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ADAM SIEMINSKI DINNER SPEECH

JOE GLAUBER: I'm going to introduce the dinner speaker. Every year we go through the ritual of trying to figure out who's going to be a good dinner speaker, and Jerry and I both came on Adam Sieminski about the same time. Energy has been so important insofar as agriculture is concerned, particularly over the last few years with the renewable fuel standard and what's been going on in the gasoline markets. So we're very fortunate to have the administrator of the U.S. Energy Information Administration here, Adam Sieminski. He has an extensive biography. He was chief energy economist with Deutsche Bank, senior energy analyst for NatWest Security, a senior adviser to the Energy and National Security Program at CSIS, the Center for Strategic and International Studies. In this last year he's come to the EIA. Adam's going to talk a little bit, and then we'll take some Q&A from everyone. Let me just welcome him up, and we're delighted he's able to come here on a Thursday evening.

[Applause]

ADAM SIEMINSKI: Joe, thank you very much for the kind introduction and for not reading my entire bio. I want to thank Brenda Chapin for finding me down in the lobby. I know she has been deeply involved in running the conference here along with Joe and others. But before we start to talk about the energy markets, I want to mention that dinner was great. I hope I am invited to come back to more Agriculture meetings because when we do things like this at Energy it seems we end up with some kind of a petro-product on the table. That was really good beef tonight.

[Laughter]

I wanted to start off by telling you about one of the most frequent questions that I hear. People ask me, "What's the difference between heading up a federal agency and being at a bank?" I say, when I was in the private sector, despite being the chief energy economist, nobody ever called me "sir." But now that I'm running EIA I have to fly economy class. So there are differences.

[Laughter]

OK. Let's summarize what the energy outlook is up to the year 2040. Every year EIA does something that's basically a U.S. energy outlook. We call it the Annual Energy Outlook. We make projections out 25 years or so.

There are five major conclusions from our 2013 Outlook:

- Growth in energy production is outstripping consumption growth in the United States.

- Second, crude oil production is rising sharply and is likely to continue on that path for the next decade.

- Meanwhile, motor gasoline consumption is reflecting more stringent fuel economy standards and the introduction of biofuels and other nontraditional petroleum fuels, and that's reducing demand for oil.

- Fourth, we think the United States is going to be a net exporter of natural gas, probably starting sometime around 2020. The United States is already a net exporter of coal. So we are getting closer and closer to a dream that six presidents have had for 50 years: energy independence, moving in that direction.

- The final finding is on energy-related carbon dioxide emissions. CO2 related to energy consumption in the United States is likely to remain below the 2005 level all the way out to 2040.

Let's put a little detail on all of this. The biggest percentage annual growth in energy out to 2040 is probably coming in renewables, including biofuels. In terms of absolute numbers, the biggest growth will likely be in natural gas. Oil demand is likely to decline over this time period. Coal, interestingly, we think will hold on to a lot of its share because we project that natural gas prices are likely to go up and that will make coal economically competitive.

One thing to keep in mind in all the things I'll talk about tonight: EIA does its projections on the basis of existing legislation and law and regulation. We do that because it's hard enough for me to go up to the hearings to explain why we got the oil price projection wrong. Can you imagine if we had to go up there and say, "We think the Democratic proposal will win or the Republican proposal will win"? That won't work. So we use existing law and regulation. If law and regulation change, it could change our outlook, so we do side cases to examine the *what ifs* associated with changes in law or other key assumptions.

We were importing probably 20 or 25 percent of our energy consumption in 2005, and that number will be down to 10 percent in our reference case by 2040. We base the reference case on an oil price projection that starts near $100 a barrel, close to where it is now. West Texas Intermediate, the U.S. benchmark, is closer to $93, and Brent is closer to $113 this morning. In our projections, oil prices go up over time, and we think world crude oil prices could be more than $150 by the end of our projection period. Interestingly, GDP is rising faster than the percent of change in our oil price projection. That means even at $150 in the year 2040 in real dollars, it will be more affordable to consumers because wealth is growing faster than the oil price.

The proven reserve numbers for oil, after basically being on a downtrend for the entire period from 1980 to 2009, has taken a sharp upward turn, and so we're now seeing more growth in crude oil reserves and production than anybody that I can find in the literature imagined just five years ago. Where we really began to see this was not so much on the oil side, but rather in shale gas. We call it tight gas [because of the low permeability of the rock it comes from]. So, tight oil and tight gas really began to take off.

