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PARTICIPANTS:

SESSION 1: CROSS CUTTING ISSUES IN U.S.-CHINA CLEAN ENERGY COOPERATION

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P R O C E E D I N G S

MR. LIEBERTHAL: Good morning. It's a pleasure to welcome you to the Brookings U.S.-China Clean Energy Cooperation Conference today. We have a very full agenda and I hope you'll find it to be a very interesting day and really look forward to the issues that you raise as we go through the course of the day.

I'm Ken Lieberthal. I'm director of the John L. Thornton China Center. I'll be moderating the first panel and some things later on.

Let me tee this up as follows. The U.S.-China relationship, as all of you are aware, has just been through a very tough patch. You know, the level of tension and rank, at least rhetorically, has been unusually high these past few months. Hopefully, frankly, as I look ahead, we will now see that begin to turn around, in no small part because both sides would like to get a summit meeting between our two presidents in Washington during the middle of this winter. And no one wants to have a bad summit, so I would anticipate that a lot of steps will be taken to kind of get things moving in a more positive direction to provide the right framing for President Hu Jintao to come here early next year.

What's interesting though is if you look across the board at various dimensions of economic and trade relations, security ties and so forth, the one area that seems to have been very little affected, if at all by the tensions of the last few months, is U.S.-China cooperation on clean energy. As you know, President Obama signed six cooperative agreements with the Chinese side when he was in Beijing for the summit last November. The EPA signed a seventh agreement almost within days of that summit. There has been a lot of activity since those agreements were signed. That activity has been government to government at the corporate level, at the academic and research level, and frankly among every combination of those three categories one could imagine.

So this is an enormously important arena for U.S.-China cooperation as one that actually has been moving forward I think in a very impressive fashion.

When I think of U.S.-China clean energy cooperation, I think of kind of six major reasons why cooperation in this area is especially important. And let me tick them off briefly just as a way to kind of tee up why we put on this meeting that you'll be participating in for the rest of the morning and part of the afternoon.

First, clean energy is arguably the major part of both the U.S. and China's potential area of activity to motivate climate change. When we cooperate on clean energy, we're doing probably, I don't know, 80 percent or so of what we would do for climate change mitigation purposes. But the politics of clean energy are enormously less difficult than the politics of climate change. Clean energy you can do on a win-win project basis and that kind of thing. You aren't dealing with historical emissions and peak emissions and per capita emissions and all the things, you know, Kyoto and the G-77, all the things that weigh down the climate change discussion. So the U.S.-China Clean Energy Cooperation both is easier to move forward and can have a significant impact on the global climate change trajectory.

Secondly, we can focus -- and very closely related, we can focus on clean energy project level activities that can be structured typically as win-wins and, therefore, move through relatively easily and have clear payoffs for both sides.

Thirdly, by bringing together scientists, entrepreneurs, government officials, and others who generally do not do foreign policy, both sides significantly expand the circle of those invested in solid U.S.-China relations. I think through having them work together, you know, on a day-to-day detailed basis also increases the level of mutual understanding and mutual trust. And to my mind the biggest single problem that U.S.-China relations faces is a lack of mutual trust. And so this is potentially a very

important dimension, one of the significant side benefits of U.S.-China clean energy cooperation.

Fourth, the climate change issue is a long-term issue. Clean energy cooperation is a long-term proposition. So this builds in modes of cooperation that are there or the long term. They're not just short-term, problem focused resolution mechanisms. And that helps to bring stability to the relationship. You can see by the way there is an underlying premise here in my mind, which is to say a good U.S.-China relationship where we're each trying to act constructively is good for both sides. If you reject that premise, than most of what I'm saying you will also find not very persuasive.

Fifth, what each side does on the clean energy -- in a clean energy sector clearly affects the political will of the other side to take comparable measures in this sector. I mean, this is an area where each of us really does look at the other, and the other is part of our own political discourse on what we should do and why we should do it. And so there's a kind of multiplier affect to being able to move ahead here. We each empower the other to move ahead.

And then finally, at least in theory, there's a lot of substantive complementarity in what the U.S. and China bring to the table on clean energy issues so that we actually can resolve issues more effectively together with our complementary capabilities -- technical, financial, construction capacity, regulatory environment, and so forth -- than either of us can do on our own.

