countries and fighting and doing all the things we have to do to get oil and all of those things that we think about in terms of securing that petroleum and you add that to the life cycle and think about the energy that we have to put into growing crops and the effort that we have to do to convince people to grow something that they would like to do with their land and make profit, then you start to think about it in a little bit different perspective because you bring in things -- it's not just the BTUs or the kilojoules, but it's also the people and the spirit and those types of things that we think about adding to this equation.

MR. SCHNOOR: But as a transition fuel, the next generation is more like 8 to 1, not 1.3, but 8 to 1, so we're talking about, you know, just an order of magnitude improvement in the technology.

MR. SUBRAMANIAN: Yeah. I think I want to add one more point with respect to this debate about are we putting in more energy than what we get out of ethanol. I want to look at this in a little bit different way. I don't want to look at this just as ethanol. What are the other things we can add?

First of all, the technology can be improved tremendously so the energy balance that we are doing today may be completely different in about five

years time --

MR. BORG: To be more efficient in producing ethanol.

MR. SUBRAMANIAN: Producing ethanol and reducing the cost. Processes always improve. I mean, that's the rule.

And then my second point is what values can we add in the process? You know, oil, we don't just look at oil. Everything that you see here is oil derived, to chairs, plastics, and everything, as Tonya mentioned. What can we add? You know, we have oil producing certain platform chemicals from which we have enormous chemical industry.

Now, we can look at a parallel? Can we take an a ag-based economy, look at platform chemicals, just sugars and these are all various type of sugars, and one can do just about chemistry on these sugars to derive the same kinds of products, less toxic and more biodegradable.

So, we need to look at this energy balance in a much larger way. I don't think it can be segmented out into just ethanol and what is going in and what's coming out. That's something that I wanted to mention.

MR. BORG: Is this business about food versus fuel a valid argument? And is that something we're going to have to contend with in the production of ethanol?

SPEAKER: I would argue no, it's not a valid issue. If you look at -- I was using the 14, 15 billion gallon number for 2015 or 16. The key thing here

is that it raises the food costs of a family of four about $150 a year. That's much higher price for corn. It's a higher price for meats and so forth. But we've got to look at what's driving right now the prices that we're paying for food in the grocery store.

One of the things that's driving it is a weak dollar. A weak dollar means we pay more for our oil. And I think that's good because that provides incentives in the system to start making changes. You know, we've pursued a cheap energy policy in this country way to long with all kinds of subsidies and tax breaks for the oil industry. And that cheap oil kept us from developing alternative liquid transportation fuels and substitutes. And so, I think it's really good.

But in addition to that, the world is demanding more meat. Globally, economies are growing, China, India, and so forth. And people around the world are demanding a lot more meat. Even though it may be higher priced, but again, the weak dollar makes it cheaper to people abroad, there's a bigger demand for meat. And so, that's pushing the price up in the supermarket. You know, the 9 cents or whatever it is that the corn in your cornflakes cost aren't going to change the price of food in the marketplace. It's all the other services we get along with and things we just toss in the microwave and have dinner in 10 minutes.

So, basically, from what we can do, the part that we can attribute to biofuel growth is very small in terms of what we've seen in rising food costs.

MR. SUBRAMANIAN: I think I want to add a little bit to that as well. And I kind of agree that somewhere we're going to strike a balance. This much of corn is going to go into ethanol, and it's not going to go beyond that.

MR. BORG: What will establish that balance, price and demand?

MR. SUBRAMANIAN: I think it will be both. But, for example, my question is are we really eating or eating it as food everything we produce? Just look at the wastage of food. If we just look at the wastage of food and we know how much of food we are throwing away relative to what we are consuming. So to me, that is one point.

And second, if we put some kind of a number saying 20 percent of corn is going to go into energy production, we are going to leave 80 percent there, that 20 percent in 5 years is going to produce 4 to 5 times the amount of ethanol if we think about ethanol and other items.

So, these things are going to constantly improve, so the balance is going to be much more dynamic than what we fix it today.

MR. BORG: Yeah, yeah. Jerry, you have something to say and then I have a question for you. Did you have --

MR. SCHNOOR: Either way, but I was just going to say that I think I agree with what's been said. I'm not sure. And that is that farmers are being asked and we have a wonderful farm system here -- I want the Brookings Institution people to hear this, the most efficient in the world. And farmers are

being asked to compete in probably the most competitive commodity market that exists in the world, and they're doing a good job with razor thin margins.

But having said that, they're being asked to contribute to our economy in many ways, the traditional ways of food, feed, and fiber and now the fourth f, fuel. And that -- I don't think it's so much an issue that we're not producing food, but it's an issue of the land, competition for the land. The land resource is somewhat finite at 400 and some million acres of agriculture land in the United States. That's -- that's the kind -- I mean, it's no accident that wheat is at its all time high, bean prices are high, corn prices are not at their highest but relatively high. It's because the ethanol has made an impact in the competition for what we do with our land.