In EIA's projection we think domestic oil production, for example, will go from numbers that were close to 5 million barrels a day just three or four years ago to numbers that even at the end of next year could be as high as 8 million barrels a day—a huge growth in oil production in the U.S. On the demand side, because of the EPA and Department of Transportation, new fuel economy standards kicked into place; they were agreed to last year. Measuring this is complicated, but in our preferred method, new light-duty vehicle fuel economy performance values go from about 32 or 33 MPG currently to reach almost 50 MPG by the year 2040. When we put that in our 2013 outlook, it reduced our gasoline demand projection by 1.5 million barrels a day. So in 2035, instead of the U.S. consuming 9 million barrels a day of motor fuels, that number will likely be closer to 7.5 million barrels a day. That makes a huge difference.

The U.S. is consuming 18 or 19 million barrels a day of oil [from which motor fuels are principally made], so if you drop off 1.5 million barrels a day you are talking a significant portion of the consumption – it's really big.

In the transportation sector, we're not looking for growth in traditional motor gasoline but rather continuing growth in nontraditional fuels like ethanol, cellulosic ethanol, biodiesel, and, interestingly, compressed gas and liquefied natural gas in the transportation sector. We believe we can see a lot of heavy-duty trucks running on liquefied natural gas in the not-too -distant future.

We were importing 60 percent of our oil in 2005, and in 2011 that number fell to 45 percent. It was 42 percent last year; we think it will be under 40 percent this year or next year. As we move out over time, we think that number will drop to the mid-30s.

We think we will still import about a third of our oil consumption, but we think we will be net exporters of natural gas.

What's not in our numbers at this point is LNG use in rail transportation. So you remember from the old movies, the steam engine in the front and the coal car in the back; now picture diesel locomotive with big diesel engines that drive generators to make electricity to turn the train wheels. Well, you could put a big LNG tank behind the diesel locomotive just the way we used put a coal car behind the old coal locomotive. And LNG becomes natural gas when it is warmed, and that would go easily with very little modification in a diesel engine. This looks to be economically attractive. The gap between what oil sells for and what natural gas sells for is creating tremendous engineering and scientific opportunities for things like that to take place.

Now, let's talk about natural gas. I said that in the last three years we've had the sharp upturn in the oil numbers, but proved natural gas reserves have been going up since the late 1990s, and if you plotted it, it would look like an exponential growth. That is because of this breakthrough in shale gas development.

Let me describe what the industry is doing now that's different than what it did 10 or 20 years ago. You used to drill wells vertically, and literally you might start up here and get down to the rug, which might represent the thickness of an oil reservoir. And the vertical well would penetrate a few feet, maybe 10 or 40 feet, and if you were lucky it would be 100 feet of pay. You'd produce from that section of the well which might be thousands of feet deep.

Somebody said, "Why don't we drill these wells vertically to the pay zone, and then turn the drill bit horizontally? We've learned how to do this and we can drill for thousands of feet. Imagine, instead of having 50 feet of "pay", you've now got 1,500 feet because you're going through the reservoir horizontally.

Second thing that happened is that 3D seismic technology developed, so all the computer growth we saw in the 1990s paid off in the ability to locate these reservoirs.

The third thing, very controversial, is fracturing, nicknamed fracking. Fracking doesn't sound very good, but industry has been doing it routinely for years. It requires a lot of water, a lot of sand and some chemicals. Most of the chemicals in hydraulic fracturing fluids are things under your sink, detergents to make the fluid slippery, bleach to prevent algae growth, that sort of thing. Of course, you don't want to drink that, so you strive to keep the fracking water, which does come back up when the gas is produced, segregate it, treat it or recycle it. So the fracking that takes place 4,000 or 8,000 or 12,000 feet deep won't get into the water supply.

What could endanger water supply is the last couple hundred feet of well at the surface. If that's not properly engineered, not cased with steel pipe and carefully cemented, the gas or oil and the backflow water from fracturing and whatever chemicals are in it could leak into potable water supplies. Incident of fracturing leading to problems with water supply are extremely rare. There have been cases where wells weren't designed properly and material got into water supplies, but that does not happen too often. EPA is looking at this. The Secretary of Energy had a big group looking at it, and their conclusion was that hydraulic fracturing, like almost any human activity, can potentially have problems, but these things are manageable.