So for all these reasons, the Thornton China Center at Brookings is really pleased to be holding this conference on U.S.-China Clean Energy Cooperation today. The conference seeks to highlight both the challenges to such cooperation and the ideas out there to address these challenges. And in the process we'll learn a lot about what is actually going on in this sphere between the U.S. and China right now.

We're going to do this via three panels. There are plenty of seats here up towards the front so people over there can kind of walk around and find seating. We're going to do this through three panels. The first, which will begin in about one minute, on cross-cutting issues in U.S.-China cooperation. The other is sitting back and looking at U.S.-China clean energy cooperation at large. Secondly, nuclear energy. No pun intended, but this is an area that is mushrooming at an extraordinarily rapid speed and is extremely important. It's a big new issue, relatively new issue on our agenda. And then third, cooperation on clean coal. And anyone who knows the structure of our respective energy sectors knows that clean coal at the end of the day is the ballgame one way or another. You don't get from here any reasonable outcome unless you can make handling of coal much less of a problem in terms of carbon emissions than it currently is.

We're also going to -- lest we fool ourselves into focusing on all the good things that can happen and how to overcome technical barriers and that kind of stuff and forget the larger context within which all of this takes place in both countries -- we're going to have a lunch presentation by Mike Eckhart that looks at the broader economic and trade relationship as it deals with clean energy cooperation because that clearly is part of what is going to shape outcomes here. And so we want to make this a wide ranging and very realistic set of presentations and discussions today.

With that as tee-up, let me introduce the first panel. I'll introduce all three speakers now. They'll come up in the order in which I'm introducing them. Each will speak for about 15 minutes. If anyone gets beyond 20 minutes, you will see the microphone go dead immediately. And we're all going to sit down here during the presentations because we're using slides. But at the end of the presentations we'll come up and we'll have plenty of time for Q&A. This panel goes until 10:45 this morning.

The first speaker is Dejan Ostojic. He is section leader for energy in

East Asia in the East Asia Pacific Region at the World Bank. He'll provide an overview primarily of China's massive program in renewable energies and the challenges China faces in that sphere. And related policies are necessary to make that program effective and sustainable.

Second is Joanna Lewis, who is assistant professor of science technology and international affairs at the Edmund A. Walsh School of Foreign Service at Georgetown University. She's going to focus on three cross-cutting issues in clean energy cooperation implementation, competition, and climate, which is to say how climate politics get in the way of or sometimes confuse clean energy cooperation.

And third, Bill Tyndall, senior vice president in federal government and regulatory affairs at Duke Energy who will address the clean coal issue.

Okay. So with that, welcome Mr. Ostojic to the podium, and I look forward to your questions and comments in the wake of these presentations. Thank you.

MR. OSTOJIC: Thank you, Mr. Chairman. Good morning, ladies and gentlemen. It's a pleasure to be with you and I thank you Brookings for the invitation to represent some views from the World Bank about renewable energy in China and some of the dialogue that we have in China on these issues.

The structure of this presentation follows the following outline. We will talk briefly about the context and challenges facing China in renewable energy. I will take a look at what are the results of recent bank analysis and modeling of different scenarios for energy development in China. I can probably skip the World Bank Group role because that will take us beyond 15 minutes so I will be short on this one. I assume this is also well known, and focus really on what we have learned in China. What the World Bank and now clients we are working with have learned over these 30 years of cooperation is that the World Bank is actually celebrating this year between China and

the World Bank. And finally, some remarks about sustainable development in the context of renewable energy.

As Mr. Chairman already mentioned, climate change happens to be one of those big challenges. But in many of the discussions that we have in China we found out that this global solution is not always the best entry point. And this is obviously because China has the greatest possibility, but China also insists that this is differentiated responsibility because this is a developing country.

And that's why the last point here is the one that I want to emphasize. China is in the first place looking at its economic growth and importance of improving the living conditions and the standard of its citizens. And of course, they are facing a lot of challenges to do it in an environmentally sustainable in a way that would reduce (inaudible) of its economy. Of course, energy security is an issue that we can talk a lot, but I will skip it here because everybody I think who deals with energy knows the importance of china in the energy markets.

Now, a little bit of history. This is how the energy -- primary energy consumption in China looks over the last, well, it's from 1980s until 2005. Not because we don't have data beyond 2005, but because I intentionally wanted to stop in 2005 because I want to draw your attention to significant changes that happened in the last decade. You will see that after a period of relatively fast reduction of energy intensity, when China increased GDP 10 times and energy consumption only 3 times leading to 3 times reduction in energy intensity, something significantly changed in the last decade. And actually, we have seen the significant increase in energy intensity where you can see the energy demand is basically following one to one the GDP growth.