MR. BORG: Bill Antholis, you know, I've wondered for a long time if we shouldn't have had -- it isn't in our format that you three who preceded this panel ought to be up here also. Would you come up? And I'm not using this car. Would you come up and just join us?

And we're going to put you on the hot seat too, because part of this discussion really relates a lot to our previous discussion. And I don't know where that microphone is, and I suppose that's the problem that we're going to run into here.

But -- Jerry?

MR. SCHNOOR: Maybe Bill could have that traveling mike

there. Can that come off?

MR. BORG: Yeah -- no, I don't think that --

MR. SCHNOOR: Will that work?

MR. BORG: I don't think that travels.

MR. SCHNOOR: No? sorry.

MR. BORG: Jerry, while we're going to make some changes here and get him miked, you probably of all people up here discussing tonight have been the most negative. You've been a cautionary -- let me say that.

MR. SCHNOOR: I like cautionary.

MR. BORG: You haven't been a detractor of ethanol, but you've expressed some cautionary thoughts.

MR. SCHNOOR: Yes.

MR. BORG: How would you weigh that, though? And this is where I want Bill to comment eventually, as soon as we get him miked. How do you weigh all of the cautionary things you said about ethanol production against national defense and national security?

MR. SCHNOOR: I think I already said that biofuels as a -- will play a role in energy security. They will play a role also as we become more efficient in reducing our greenhouse gas emissions. They will. Already, they're 30 percent renewable if you can appreciate that. And maybe they'll be eventually much more renewable than that.

So, they are here to stay. They're going to play a role in both problems. And ethanol as we produce it today is a transition, a bridge, to get us to a better technology in the future.

MS. PEEPLES: Well, one of the things that struck me is the idea of this transitional issue and whether when we talk about energy independence and how do we define the problem? Are we really concerned about just using domestic resources that we have or are we concerned about the environmental constraints?

Because if we're concerned about the domestic resources, we have coal in this country. And we can supplant a lot of the things by developing those technologies that I started my graduate work on and finding cleaner ways to do that, so, reducing the environmental impact of using that particular fuel that we have control over. We have oil resources in this country.

And so transitionally, we could use those resources also to help us get to the point where we're independent of imports faster. And the question is what is -- what is the driver in terms of this? Are -- do we have a stronger driver with global warming or do we have a stronger driver with security and where do we meet in the middle?

I think the optimal situation would be to address all of those criteria, but should we prioritize and say let's go after independence first and then make it green or should we say let's do it altogether.

SPEAKER: No, no.

MR. ANTHOLIS: Well, and there's a third bit of this too, which is -- which I know that people here are very focused on, which is the global competitiveness of agriculture in general. We've been for -- well, for 50 years, we've been part of a global trading regime and agriculture has finally come into the focus in the last 10 years or so.

And one of the big issues that's come into focus is agricultural subsidies. We for years have been trying to get the Europeans to reduce their subsidies, 14 years ago or so. In the Freedom to Farm Act, we did that in the United States. And because we couldn't get Europe to respond, the ag subsidies came back with respect to trade.

Now, there's a potential opportunity that's win-win here, right, which is to shift our subsidies at least for a transition period, from export subsidies to fuel subsidies in the agricultural sphere. But, if you're doing that, you have to pay attention to a couple of other things. One is one that I mentioned before, which is we're in a new free trade environment and that's going to mean reducing barriers to entry in the United States for biofuels from abroad.

And I don't live here, so it's hard -- far be it for me to say to you all it would be in your interest to, on the one hand, shift to fuel subsidies in agriculture but let those barriers to come down. There are a lot of people that are going to start making those kinds of arguments.

I think that given the choice between -- there are -- as I had suggested before, there are going to be some -- some things that you might do to address the climate that wouldn't necessarily help in the international securities side. So, for instance, if you insist that every new coal fired power plant captures the carbon and pumps it down into the ground, that adds cost. It could add quite tremendous cost. And suddenly now, coal is not quite as attractive vis-à-vis other forms of energy.

There are going to be tradeoffs in this. My own sense of this is to start with the enormous national consensus for energy security but to make sure that that is not so overriding a concern that it prevents us from doing good things for the climate, which over a 30 or 40 year period is really probably more important to our security than -- or as important to our security as the concern about Middle Eastern oil or Russia gone amuck or Iran trying to hold us hostage.

MR. BORG: Bill, is there a national consensus that ethanol or we have to go to alternative fuels if that is -- there is also a lot of whispering that the oil industry is still smarting and really doesn't support the use of alterative fuels?