One thing that's very different in the United States relative to many other countries is that the control of fracturing is a state function, so it's the states that are responsible for it. Texas, Oklahoma, North Dakota, and even Pennsylvania think they can do it, can manage it, and they've been doing what would appear to be a pretty good job of that. Other states like New York state have qualms about it. With the New York City water supply, if you were to fracture a well in the Adirondacks, could material get into the New York City water supply, which is not filtered? That could be a big issue. Everybody wants to make really sure before something like that should happen.

We think gas from shale is going to dominate. It's about a third of our production now. In 2000 it was less than 2 percent, and now it's a third of the gas supply in the United States, and by 2040 it could be 50 percent.

Where will it go? It will go to industry and electric utilities. What's happening is this relatively inexpensive gas from hydraulic fracturing is pushing coal out of the electric utility marketplace on a price basis. It's just a good economic decision for utility executives to build natural gas turbines and make electricity that way rather than to build a new coal-fired power plant or even heavily run the coal plants we have now. So, existing coal plants have run at very low utilization rates; natural gas plants have been running at very high utilization rates.

We think as the economy comes back, as we see more demand for natural gas coming in, we'll see prices move up, and that will make coal a little bit more competitive. I already mentioned gas being used in transportation. Not only because you have LNG in freight trucks and rail, but you can take natural gas and turn it into, through a chemical process, a very high quality diesel fuel substitute. And there's a company, SASOL, that has a plant it's considering building down in Louisiana to do just that. This could be relatively significant to the outlook for gas used in transportation.

So, demand in the United States for gas is not growing as fast as the potential supply is. There is another company called Cheniere Energy that already has permits from both the Department of Energy and the Federal Energy Regulatory Commission to build an LNG facility in Louisiana to export LNG. It will go to both Asia and Europe. Our assumption is that all the LNG production trains they have approval for will be built.

Another thing we were looking at in our economic model is the possibility of an LNG facility in Alaska. Alaskan oil in Prudhoe Bay has associated natural gas. Right now the gas comes up with the oil, but they pump it back into the oil reservoir because there's no place to put all the gas. Five or ten years ago, everybody thought the demand for gas would be high enough and there wouldn't be enough supply in the Lower 48 states, The solution would be to build a big pipeline to move Prudhoe Bay gas to Chicago – a very, very expensive project. Now, our models suggest it may be economic in the coming years to build a pipeline from Prudhoe Bay to southern Alaska, where the gas would be liquefied, and probably end up in the Asian markets if it's not needed on the U.S. West Coast.

Let's talk a little bit about electricity and then I'll have a couple of thoughts on biofuels, before we open it up for questions.

One of the most interesting things that we see going on in the electric markets in the United States is the difference between what electricity consumption growth looks like now against what it looked like 20-30 years ago. When I first started working here in Washington in the early 1970s, average growth in electricity demand in the U.S. was 5 or 6 or 7 percent per year. There were periods – when we had the oil crisis and prices for everything went up – including for oil, gas and coal – that those rates sank and then moved back up again. But recently they've been on a decline curve that we think puts electricity demand growth at less than 1 percent per year out to 2040 – not the old 5-percent rate.

What's doing that? Population is slowing a little, markets for a lot of electrical products are saturated, and things like air conditioners, water heaters, dishwashers and refrigerators are getting much less energy-intensive than they used to be. Some of that could change.

I have a question for you here. Did anybody buy a new refrigerator recently, one of the Energy Star refrigerators that uses a lot less electricity? I saw a bunch of hands go up. What did we do with the old refrigerator?

[Laughter]

I know what we did! We put the old refrigerator in the basement or garage, and that's where we keep the soft drinks.

[Laughter]

Joe Glauber, who introduced me here this evening, is the chief economist for the Department of Agriculture. He can tell you that economists have a name for this: it's called Jevons Paradox. I didn't think I was going to be talking about that tonight. Jevons Paradox postulates that that people consume efficiency. So if your car gets 40 MPG now instead of the 20 that you used to get, some of you might buy a second car – or drive your current car more miles!