So when the Chinese leaders saw that during the preparation of their 11th five-year plan, they obviously were very concerned. They knew perfectly well this

was never sustainable. And that's why the government came with the number of actions which were addressing energy efficiency and renewable energy. And they set very clear targets. In the Chinese context and economy, targets are very important. And those are the targets from the 11th 5-year plan where energy intensity was to be reduced by 20 percent between 2005 and 2010.

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MS. LEWIS: -- of these technologies, not just to the United States, but in two other developing country markets, emerging country markets as well.

And then there's concern on the Chinese side about market access in the U.S. This is a somewhat parallel concern I think which we don't hear as much about here in the U.S. We also see some preference for U.S. manufacturers, for buy America. And then concerns, some warranted and some perhaps not, about technology performance of the products potentially coming out of China in this sector.

When we look at solar photovoltaic technology, for example, I think it's important to keep in mind that there is a somewhat uneven situation between the production side of solar photovoltaics coming out of China. And this is a couple years old now. The production scale of Chinese PV is actually now quite a bit larger. And the deployment side of solar PV in China where they're primarily a manufacturing industry. We're just now starting to see solar photovoltaics really deployed at scale in China. And there are not yet strong subsidies or policies in place to really promote the use of solar domestically. In the U.S. it's the reverse, where we are far ahead of China in deploying these technologies, although we are falling behind on the production side.

Wind is a somewhat different story, of course. The United States is currently the largest country in terms of installed wind power capacity in the world today. We've recently surpassed Germany. But if you look at just the amount of wind capacity

that went in last year, of course, you see that China was really where the bulk of these installations took place. China basically doubled its installed wind capacity last year as it has for the last several years, year on year. And so this is really where the new deployment is starting to take place.

This chart just shows you how you can actually see China's share of annual installations and global wind power capacity has just been increasing exponentially over the last few years. So we really do see this market globally shifting to China. So very different from the PV story where China is actually deploying quite a bit of this technology. But they are manufacturing it domestically as well. This shows market share within the Chinese wind industry in terms of Chinese-owned manufacturers versus foreign manufacturers. Getting market share in terms of installed capacity. You can see just in the last three years, foreign-owned companies had 60 percent of market share. They now have just 18 percent. Although, of course, if you look at the total size of the market it has expanded almost 13-fold in the last 3 years. And so the actual installations by both of these sides has gone up over this time period.

So 82 percent of Chinese market share, currently Chinese-owned companies -- and this is a pretty new phenomenon. It's not just that you've had the same companies taking on more and more market share. You've also had a situation where you have more and more companies entering the market. This is an early stage in the Chinese market. There's a lot of innovation going on. A lot of entry into this industry.

It's probably not going to last, but this chart just shows you the actual number of Chinese companies that have increased over the last few years. You have roughly 35 Chinese companies that have actually installed wind turbines in China commercially, although potentially double that number if you look at companies that have some sort of prototype underway or R&D in process

Of course, it was the foreign companies that were there first and the same ones are still there. And this didn't just happen overnight. There was a long list of policies that the government did put in place which the previous speaker mentioned. Many of them that have really been encouraged, not just the deployment of wind, but I think notably the development of this industry as well.

And if you look at what's happening on the technology side in wind in China, of course China is a late comer to this industry. They're playing catch-up with this technology to the other countries that were involved in this industry first. Namely, the U.S. Germany, Spain, and the United States. And you can see that just in the last five years the actual average size wind turbines that are installed in China has doubled. As you may know, wind turbines tend to be getting larger and larger as the technology gets more advanced. We're making now five megawatt and larger turbines for offshore deployments and China is still -- the turbines that are being installed there are on the whole a bit smaller, but increasingly rapidly.

There's obviously a lot of perceived challenges to cooperation when we talk about clean energy cooperation with China. The notion that we're competing with them to become a renewable energy technology leader, of course China does lead in production, but they do not lead right now in research and development or, for the most part, in the deployment of these technologies on an aggregate basis. These are areas where the United States still does dominate. There are of course concerns about cooperating with Chinese companies, concerns about intellectual property rights. Although I think it's also important to point out that there are many U.S. companies that are doing quite well with cooperation on clean energy in China. The top two wind companies in China right now, which are also in the top 10 of the global marketplace, are working with a United States company and that's where they really jointly developed their

technology.