MR. ANTHOLIS: Well, I think that that's the case, although the oil industry itself is trying to figure out how it's positioned and what its position is. There are a bunch of interesting games going on. If you look at the senate energy bill on the one hand and the house energy bill on the other, there are big gaps in the house side; there are big gaps in the senate side. The senate has café

standards. The house side doesn't have café standards. The house side has all kinds of research money for biofuels and things like that. The senate side doesn't have as much.

So, part of that is the lobbying. Part of that is the new members of congress in here. You know, I -- one of the things I did in the run up to the midterm elections last year when we all thought that there might be seat changes, I sat down and I looked how many members in swing state districts in the house are pro free trade and how many are against free trade, how many are pro a sensible energy policy, how many are against.

And what essentially happened in that midterm election was we lost 30 consistent votes for free trade. We gained about -- we also lost about five consistent votes against renewables, energy efficiency. So, there's essentially for the first time in my -- in my political memory, there are more people in favor of a sensible energy policy in the United States than there are in favor of free trade.

Now, as a free trade, pro climate change action person, I see this as good on the climate change side and of a concern on the free trade side. So, I think we should pursue those things that get us both.

MR. SANDALOW: Dean, could I make a quick point on this?

MR. BORG: Yes, absolutely, David.

MR. SANDALOW: Just two quick points. First, the energy -- the oil industry is not monolithic, companies vary. A few of the big companies see

themselves as purely oil companies, and a few of them see themselves as energy companies diversifying in different directions.

Second, the issue here is not the United States' dependence on foreign oil. That's not the fundamental issue. And I said this from the beginning of my remarks. The fundamental issue is the reliance of the world's transportation system on this one fuel.

We have not imported a drop of oil from Iran in 25 years. We stopped in 1979. that fact does not prevent Iran from playing its oil card in international negotiations. We don't solve this problem until the world's transportation system relies not just on petroleum but also on electricity and biofuels.

MR. BORG: Thank you for making that point. I was going to follow up, but I think I everybody here understands. But I am going to open this up now for questions from our audience.

And our people here are going to -- our panelists are going to have the chance also to continue to interact. Because as you ask questions, I hope that they'll be provocative and introduce maybe new subject matter that will allow us to have the interaction among the panelists.

Yes, question?

MS. BENZONI: Actually --

MR. BORG: Yes, Sharon?

MS. BENZONI: I'm sorry, Dean. I wanted to briefly talk to you about allowing the Iowa Renewable Energy -- or Renewable Fuels Association to make a comment before questions. I hope you don't mind waiting a moment.

MR. BORG: No, that's fine. Yeah.

MS. BENZONI: First of all, I wanted to say that there -- ethanol obviously is a very contentious issue. I think you've all brought up some very good points. We had invited one of the most contentious scholars in the nation, David Penmentel from Cornell University to join us, and he was unable to because of another commitment, but he did submit a statement.

You all have brought up many of his points, but I wanted to summarize what he had said sort of in his main analysis and then introduce our Iowa Renewable Fuels Association representative so that he can comment on that. And then hopefully, you all can comment on those two things together as sort of the pro con side.

MR. BORG: Please.

SPEAKER: Okay. So, David Penmentel says that, "In our 2007 analysis of all the 14 energy inputs that typically go into corn production plus the 9 inputs invested in fermentation and distillation operations confirms that more than 40 percent of the energy, mostly high value oil and natural gas is expended to produce a gallon of corn ethanol than the energy in the ethanol.

Often investigators omit some of the energy inputs required in corn

production and processing such as farm labor, farm machinery, energy production of hybrid corn seed, irrigation, as well as the processing equipment. And many of these energy inputs suggest a corn ethanol production system provides a positive energy return."

All right. So, that's basically the synopsis of what David Penmentel thinks. And next, we think that it's really important to allow our industry in Iowa to talk briefly about their thoughts on all the new things happening in ethanol.

So, I'm going to introduce Walter -- Wendland, excuse me, the CEO of Golden Grain Energy and a representative of Iowa Renewable Fuels.

MR. WENDLAND: Thank you. I'd like to commend the panel on their pulse on our industry. I think it's very reflective of exactly what's been going on here. I would like to make a couple of comments and give a little background about Mr. Penmentel's history.

His funding came from the oil industry and he is a doctor in anthropology or insects, so I really think that --

SPEAKER: Entomology.

MR. WENDLAND: -- it's -- his comments toward industry probably come without a lot of background. You know, the economics that he talks about our industry as it was in 1980 when our industry was at its infancy. Since then, we've had great improvements in efficiency and the panel has talked

on a lot of that.

And today, at Golden Grain Energy in Mason City, we produce about three units of energy for each unit of energy that goes in. And we have become a very efficient and productive facility.

One of the other things that he talks about is corn production, of producing a crop less than 100 bushels per acre. In Iowa here, you realize that our productivity has been great enhanced by the new genetics that the company is coming up with, new technologies in tillage and herbicides. And we probably produce about 200 bushels per acre in our immediate area. So, we're twice as efficient as he states just off of that comment alone.