[Laughter]

I say that simply by way of wanting to be a little humble in thinking that our projections for the year 2040 are going to prove perfectly correct. In fact, there's one thing I'm absolutely sure of tonight is that our projections for the year 2040 are going to be wrong. And if we get it right I hope that it's more than a random walk.

[Laughter]

You know, things change. Just look at how the technology in computers changed from the mid-80s to now. Look at what's happened in shale in the last five years. Secretary Chu tells me all the time that EIA's estimates of the costs of solar power are too high, that he's seeing things on the physics side in solar cell technology that he thinks will really bring the cost curves down, and that we're going to see a lot more solar going into our electricity grid than EIA currently believes.

Now let's talk about the nontraditional fuels, including biofuels. Renewable fuels include waterpower generation – but people usually think of renewables as wind, solar, biofuels, geothermal, waste energy projects, and that sort of thing. In nonhydro renewables, on an absolute basis, the largest growth that EIA projects from now to 2040 is in wind, where cost curves have already come down very sharply. The next biggest growth we expect is in solar and if the technology improves faster than we think, solar may end up surpassing wind.

There will be quite a bit of growth, we believe, in biomass, although, just recently, EIA had to reduce estimates of cellulosic ethanol because the technology just hasn't evolved as rapidly as we thought a year or two ago. We had only a billion gallons of ethanol equivalent in 2001; that number was 15 billion gallons end of last year. The vast majority of that was ethanol. So by the time we get to 2022, we think the total biofuels number could be closer to 20 billion gallons. Ethanol will grow by about 1 billion gallons to reach 15 billion gallons, so most of the growth we think really will not come in straight ethanol but will be in biodiesel, in cellulosic biofuels, and other advanced biofuels.

If you were to try to turn that into a share of the motor fuel market, biodiesel's share now is a little under 2 percent; the 10 percent ethanol in gasoline is a little under 10 percent by volume. But if you measure the energy content, ethanol is only about two-thirds of the energy content of gasoline; so by energy content, ethanol really accounts for about 6 percent of the current transportation market. We think those numbers will go up a bit, and they'd go up even more if we had a technological breakthrough. Maybe we'll see that in biodiesel: algae, as an example, or something going on in the cellulosic side that really accelerates those numbers.

One interesting development is the drought in Brazil. Agriculture people deal with this all the time, and droughts have been a big part of agricultural forecasting for many years. Weather has become increasingly important in the energy area, first, because a drought can impact corn growing and ethanol production. Secondly, there's a lot of water used in producing energy – for cooling power plants, and so on. That can be an issue. We are now seeing with changes in weather patterns, Hurricane Sandy for example, the impact that weather can have on electricity and fuel distribution in areas that are hit hard. Nevertheless, we are involved in a two-way ethanol trade with Brazil. But Brazil has been a net importer of U.S. ethanol recently because of the drought they've been suffering, and some regions of the United States are importing sugar-based ethanol from Brazil.

We think part of the growth in biofuels is tax-incentive dependent. Because we do all our projections on current law and regulations, we got caught up short with the bill that passed at the end of the year. We published our reference case in early December, and at the end of the month the wind tax credit got extended. That wasn't built into our numbers, and that could mean more wind and less solar and possibly less for some of the other renewables—because more of the capital will flow to the program that's tax-incentivized. By the way, EIA will be holding a biofuels workshop and webinar on March 20 to discuss many of these issues. I'm sure there's an announcement about that on our website.

I'll just conclude with one quick thought on climate change and energy, and the carbon dioxide being produced from energy activities. The energy use per dollar of GDP has been falling for 30 years, and we think that will continue. Carbon dioxide emissions per unit of GDP have followed that energy number down. What was flat from 1980 to 2005 was the per capita use of energy, which had not changed much on an indexed basis. As we go out over the next 25 or 30 years, we expect – because of fuel efficiency standards for automobiles and more efficient appliances and efforts on the part of industry and especially commercial and maybe residential building standards improving – that we'll see lower per capita energy consumption numbers. That, along with the substitution of lower-carbon fuels, both renewables and natural gas, for higher-carbon fuels, will keep our carbon emissions below the peak we reached in 2005 to 2007 of about 6 billion metric tons and keep that number below 6 billion metric tons over the entire projection period.