There's often a notion that they can't learn anything from us at this point. What are we cooperating on exactly? Are we just giving them technology or are they actually, win-wins for both sides. I think, you know, one thing that China really can benefit from, from U.S. cooperation, is more on the department side -- the operation and maintenance side of a lot of these technologies, which they're starting to deploy into the field, but you're seeing real problems with the actual operation of these technologies.

And then on the flipside of that, of course, I think we do have important things to learn from China as well. There aren't many areas where we're still ahead, but China is currently the only country in the world pursuing gigawatts scale. Wind development, for example. They're already having, as was mentioned, problems with grid integration as a result of that. I think this is a really interesting test case, if you will, a pilot case for really large-scale wind development and integration, and something that we're going to need to grapple with in this country as well. I think we can potentially learn a lot from what's happening right now in China on that issue.

So moving onto climate change, as Ken mentioned at the beginning, climate policy is absolutely related to clean energy policy, although we often separate the two issues in U.S.-China policy discussions. And the reason for that is that as Ken mentioned, the climate tends to be a more sensitive issue. Clean energy is a very hands-on issue where we can actually talk about tangible things -- tangible results.

Although something that's been, I think, somewhat surprising in the last year or so is that we're seeing China increasingly combine these two issues domestically in its own domestic policy sphere whereas they used to very much have, you know, energy policies they were doing. They would talk about climate policy in a somewhat different vein. We saw one of China's quintessential energy targets -- the energy

intensity target which was mentioned really be the building block for a carbon intensity target. These are going to be very similar in how they're implemented and in terms of the agencies and data being used to enforce these targets. It's really building upon the systems that were put in place.

Of course, there will be additional policies required. We're now seeing a whole new system of greenhouse gas accounting being put in place in China, as well as new policies. For example, a potential trading program, as I mentioned. But, of course, there are still major concerns over data quality and there's also the concern that the energy intensity target may not be achieved by the end of this year due to resurgence in particularly heavy industry industrial activity energy consumption.

In the international climate negotiations, of course, U.S. China tensions are often high as we saw in Copenhagen last December. Of course, China is often in those negotiations. Rather than discussing bilaterally with the U.S., they are there with their friends from the G-77. Often you see a lowest common denominator position among this group of developing countries somewhat being the dominant one. Although, we've seen a more recent alliance emerge between China and the basic countries. This is Brazil, India, South Africa. And many of these countries are actually taking serious actions at home to deal with climate change. And this, I think, somewhat changes China's voice in these negotiations.

Another interesting point is that the next two rounds of negotiations are not going to be taking place in Copenhagen or in Bonn, but rather in Xinxiang, China, and in Cancun, Mexico. So we're now going to be moving to the non-Annex I countries for the next two rounds of negotiations. I think it will be interesting to see to what extent this changes the mood or the dynamic at these meetings. And, you know, this meeting in Xinxiang is going to be the first-ever negotiation hosted by China. It's quite interesting

they offered to even host this meeting. It certainly puts them in the spotlight on climate change and I think they wouldn't have necessarily been willing to be there just a few years ago.

So in conclusion, when we think about cooperation with China on clean energy, we do, of course, face many similar challenges. Both of our countries are very concerned with maintaining energy security. We're concerned about climate change. But overall, we're concerned about ensuring economic growth and prosperity. This is something that we have in common with China. And these opportunities -- these can either create opportunities for cooperation or grounds for competition because we have so many similarities in the way that we're viewing things.

I think we are clearly entering a challenging time in U.S.-China relations. And here I'm talking broader than just the Clean Energy Sphere, but in terms of other issues over North Korea, Taiwan. And I think climate and energy cooperation can be one key area where we can either advance this relationship or we can further strain it. Of course, this is a sensitive area. There's trade issues. There's competition issues. But in many ways this is still one of the areas where we had the most in common with china and can really improve upon the relationship and this can help in these other spheres, which are also very important.

And I think, you know, something we often forget is that both China and the United States are positioned to lead the global transformation to a sustainable, low carbon economy. And I actually mean that in tangible terms. We have the largest markets in the world where these clean energy technologies will be deployed. We're going to be the largest manufacturer of these technologies. The cost reductions that these technologies will experience over the next couple decades will be due to deployment in the U.S. and China primarily. And so to the extent that we decide to take

on this role, the rest of the world will absolutely benefit from both the U.S. and China's role in bringing down the cost of these technologies in terms of the learning and innovation that we contribute.