So, there is a lot of history there and one of the things that we talked about is the negativity in this industry. We think that -- you know, it's our understanding the oil company thinks that they repeat this over and over again, people will finally start to believe it. And I think that's what's happening out here, and that's probably why the result of the some of the increased negativity of our industry.

You know, I'd like to think that no good deed goes unpunished. The industry has certainly done everything that they've said they would do for the Iowa economy in providing jobs, rural economic opportunities, vitality to the agriculture again.

I've farmed my whole life. I have -- started this industry because

of the problems we went through in the mid 80's when we lost our market for our grains and the export markets went away. How nice it is to be able to have a crop that we can utilize locally and support our economy. And don't forget for each three bushels of corn that we process, we give back one bushel of high quality feed that has three times the protein, oil, fiber, and minerals of the corn that we use to produce ethanol.

And none of that --

MR. BORG: Could I ask you to maybe wrap it up here in about a minute?

MR. WENDLAND: A couple of the comments were about water. You know, oil touches about six to eight gallons of -- gasoline touches about six to eight gallons of water. I guess my question is if our industry touches three gallons, it doesn't disappear. You know, where does that water go, I guess is one of my questions.

You know, it's like, you know, he made the comment that -- Penmentel makes the comment on how he takes water to grow crops and that's also a water loss, not really true. So, you know, our water goes in -- we evaporate some water and we return some water cleaner than what we take it out of the ground back to streams.

But, I would like to hear your comment on that.

MR. BORG: Who on the panel would like to -- Jerry, I thought it

would be you.

MR. SCHNOOR: I guess the water -- you know, we do have pretty good meters at the plants and they are very efficient. And they have -- it's all -- the entire industry is permitted as you say. But about roughly 70 percent of the water is lost due to evaporation and 30 percent returned. And there's permits on the total dissolved solids because the -- it requires very pure water, as you know, from reverse osmosis or ion exchange. So, that's where the water goes.

And it is a valid point. I think we can feel good about our agriculture here in Iowa because we're blessed with rain fed agriculture, almost unique in the entire world that we have these deep soils that in July when corn pollinates hold just enough moisture to make it maybe two weeks between rainfalls, almost unique.

Maybe the Ukraine and the Iowa bread basket right here have the proposition where we can have rain fed corn agriculture and -- but, having said that, there's an awful lot of ethanol production facilities both planned and constructed, for example, in the high plains aquifer, the Ogallala aquifer.

Nebraska is second to Iowa in ethanol production, and they don't have any water. It's a very serious issue when you take 2,000 gallons of water per bushel of corn to irrigate it. We're not doing that here, but in Nebraska they are. That's enough water for a -- for a 100 million gallon plant a year, that's enough water for a city of 2 million people.

We're talking about huge water requirements, and that's why, again, we say you can't go on like this. There's got to be a transition to a better way of doing it, and no, we're not doing it that way in Iowa, but there are people who are mining water to produce biofuels instead of mining petroleum. And I say that's just as bad.

MR. BORG: And I know that our agronomy representative wants a quick comment too.

MR. FALES: No, I -- well, I agree with what Jerry said here. I did want to make a quick comment on the Penmentel analysis and refer back to something that Tonya said earlier about boundaries and life cycle analysis.

I think Dr. Penmentel's analysis would be more complete if he included the energy in the sandwich that the farmer had for lunch.

MR. BORG: Let's go to a question then and after you ask your question, I'm going to ask if the lady who is at the rear of the line there who didn't have an opportunity to ask a question last time, we cut her off because of time, go to the second in line over here, and you'll be able to ask your question.

Go ahead, sir.

SPEAKER: Okay. Thank you, Dean. I'm a dairy farmer. I live 50 miles west of here. I would suggest that next time you have a panel that involves policy about farmers, you have a real farmer on the panel. I also happen to be president of the largest farm organization within the state and I believe we

got a great region institution across the state, but I don't want this audience leaving today when you're trying to incent the public that we need to encourage them for renewable energy to go back and consider every time they fill up with ethanol, they take a tank of Iowa soil with them, Jerry, so I don't want them to leave with that idea.

And I think a couple of things were said that were very important. Number one is I think this is a time not only to consider the challenges that we have today like the Manhattan Project, which the government got behind but also to look at when Sputnik, 50 years ago went into space and all at once, the American public woke up and they were afraid of what position they put that in.

I think this is an opportunity for the next president, whoever she or he is, to have an opportunity to show leadership that hasn't been shown for a long time. And you may want to comment on it, but the other thing I want to say is there are two web sites that I commonly go to. One is Bloomberg to find out commodity prices, and the other is Brookings Institute, and that's how I found out the meeting was here today.

And I also want to say that --

SPEAKER: You saw our new website then this week?