I've seen forecasts from other companies. ExxonMobil, for example, does a long-term forecast, and, because they build in the assumption that eventually there will be a modest charge on carbon, they have a CO2 number that goes below the 5 billion ton level. I bring that up because, interestingly, the 5 billion number would be what the United States would have targeted if we had signed the Kyoto Treaty.

There's a lot of talk in Europe about limiting carbon output, but it turns out the "walk is being walked" in the United States, and it seems to be a combination of technology and movement to lower-carbon fuels, including natural gas and renewables that's played a huge role.

I'll stop there. We've got half an hour for questions. Joe, what do you think? There are some microphones out there-- I see one in the middle of the room and one on each side, so throw your hands up if you have a question.

QUESTION: Why was Louisiana chosen for both the already-under-construction

LNG facility and a proposed, but still in engineering studies, gas-to-liquid GTL plant?

ADAM SIEMINSKI: The main reason is there's a lot of natural gas there, and you've got access as far as LNG is concerned to deepwater port facilities. The planned GTL facility is there because the gas is there. The very clean diesel fuel type product from GTL facilities would probably be used in U.S. markets. Why is the LNG facility being built, specifically in Sabine Pass, Louisiana? The answer there is simple – there was already an existing LNG import facility that could be inexpensively used in reverse. Ten years ago many analysts thought that by now the United Sates would be importing 6 Bcf a day of natural gas, roughly 10 percent of our consumption. Instead, last year we imported less than 1 Bcf of gas. In our forecasts, we'll export 2 or 3 Bcf a day of gas in the mid-part of this decade.

The United States has a dozen LNG import facilities, although not all are heavily used. They were all designed to bring in the massive amounts of gas everyone thought we'd have to import in order to run our industry. The Sabine Pass facility is the first that's being converted to also be an export facility. One key: You want to be on the water where big LNG ships can dock.

There is some controversy about LNG exports: EIA does not get involved in the policy decisions of whether we should do that or not. The DOE licenses have to come from the Office of Fossil Energy—they must provide a national interest finding. Is it in the national interest of the U.S. to do it, or not? And the Federal Energy Regulatory Commission must rule on whether it can be done safely and adequately from an engineering perspective.

The most recent controversy surrounds the idea that perhaps we should try to use low-priced natural gas here in the United States to fuel our petrochemical and other industries that use a lot of natural gas: steel, cement, glass, and so on. There is a big issue around that. Dow Chemical has formed a group to try to put some limits on LNG exports.

The policy question is something people have to wrestle with: What does it mean to the overall economy, to the balance of trade, to consumers and others, to the environment, and to national security? These questions can apply to the exports of anything. We export coal, corn, wheat, and we likely will be a net exporter of LNG by 2020. What are the pros and cons, and what does it mean to various industries? What kind of decision leads to the best one from a national interest standpoint? I'm glad I'm not the one asked to make that decision.

QUESTION: I've got two questions. How much does the EIA think the U.S. would export by 2030? The second one, you mentioned the EIA thinks LNG energy will be used in trucking, and will it have a significant impact on demand? I understand it's an issue.

ADAM SIEMINSKI: First question is how much we'd export by 2030 of LNG and the second question is on trucking. That question came from one of the students here who wrote papers and got invited to this August meeting, right?

That reminds me, students, stand up. Let's hear it for the students who were selected to participate in the conference. Stand up, students, please.

[Applause]

That's really cool. I understand why they want you at the Agriculture Department. If anybody thinks it would be exciting to work at EIA, come see me.

Oh dear, am I in trouble here for saying that? But there are some very interesting issues that involve both energy and agriculture.

Now, back to the fellow who asked the question. I'm sorry for mistaking you for one of the students. Sometimes I start meetings by saying, "I see some longstanding friends in the audience." I say "longstanding friends" because at my age I don't want to talk about "old" friends. So when I look at some of the people here I think they might be students, and they probably have been working for a decade already.

Let's talk about how much. First, the U.S. is already a big exporter of gas to Mexico and Canada, believe it or not, by pipeline. We export probably 2.5 trillion cubic feet a year of gas to Mexico; there's about 1.5 trillion cubic feet a year that goes to Canada. We get more in from Canada by pipeline than we send out. There's a lot of cross-border trade with Canada in both oil and natural gas. With Mexico, it's mostly we send them gas, and they send us oil; about half a million barrels a day of Mexican oil comes north to the U.S. EIA's projections show exports of LNG from the U.S. Gulf Coast and the possibility that LNG from Alaska might be economic, would get you up to just under 2 Bcf a day. So it's about 2 trillion cubic feet a year of LNG and about that same amount of gas going by pipeline to Canada and a little more than that to Mexico.