So I'll stop there. I look forward to your questions later. Thank you.

(Applause)

MR. TYNDALL: Good morning. I'm Bill Tyndall with Duke Energy, and I'm going to try and give you a little bit of a report from the front of China-U.S. cooperation and economic cooperation. And part of what I'm going to be describing are some, I would say, aspirations that we have and hopefully our Chinese partners have on what we're trying to do. But they literally are things that are going on right this second. In fact, our China policy, work we're doing in China, is really being driven by our CEO, Jim Rogers; our chief technology officer, David Mohler; and both of them are in China today. So, you know, we're in negotiations and discussions. So we're in the middle of this, and that's going to be my excuse for why I don't actually have slides for you this morning. I'm just going to describe briefly some of the things we're looking at and help you understand why a U.S. utility that essentially is not a big manufacturer really can't outsource what we do since it's very hard to outsource producing electricity for Cincinnati, Ohio, or Indianapolis, Indiana, to China.

So, you know, why are we involved? What do we see as the opportunity? But it is illustrative of what is -- what is really the advantages for the U.S. for cooperating in some areas. Not true in every case. Not true across the board. So, you know, in trying to think about this, we have spent a lot of time trying to explain internally to some of our employees about what we're up to in China. What is Duke Energy? A company with a U.S. utility operations in South Carolina and North Carolina, Indiana, Ohio, serving customers with electricity, natural gas in the Midwest -- we have some

overseas operations, but they're in South America and they also are what you would say are utility operations providing -- generating power, distributing power. Why is a company like that interested in China?

And in trying to explain it, I mean, it almost comes down to a quote from a famous bank robber. I believe it was Willie Sutton was asked, you know, why do you rob banks? Because that's where the money is. Well, in a little bit, in our area, in looking to where the technology is going to be developed, deployed, commercialized, you know, lessons learned, refined, it's going to be in places where it is being added into the generation distribution, home grid. And where is that happening faster than anyplace in the world? Where is that being built faster than anyplace in the world? China. And that's why we are interested in China.

The U.S., for our area, is, in fact, you know, a mature market. We have electrified the country largely. We have existing distribution. We have existing generation. We have the need to perhaps, certainly on the generation side, we have the need to deal with what is at the moment about a 60 percent coal fleet in the United States for our power. Where is, you know, it's both aging and it's high emitting in terms of carbon so we have to deal with that. And then we have -- and then there is a question of our existing distribution and home use. Are there, you know, we see the future in terms of smart grid, micro grid, those sorts of things. But in the U.S., we've already built it so everything we do is replacing.

And obviously, in some situations that replacement needs to be done today and it needs to be done quickly as, you know, in a very unfortunate way, you know, natural gas distribution in northern California, I mean, they saw what having an aging infrastructure, the risks it poses. So there are issues that we have to deal with today, but we're just not going to be dealing with them at the speed in the numbers that is going on

in China. And both speakers before me have talked about this a little bit. I mean, you know, some ones we look at are, you know, 15 million people moving into cities every year. The Chinese utilities are growing at 30 percent-plus per year on average. U.S. utilities are growing at about one percent. And quite frankly, I mean, U.S. electricity consumption, like by industrials, are at a level significantly below where they were pre-recession. And in some of our areas we're not projecting that we're going to get back to that level of load until 2015 or 2016. So, you know, in fact, the U.S. has a shrinking electrical demand as opposed to a 30 percent growth in China.

As has been talked about, China now has more CO2 emissions than the U.S. And there are also some similarities with those CO2 emissions. There are also similarities in the challenges the two countries face. I mean, as I mentioned before, the U.S. is primarily or largely dependent on coal. China is more, almost exclusively, dependent on coal. There are not just CO2 issues with coal use that both China and the U.S. are wrestling with, but there are also assorted other air pollution, ash waste management issues that are associated with it.

So there are shared challenges. And what Duke Energy has been doing is setting up a series of MOUs -- memorandums of understanding -- with various Chinese utilities and trying to work with them on some of these challenges. And I'll give a few examples, but we're working with the largest generator in China, the Huaneng Group on coal carbon capture from power plants. And we're also talking to them about integrated gasification combined cycle, which is gasifying coal. And in what we're trying to do there is we are moving forward with some of those technologies in the United States. China is moving forward. The Huaneng Group is moving forward. And is there a way to cooperate so that we can accelerate this? Can we take both sides lessons learned and help refine the projects faster?