SPEAKER: Yes.

SPEAKER: I'm glad to hear that.

SPEAKER: Yes. Every subject you talked about tonight from gap

to world trade to carbon sequestration to corn to renewable energy touches a farmer right at the core. So, next time you have a discussion, let's get a farmer on the panel too.

SPEAKER: Here, here.

MR. BORG: Any comment from members of the panel here on the statements that he made? Jerry, he referred to your soil going down in the tank of gas.

MR. SCHNOOR: I appreciate and I want you to know that I am a proponent of ethanol, but it is true that we export an awful lot of sediment down the Mississippi River.

MR. BORG: Sharon, is it all right that we stay over here then for questions?

SPEAKER: Yes, I guess everyone can go over there.

MR. BORG: All right, fine. Yes, ma'am?

SPEAKER: I'm not have a question about farming at all, but I just think maybe a buzz word today is climate security. I'm really looking forward to a day where there's a robust strategy integrating energy policy and climate change policy together.

My question was more about -- I'm quite concerned about the environmental macro effects of a lot of these biofuels, so maybe not just here nationally but internationally and global scale, so issues like tropical deforestation

and bio-diversity loss and the effect on ecosystem services.

I know there will always be tradeoffs, but it just seems like for the next few years, it seems they're very, very extreme. I'm just wondering is there an area where these tradeoffs might not be as extreme and maybe it's just looking at getting away from mono-culture plantations or other types of biofuel sources.

MR. BORG: I'm going to ask John Miranowski to lead off on that. Would you, John? She's raised some important points there concerning economics.

MR. MIRANOWSKI: Basically, the biofuels boom is a global phenomenon. It's big in Europe. It's big in a lot of the --

MR. BORG: Yeah, different countries.

MR. MIRANOWSKI: -- big developing countries like China and India and so forth. Maybe using different forms of fuels, probably more methane coming into the process, other forms of bio-based fuels are coming into the process as well. I think there's going to always be those dangers when land that's used for -- or potentially usable for agriculture is going to be brought into production in places maybe in the Amazon area and others that, you know, right now there's not a process to protect in some countries.

And I don't think there's -- I mean, the economic incentives are there. The social costs are not -- or external costs are not taken into account. And I think that's one of the things that maybe Bill can comment on. Kyoto in a sense

had a lot of new mechanisms for protecting the environment in developing countries.

MR. BORG: Let's take a comment from Bill and then Steve wants to comment too. Bill?

MR. ANTHOLIS: Sure. I -- it is a terrific question. The -- there is potentially in this a real win-win. But there are also some side tradeoffs that we have to pay attention to. I mean there is a win-win in simply giving credit to true environmental protection in parts of the world where crops wouldn't be used to create biofuels; they would be used to sequester carbon. And it's not just crops. It's natural forests out there.

You know, India -- I'm sorry, Indonesia and Brazil are not in the top 10 -- if you count the EU as one, Indonesia and Brazil are not in the top 10 of greenhouse gas emitters. But they are so critical to the planet's carbon balance because of the carbon that their forests consume and store. And so, they need to be part of that global package. And that was something that we tried to do at Kyoto.

And one of the reasons that, you know, one of the approaches that a number of us had been -- including the Bush Administration had been focusing on is the key emitters. But they include Brazil and Indonesia in that group because they're not necessarily emitters but they're potential emitters if their forests, their natural growth forest and tropical forests are eroded, that carbon

would be released into the atmosphere.

There are a whole number of other things like mono-culture that you talked about that I'm just knowledgeable enough to be dangerous with. David Sandalow has followed them more closely as part of his broader research and so maybe if we had a chance for David to get pulled in too.

MR. FALES: I might set that up further. If we got to a system where we had international trade and biofuels, would we have an opportunity or is it pie in the sky to consider that we could have an international certification program similar to organic or ISO or one of those things? It's a question I'd --

SPEAKER: FSC.

MR. BORG: David is deferring, I think, in order to let us -- David, if you just wanted to make a quick comment. Otherwise, we've got a long line of questioners.

MR. SANDALOW: Okay, just very quickly. Yes, I think that's the answer as to some type of certification scheme. This problem that you point to is a crisis in one part of the world today and that's Indonesia, where tropical rainforests are being cleared and we are losing precious bio-diversity in order mainly to do biodiesel in Europe. And we have a big problem we have to address there.

MR. BORG: Thank you, ma'am, for that question and --

SPEAKER: I have just a really quick other question. It's about

maybe the role of the private sector versus government.

MR. BORG: If you will, you can go back to the back of the line, but I need to take another questioner, please.

SPEAKER: It had to do with Indonesia, and I used to work a little bit with British American tobacco, and so they were really interested in themselves for their own company and progressive looking at alternative fuel sources for the curing of tobacco. And they were saying oh, if we want to plant trotrophil, we'll do it. You know, we'll do that instead of using kerosene, so -- but then you know, they're cutting down more forests in Indonesia and of course, they grow a lot of tobacco in Indonesia, so there's that tradeoff question again.