Those overall numbers are relatively small, and the United States currently produces about 70 billion cubic feet a day; and we are talking of LNG exports of 3 or 4 billion cubic feet a day, a relatively small proportion.

Your other question was on LNG trucking. This reminds me of an apocryphal story. If you took the top scientists that know everything about energy and put them in a room and said, "Invent a fuel," – they'd invent gasoline or maybe diesel. Why? Because it has a huge amount of energy per unit of volume, and it's easy and relatively inexpensive to manufacture and transport. That small tank that's in the back of your car that holds 15 or 20 gallons of gasoline will take you 200 miles without having to fill it up. If you try to do that with a battery or compressed gas you can go 40 or 50 miles. Hybrid vehicles that have a combination of battery for short distances and then can kick in an engine do better. If we had better battery technology—and that's another thing Secretary Chu keeps trying to convince me that the physics of batteries is getting better and that eventually we'll make a lot of progress there. Another issue you're confronted with in this is infrastructure. Now, there's a gasoline station everywhere you need one and you can get diesel too. For natural gas vehicles, there's not many places to fuel up, so you'll have to build out an infrastructure to do that. It works well for buses here in cites; buses go back to a yard overnight and can fill up the compressed gas tanks. For an LNG truck, you'll need LNG fueling facilities along the interstate highways where the trucks will go. If you can get that built out, it will probably work. The economics actually look pretty attractive for the truck itself, but the economics of building the fueling stations is dicier. Somebody must put a lot of money into that, and who will do it? The federal government is broke, and the financial industry is under a lot of pressure too, and so it will probably take a while to do the build-out.

QUESTION: You mentioned you had to reduce your cellulosic ethanol production estimate, but you also said you're going by the current statutes, which gets us into 36 billion gallons of ethanol by 2022, and cellulosic was supposed to be a big chunk of that. So do you still get the 36 billion by 2022? And what's the mix?

ADAM SIEMINSKI: We call that a challenge.

[Laughter]

Although EIA's analyses use current law as a starting point, we take into account the economic and technical facts as we understand them. With what we can see now, with existing technology and how much capacity we believe can be built, it will be really hard to achieve the legislated targets. I have to write a letter to the head of the Environmental Protection Agency every year saying what our forecasts look like, and in the last two letters we have scaled back those numbers. The good news for me is that I just have to provide an estimate of what we think the market is actually capable of delivering. The decision as to what to do about that from a policy standpoint rests with the Environmental Protection Agency and the president of the United States.

QUESTION: You were just speaking about EPA. From an environmental standpoint, what is your outlook when it comes to the energy industry, and also the Environmental Protection Agency? I know, especially coming from Oklahoma, with oil and natural gas a big boom there, we also have the wind farms. Now we've come under some scrutiny with endangering some prairie chickens. So what is your outlook on that?

ADAM SIEMINSKI: What's my outlook on prairie chickens?

QUESTION: There you go!!

[Laughter]

ADAM SIEMINSKI: Well, I'm really pleased to say we didn't eat any tonight.

[Laughter]

You know, there are a lot of serious issues out there involving endangered species. There are lots of issues about federal land leasing policies also. I had to testify a couple times over the last two weeks, once to the Energy and Power Subcommittee in the House, and another time to the Science and Technology Committee. In both cases I got a lot of questions about federal land policy. That kind of goes into those issues.

EIA doesn't make environmental policy or federal land policy.

On federal land policy, one thing I can say is that most of the shale resources, if you look at a map, they are in Texas, North Dakota, California, and a huge swath of area from Louisiana and Arkansas, and then the Marcellus formation that runs from West Virginia up into Pennsylvania and New York state and hits part of Ohio. Interestingly, it's in places that don't have a lot of federal land ownership. In those areas like Oklahoma, Wyoming, and Colorado and a number of other states, they are very concerned about what the federal government is doing on leasing policy. From the standpoint of development of shale resources, the main reason the shale is being developed mostly on private property is because that's where the bulk of the resource base is, as far as we know now.