We're very confident that we will be able to do this and that in these kinds of arrangements, the competitive interests are much less than the advantages of cooperating. To illustrate this, and again, I'm not trying to argue that this is true across the board and that there aren't some of the challenges that were mentioned around intellectual property and other areas where competition -- the competition nature of it dominates the ability to have -- to cooperate. It's not possible.

But in our areas, a lot of things are going on with the large coal-fired power plant. If you're going to install, say something called a selective catalytic reduction unit, which is a -- it's like a catalytic converter that sits and removes knocks from the emissions, so a precursor of ozone, when you look at that project, it's a huge project. It's a 200- to $300 million project at your average coal-fired power plant. The little technology, the sort of proprietary technology, the catalytic converter if you will, that's only a very small part, like 10 percent of that expenditure. So when we look at the issues, it's really -- what's less important to us from both a -- well, certainly as a purchaser we're ultimately interested in the least cost solution. But also in terms of the, you know, just looking at it from the politics that we all face, you know, even if we were to buy the little selective catalytic unit from an overseas company, the amount of -- you know, that's only a small -- you know, it's 10 percent of the project. And the remaining part of the project is all going to be U.S. labor, largely U.S. supply.

So, you know, we just don't have the same issues. Or we're building a huge new state-of-the-art, integrated gasification, combined cycle power plant in southern Indiana. It's probably the largest construction project in the Midwest going on right now. It's an ultimately more than $2 billion project. We bought -- the gasifier is being supplied by G.E. Bechtel is doing the work for us. The largest cost item, including the gasifier, is the structural steel for it and that's coming from China. So, you know, we bought U.S.

and we still have this huge overseas component.

So, again, the point I'm making, which is just one that we're, in our world, it's not as important who owns the technology. It's more important about access to that technology and really in this world of trying to decarbonizes coal, you know, trying to come up with how we're going to integrate renewable into a grid, how you deploy smart grid and maximize the energy efficiency potentials, those are all areas where we see cooperation dominates over the competition over the whose widget is it? And so we see the opportunity to partner with the fastest and largest market in the world and actually have gains.

Just in terms of the areas that we're looking at cooperating right now, I mentioned carbon capture. China also is -- has a -- you know, you hate to use a sentence like that in terms of a country, but the general policy has been negative on the notion that you can capture carbon from coal-fired power plants and sequester it underground and that that's the best solution for the carbon challenge in coal-fired power plants. So China, in a series of companies and labs and anything, is aggressively pursuing what's being called beneficial reuse. So, for instance, one of our partners, ENN, has a series of different experiments going with using algae to -- growing algae with the CO2 and then using that as a bio fuel and then setting up a cycle, a continuous cycle of that. And you know, if I talk to my friends -- I'm going to just -- I just spent two years as a victim of the climate legislation so I'm fully aware of sort of all the pros and cons and ins and outs of all of this and, you know, that is generally seen as not a solution for the volumes of CO2 that would need to be removed from coal-fired power plants if you're going for a 90 percent removal efficiency.

But, you know, by 2030 the U.S. was supposed to remove 30 percent of the CO2 in general. You know, that was the reduction level and, you know, this is a

technology that may allow that kind of reduction target to be met. So maybe it's more of a transition technology. But one -- so now one of these skid-size algae units is now going to be in North Carolina at one of our plants so we're going to be evaluating it and see whether, you know, helping further the project.

We are also talking with -- looking to participate with Huaneng in some enhanced oil recovery operations that they're going to do. In our particular neck of the words there aren't a lot of enhanced oil recovery opportunities for our plant, so this is something that we're very interested in working with them on.

Just other areas that we are working with the Chinese and looking to have further specific projects, smart grid again. They're building out whole cities of transmission and distribution in the next -- as their population urbanizes. They are building a smart grid today. When you do something, you know, you use, unlike the U.S., they're not using 1950, 1960, 1970 technology; they're building with state-of-the-art technology. Micro grids and taking neighborhoods and putting them on their own system so that it's redundant. There's storage. There's -- perhaps it's renewable-driven for the generation. China is experimenting with those things. We're trying to experiment. There's very little competitive reason not to cooperate and enhance each other or essentially try and learn what can be learned from the others. Opportunities.