MR. BORG: Thank you. Thank you very much for the comment. I need to move on.

SPEAKER: Okay.

SPEAKER: Okay. I've got really two very quick questions. First of all, we haven't talked about sugar can ethanol. I mean -- and it seems to me with the opportunity to grow in Louisiana, Florida, you know, multiple crops per year, soil that doesn't -- isn't as highly valued, et cetera, that may very quickly become very important, you know. So, that is just a general question.

One very quick specific question. I don't understand here in Iowa City, the grainiest city in the whole state, there's no E85 station. I just don't understand that. I mean, they're all over western Iowa. They're all over

Minnesota. It's got to be some kind of political inhibition there. And I'm just curious if anybody can address that. I mean, there's one in Marion, there's one in Ames, they're up there in Humbolt and Emmitsburg, but why is there no E85 station? I'm ready. I've got my flex fuel vehicle. I'm committed, but I can't buy it.

MR. BORG: Mani, I'm going to -- can you answer the question? I'm not saying that you're an expert in how E85s are set up, but Mani, do you know?

MR. SUBRAMANIAN: No.

MR. BORG: John?

SPEAKER: There is one. There's one in Coralville.

MR. BORG: All right. But I think the larger question is not why there isn't one in Iowa City but why aren't they more prevalent throughout the state of Iowa. What holds them back, John?

MR. MIRANOWSKI: The example of Minnesota was used. Minnesota put in place back in '97 a program to subsidize putting in place E85 fueling stations. Today, I just read last week that they have 25 percent of the E85 fueling stations in the nation, Minnesota. And I think in 2005 they sold 8 million gallons of E85, not huge in any sense, but the thing is there was a program put in place to do that.

It's a chicken egg problem. Who is going to put in an E85 fueling station when there's so few flex fuel vehicles around. And you know, we don't have a lot of them around the nation. I mean -- and I think this is one of the issues. I mean, you know, you want to use it a lot and so you need some kind of an incentive system one way or another, either the auto companies produce a lot more flex fuel vehicles, which provide then some incentive to do it or vice versa.

MR. BORG: Okay. Next question.

SPEAKER: Yes. I'd like the panel to comment a little bit specifically on Iowa and the effect of land use on bio-diversity as it relates to biofuels, specifically with the supposed transition from corn-based biofuels to cellulosic-based biofuels and the fact that we have a limited or a finite acreage of Iowa land that we can use and that, as far as I can see, agriculture in Iowa from a bio-diversity standpoint has been an absolute disaster.

We are the most altered state of any of the lower 48 biodiversity-wise because of the plow. And combined with drainage tile that's needed to grow row crops, is the long term plan as you see it to replace row crops with perennial crops and keep the amount of land that's in agriculture finite or at least reduce it or do you envision marginal land being brought in, CRP being taken out of CRP and put into production? I'd just like you to comment on that in bio-diversity.

MS. PEEPLES: Well, I'd like to comment just because I've interacted with folks from sort of the big industries, the ADMs, the cargils, and they talk about all of this stuff in terms of the land.

And their ideas in terms of this issue is that it's not going to be the prime farmland that you're going to get the cellulosics from, that we can recover cellulosics from stover and from other parts of the corn plant and plant clover to keep the soil on in the times that if we removed all of the stover -- I mean, there are different things that they've postulated as ideas to sort of address some of these issues but that the switch grass crops and those types of things would be grown in places where the soil wasn't that great, so you're not -- you're talking about alternative areas.

So, it may end up that you're looking at a place where the perennials are growing not in the same land that you're looking at the harvesting of starch. But, you also can get cellulose when you grow corn too from the other parts of the plant.

MR. BORG: Mani?

MR. SUBRAMANIAN: Yeah. I can't answer your question directly because first of all, I'm not a farmer or I don't track bio-diversity. But, switching from starch-based ethanol to cellulosic ethanol and then later on, so many other sources, it's not going to be like a little switch. We are not going to

say okay, today we're going to do starch, bingo. We turn ourselves into word or something else. That's not going to happen.

There are going to be a hundred different biomass feeding into ethanol. And each will have its own place depending on what is rich and where it is rich. I mean, you can probably grow sugar cane in Iowa. I'm not sure, but it's going to be corn here. And we're going to find different ways to harvest corn and feed into ethanol. It's going to be sugar cane in the southeast, Brazil, India.

And when one of the companies that visited Iowa in one of the discussions we had, they said if I put up a cellulosic ethanol plant, okay, I'm going to run it maybe for four months using corn stover. What else are you going to give me for the remaining eight months? I can't shut down the plant. Can you go sugar bean?