On endangered species, I don't know. This is one of the balancing acts that policy makers must deal with on a constant basis.

One thing I've discovered in becoming a presidential appointee is, there are a lot of balls in the air, and this is not easy. And I don't know if I should confess, but this job as EIA Administrator is a lot harder than I thought it was going to be.

Let's take a 10,000-foot view of energy and think of three circles. You've got an environmental circle, a national security circle, and an economic circle. The sweet spot in the middle is like a Venn diagram, the intersection of the three circles where they come together. And that's what everybody is aiming for, something that deals properly with the environment, enhances national security, and is good for the economy. There's a lot of the discussion about how to balance those. If you're in the sweet spot, everybody's happy. But if you're only getting two of them and not the other, then you've got a balancing act as to how much you are willing to give up on the environmental side to grow the economy and enhance national security. How much are we willing to give up on the national security side to make sure we're protecting the environment and getting reasonably priced, affordable fuels. It's really hard.

Now I can dodge the rest of the question because I'm not responsible for it.

[Laughter]

QUESTION: Thank you, and I want to do a follow-up on that. I really appreciate the candor with which you've been approaching this. I'm hoping you can delve down a little bit and help me understand how EIA may be looking at the potential on waste energy. For many of us in agriculture, we see this Venn diagram opportunity out there, being able to solve multiple things by putting anaerobic digesters behind animal waste on confined feeding operations. We see the opportunity to start mixing in our livestock populations with the ability to generate energy. The great thing about this is we are achieving greenhouse reductions by getting rid of methane. But it's kind of the ugly stepchild of renewable energies, and it's hard to get any attention. Secretary Chu wants to talk solar, wind, but talking about methane from cows is a little more difficult. Can you give an idea of what the potential may be out there on waste energy in the macro sense that would be able to help us?

ADAM SIEMINSKI: That's actually a very interesting question. I guess I'm being candid here tonight, and I hope it doesn't get in trouble.

[Laughter]

I was Deutsche Bank's chief energy economist, and I've studied a lot of economics over the years, but my undergraduate degree was in engineering. In fact, I did "sewers and gutters" in civil engineering. Methane from animal sources is actually a really interesting opportunity for both energy and the environment. Methane from waste facilities, too, we're doing a lot of that; we're pulling methane off garbage dumps.

Animal waste. So this is where you get into some really interesting social issues. Burning animal waste for fuel is still a huge source of cooking energy in the developing world. It's not good to breathe; it does get rid of the animal waste, but it's bad for health. According to the International Energy Agency, more than a billion people in the world still don't have access to electricity, and almost three billion don't have clean cooking facilities. If we try to deal with energy from a global standpoint, we have to find ways, not just in the United States, to make life get better in the developing world where it's unbelievably critical to get clean and affordable energy to households.

One thing people don't appreciate enough here is that you walk into a room and flip the switch, and the lights almost always come on. Engineers claim people's lives were immeasurably enhanced and the length of life went up when civil engineers figured out how to deal with sewage and deliver clean water to households. The same is true with energy: you can actually plot longevity against rising energy use. If you want to dramatically improve people's lives in the developing world, you really need to get them clean, affordable energy. They need electricity, and how do you get them electricity?

I don't really know the technical answers to your question about how we could take better advantage of animal waste opportunities in the U.S., but I do absolutely agree with you that it could be some of the low-hanging fruit, and it certainly makses sense from an environmental standpoint. And if we could figure out how to do it really well here—we could move that technology overseas to great effect.

QUESTION: Don Oney, *Farm Progress* Publications. You're painting a relatively optimistic picture for natural gas supplies, and I kind of doubt that farmers can get enough nitrogen fertilizer from chicken manure. Does your optimism carry over into hydro-ammonium supplies, farmers expecting to get ample supplies of nitrogen fertilizer?

ADAM SIEMINSKI: The question goes to the extent that gas resources help improve the ability to use natural gas as a feedstock for ammonia-based fertilizers. I confess to being an optimist, always have been.

We're finding in our numbers there is more supply than we have demand, so we should look for ways to grow demand. One way we're seeing, if you go back 10 years, all our natural gas-driven fertilizer industry went to Trinidad or elsewhere overseas. A lot of our natural gas-based smelting for ores like aluminum and copper went to Russia and other countries.