I mean, so you have to address these things. There are going to be 10, 15, 20 different sources including grass clippings that need to be used. So, I just wanted to bring that up. It's not a switch that we are going to use.

MR. FALES: I'll give you a simple agronomy answer, okay. Land use is a result of a convergence of three main things. One is the biophysical realities, the soil, the water, the plants you can grow due to temperature. The other is economics. The third one is policy. And what we see out there right now is a result of policy, economics, and the realities of the biophysical world.

Change those things and you can design a system to be what you want. But you're going to have to recognize you're going to need to deal with all three.

MR. BORG: Next question. Oh, did somebody else want to comment here on the panel?

(No response)

MR. BORG: Next question.

SPEAKER: This is a quickie. Forgive me I don't have your dance card. The first commentator here on this question really addressed somewhat my question and that is -- and maybe the gentleman from industry would answer -- to any one of you, can the current ethanol conversion plans in Iowa be used for other biomass conversion?

The reason I ask it is NPR announced a few weeks ago that their -- you couldn't grow enough corn if you planted all of Iowa for the plants that are out there. And this plays into the economic comment earlier.

SPEAKER: We are fast becoming a corn deficit state with all the plants coming in. So, we're probably going to face bringing -- importing corn into the state of Iowa. If we had had more time than that, I'd give you a map in terms of -- particularly looking at the Cedar Rapids area, you probably can use within a 50 mile radius 3 times as much corn as is produced.

So, we're going to end up importing corn into Iowa. Now, you know, you might think of the free market system here as not making some very

wise decisions on locating ethanol plants because they're putting them on top of each other to some extent. But, you know, that's the free market system and those are the tradeoffs we face with it.

I think that the -- the other part of your question was?

SPEAKER: That was it.

SPEAKER: Oh, that was it. Okay. We're going to be --

SPEAKER: I was looking for a quick answer from the man who has a plant.

MR. WINDLAND: Well, we know that corn-based ethanol is only a means to an end. And with our plants using corn, we have the infrastructure to bold on, so to speak, cellulosic technology and be able to utilize, you know, the same rail infrastructure, road infrastructure, water, the loop. We've got all the infrastructure, distillation, tanks for storage. All that is already onsite. So, it's very practical that once cellulosic becomes commercialized that we can adapt that to our technology.

MR. BORG: So, you're not out of business if the switch away from using corn as the raw material?

MR. WINDLAND: No.

MR. BORG: Okay. Let's go --

SPEAKER: Thank you. That was --

MR. SUBRAMANIAN: Let me just make --

MR. BORG: Mani?

MR. SUBRAMANIAN: -- one more comment on it, actually, two more comments. First of all, the sugars that come out of various streams converge into one technology to make ethanol. And the second thing I want to raise out is it's not an ethanol plant; it's a fermentation plant. If you can't make ethanol, make something else. Make medicine, make penicillin. You can make those.

So, you have to make some changes. There has got to be some flexibility. But you are to see it as a fermentation tank and what can be made in it as opposed to just ethanol, what else can we make into it.

MR. BORG: Thank you. Thank you, Mani. That's a great point. Yes?

SPEAKER: First of all, I should say thank you to David. That was a very generous comment because from about the last 25, 30 years of work both domestically and internationally on all these issues but living here in Iowa City, almost nobody knows that. You come home to rest.

And if someone could figure out a dependable replacement for nylon 6 -- this is almost all interface carpet in this building that was refurbished in the last year. I happen to sit on the board of directors for that company. We would jump on it in a minute. But I've been trying to think of a single question to ask from a lot of different pieces.

And I want to remind us of the board that's behind you and the backdrop because I think that this discussion has tonight been relatively rarified and incredibly rich and valuable for an audience that was more or less self selected. I mean, I'm discouraged that there aren't, you know, people hanging off the rafters. And I know the rain had a little bit to do with that.

But reminding us of the backdrop of why we had -- why the session was convened, which is about opportunity '08 and something that I know David and I have talked about and I remember in particular when Clinton gave his first -- what I think of was his first climate change speech, which was in '97 at the UN. And he took two speeches to the podium. Because most people don't know that. And one was going to be on -- and David wrote both of them, much of it.

But one was really the first introductory climate change speech. And the president knew he had two missions. One was to the international audience that was there, and I have never seen the general assembly more packed. The other was a speech to the American public. And people may not remember but there had been a -- an awful lot of heat and hot temperatures in Chicago right prior to that time and we sort of saw the first deaths as a result of that.

And one wants to be very careful to not make too much in terms of -- I'm going to get there, Dean -- to not make too much in terms of connections, but you also don't want to lose a teachable moment opportunity. And so, what

I'm struck by in listening to the whole evening is that we have such a paucity of quantitative literacy among the general public in this country.

And I remember in the late 80's going around to almost every county in Iowa to talk about some of these issues and some early environmental stuff. And I remember this farmer from north of Mason City who came up to me afterwards and said -- he was big and I was smaller then -- and he said little lady, can I give you $100? I went why, and he said I understand all the stuff you're talking about kind of, but he said, it overwhelms me. And he said, I don't know what to do with it.

And I think that's -- to me, I would ask us to consider that's maybe our biggest -- maybe -- if not our biggest challenge, it's our first challenge. Because the level of discussion that we've had, most -- much of -- I won't say most because hope springs eternal, but much of the public would be gone because they don't know how to grasp it. They don't know how to internalize it. They don't know where and how to engage in it. They don't know who to trust in terms of the information that's fed because for everything that we've said, there's somebody else who said something else that seems almost exactly contradictory.

And I think if nothing else, we have an incredible moment right now because so much has happened and people are paying prices at the pump. So, we have their attention. That is clear. But what and how we get from this

nascent awareness to how we manage that -- and I would maybe like to ask this panel and maybe David would like to say something on it too, because I think that's the key opportunity for '08.

I mean, I'll go tomorrow over to Des Moines and the food symposium is going on. And it is set up on biofuels and food and hunger, and much of it is being posed as being in direct contention. So, I think, you know, with all of this mix, I'd ask at the end, how do we deal with getting the public to feel comfortable, to understand, to know what to do with it and not just feel put off and intimidated by this.

MR. BORG: And you've raised eloquently excellent questions to conclude our forum here tonight and that's really what we have to do because I'm up against a time schedule here that I need to adhere to because we have one more person to do that.

Michael O'Hanlon is going to come now conclude our session here this evening. But as we do that, I just want to underscore the, again, eloquent comments that you have made here in conclusion and posed a question that I'm hoping that Mike will help answer that. And if he wants to go to the members of the panel to also comment, I leave that to his discretion.

But for right now, I just want to again ask you to join me in thanking the people who have come a long distance tonight to have this, as has been described, rich discussion. Bill Antholis, Mike O'Hanlon is going to be

here, and then David Sandalow sitting in the audience, Tonya Peeples here on the stage right now, Steve Fales, Mani Subramanian, John Miranowski, and Jerry Schnoor, join me in thanking them.

(Applause)

MR. BORG: I just want to say one more thing. I'm not sure that I'll ever be invited back to be the quarterback for something like this because I called inaudible in the middle of the program here tonight and I changed the entire format, and I'm not sure that that was appreciated by those who had the technical format all figured out. But I think it enriched our discussion. I hope that it did.

(Applause)

MR. O'HANLON: Let me join Dean in thanking you all and also join him in changing the format. I'm not going to sum up. I've asked Jerry to try to answer the last question we heard at this moment of opportunity after two and a half hours of discussion.

Could you please sum up what you would like to most see us do? What's sort of the short bullet point actionable agenda going from here?

I've learned a lot tonight, but I think you're better at summing it up than I am.

MR. SCHNOOR: Well, thank you, Michael. And thanks to Diane Dillon Ridgely for the question. If I understood it correctly, it's really what is our opportunity in '08 with all the candidates here in Iowa. And I'm not sure I know the answer to your question, but I would say that things have changed.

People have come to the point now, and if the candidates don't know it, and I do believe they do, they need to come to know it. People are ready to be challenged. We need leadership on both of these issues. And once again I come back to the point made at the very beginning by David and others that if you do it in a clever way, you can prosper from these problems.

And both energy security, particularly transportation fuels of which Iowa can play an important role and global climate change are serious, serious problems. And they can be in many cases addressed by the same solutions. And we have to find that. We have to be challenged. We have to ask our leaders, you know, Gandhi said if the people lead, the leaders will follow. That's what we have to do.

And that means that we need a new energy security challenge from the next president of the United States. We need a -- we need to be a leader in greenhouse gases. We've -- we've squandered a chance. After 9/11, everyone felt sorry for us and in Paris, they were all Americans. We've lost all that now. We have to build it back up again. And we can only do that by being an example and a leader. And our next president has to do that.

So, that would be my message for the night that we demand from our leaders, from our candidates that they challenge us as a nation, and I think we're ready for that challenge.

(Applause)

MR. BORG: Thank you all. Thank you all. Good evening. You didn't expect to hear from me again, but I -- this isn't in the script, but I really think that we owe a thanks to the universities' lecture committee chaired by Sharon Benzoni.

Sharon, come up here. I want you to see in person the young woman who started her day this morning at maybe before 4:00 a.m. because she had to go to Cedar Rapids for a television interview that promoted this evening. But she has worked tirelessly along in leading that committee. And I have come just in the past few days as a Johnny come lately into all the work that they had put in. And thank you, Sharon.

(Applause)

MS. BENZONI: And thank you to the Brookings Institution.

That's all.

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