The opportunity to take advantage of what I think is a pretty healthy supply outlook in the U.S. is good. In EIA's reference case projection, we actually had to upwardly revise our estimates of industrial production in the United States on the back of the availability of relatively low-cost natural gas. For the petrochemical industry, there have been a lot of issues raised. Much of the petrochemicals manufacturing in the U.S. is based on ethane, not methane. For those chemists out here, natural gas is methane. But when you drill a natural gas well, you also get a lot of other stuff that tends to be in the reservoir that comes up – including ethanes, propanes and butanes, a lot of things that end in A-N-E.

By the way, if anybody does the *New York Times* crossword puzzle, those words show up all the time because they have so many vowels!

The ethane is the main petrochemical feedstock, and the more natural gas you produce—and we'd produce more natural gas if we exported some of it—you actually get more ethane. And in the scheme of things, that part of it might actually be pretty good for the petrochemical industry. There likely would be a natural gas price increase from exporting LNG, but most economists who have looked at it have said they think there would be only a modest price impact. Deloitte, for example, said 15 cents per million BTU. Gas is currently selling for about $3.50 per million BTU.

One thing I think is correct is that the cost of manufacturing and moving LNG—you have to make it in a factory (a big refrigerator, really), and paying for the shipping to take it somewhere has a cost of about $5 per million BTU. So gas in the U.S. will sell for $3 to $5. In Europe gas sells for $10 and in Japan it might sell for $13 to $15. Outside the U.S.—with a few exceptions—the reason natural gas prices are so high is by law and regulation they tend to link natural gas to oil prices. So if oil prices are high, it drags the natural gas price up.

So what creates this export opportunity for the United States in natural gas is the fact that it's a big target out there. Produce the gas for $4.00 here, pay $5.00 to liquefy it and send it to Europe, and you can sell it profitably into that market for $10. Intensive gas users, like petrochemical manufacturers, the metals industry, cement, and the big food processors, would end up paying more, but it's unlikely they'd ever end up paying those oil-linked prices in Europe and Asia because the cost of making and shipping U.S. LNG provides a buffer.

So what does all that mean? I heard Daniel Yergin, a great author and energy expert who wrote **The Prize** and a new book called **The Quest**, speak about this today at the Department of Energy. He said that, just like the market sorted out all these LNG import terminals—there were proposals for something like 50 import LNG terminals and 20 got permitted but only a dozen or so ever got built – the number of LNG export facilities to get built will probably end up being less than whatever gets agreed to from a permitting standpoint, simply because the market risks are too great for all of the proposals to be built.

Sir, you get the last question.

QUESTION: We'll wrap this up with an ag-related question. You mentioned even though biodiesel accounts for most of the growth in your biofuels forecast, you still see ethanol getting to about 15 billion gallons? Given the constraint we're running up against today with the 10-percent blend wall, how much of that increase in the future do you think comes from E15 adoption, and how much of that is increased gas demand going forward?

ADAM SIEMINSKI: It's all very complicated and we have to make a lot of assumptions. We think there will be some progress made to going past the 10-percent blend wall with E15 and some E85. It's likely to be slow; there's a lot of issues associated with engine performance warranties.

In general we see the growth in biofuel being supported by three things. We still have federal tax incentives, there are renewable fuel standards that were part of the Energy Policy Act of 2005, and the third major thing, for example in California, is low carbon fuel standards. California is a pretty big market. That could move things along, and in California the law is already in place, so we recognize that in our projections.

Also, since we've seen that the technology can change dramatically in oil and gas production, it's not out of the question that the technology of biofuels production could change, too.

It's hard to step back and say how things will be different in 10 years than how they are now. I've actually studied this as an energy economist, looking at forecasts that analysts made for oil prices. It turns out the analysts' price forecasts for oil are hugely anchored to whatever the price is on the day you ask them for the forecast, and they tend to have a downward bias. That's the "dirty laundry" of forecasting. It's human nature to get locked into believing that what we see today is what we'll have in the future. It never turns out that way, but nobody wants to stick their neck out too far.

One thing any forecaster has to do, whether in energy or agriculture or any other field, is to very closely examine the assumptions you make and the biases you have. Try to avoid the biases and build some leeway into your forecasts.

On that note, I'm going to stop and, and thank you very much.

[Applause]