We're hoping to sign -- we're hoping to have an eco partnership, which is one of the cooperation arrangements between China and the U.S., between a North Carolina city and a Chinese city to develop micro grids.

Storage, renewable, electric vehicles. And then let me just add one other that raises a lot of eyebrows, but nuclear power. We are looking to learn what we can, cooperate with the Chinese on nuclear power. Duke is the third largest operator of nuclear power plants in the United States; however, all our plants are built and operating

and we would like to build a new plant. In the United States, that's a 10-year, you know, 10-year, $13 billion proposition. We're probably not going to build the next -- the first next generation plant. It looks like the Southern Company is in the lead. Right now there are, depending on how you count, as many as 13 nuclear power plants that are well on the way to being developed in China with another, you know, again, depending on who you talk to -- I suspect the World Bank would have a point of view, but, I mean, I've heard numbers up to 100 that may be constructed over the next 10 to 15 years.

So, you know, it's another technology. The U.S. developed it. The U.S., in a way, had a monopoly on it for a long time, and now we're about to be the sort of last place on earth where it is being further. And, in fact, everywhere else on the earth they're going to be -- a little exaggeration -- but lots of other countries, including China, that technology is being revived and taken forward in new projects.

So this for us is a -- is really at the nascent stages. We have a series of MOUs signed with Chinese companies. We are, at the moment, you know, I'm being very general here because, you know, with good luck there will be some very specific things announced in the very near future about what we're up to, but in our neck of the woods there really is an opportunity to further both sides' goals around climate, around clean energy by cooperation and very little reason in terms of competition not to do it.

So let me close with that. Thank you. (Applause)

MR. LIEBERTHAL: I want to thank all three speakers. We've really had an extraordinary scope of coverage here from a kind of World Bank analysis of renewables and their challenges and what's necessary to have sustainability in this sector to a U.S.-China, almost government to government level analysis and the underlying realities to a corporate level. And putting the three together we really have a very rich agenda.

I will say one thing that struck me here as it has, whenever I talk with people who are really specialists in this area is how much not only technology makes a difference, but really installation and management are huge areas of learning and one of the great attractive dimensions of China is that there is simply so much of that going on that it's a great place to become deeply involved.

I guess a question I have -- I'll ask one question and then open it up to the audience. If you look in a lot of areas of manufacturing, the money is not on the metal bending side. The money is in the product specification, design, and development in branding, sales, and service. And the metal bending, actual manufacture, is typically less than 10 percent of the equation and probably the lowest percentage in terms of profitability. And that tends to be where China does best, but in a sense is stuck. And China obviously is trying to move up on both sides back to where the R&D and product specification (inaudible) forward towards branding, sales, and service, but it's a struggle.

I'm wondering on the clean energy side, it sounds like that is also, at this point at least, still largely true -- that the most advanced technologies are not being generated in China. They've been generated elsewhere, but are being applied on a huge scale on the manufacturing side in China. Does that mean that China financially is not positioning itself well to capture the major value? And I don't mean value in terms of carbon reductions. I mean in the economics of clean energy. Are they getting drawn into the same kind of positioning that they're in, in so many other sectors? Or do we see China really moving up a technology ladder and that kind of thing here? Bill, if you would.

MR. TYNDALL: Let me answer this just from a micro point of view or with a couple of examples that I think are actually contrary to that, but they're -- I bring them up only because they are examples that we have to deal with in terms of congressional concerns and sort of the more, you know, how does what we are doing

support the U.S. economy? Because I think in general from our point of view that may be true in lots of areas and it may be true in an area like smart grid where, you know, the real value proposition out there is going to be who's got the widget that's going to be installed in 500 million houses and apartments globally. So whoever has got the proprietary platform, that's going to be very important.

But to give it a contrary example and one that we're very involved in, for combinations of reasons, but primarily because China right now is building more coal and then having to deal with the environmental repercussions of that, we believe that they are going to be an important source of technology, proprietary, sort of unique in the world technology to, for instance, capture carbon efficiently from an existing pulverized coal unit and take that and do something with that stream that makes it benign in terms of the climate issue. And so we think we can benefit and help -- we can benefit for the U.S. and for our company and speed that up by working with them.

So that's an example where I think they may actually own the widget at the end of the day, but I don't think that is necessarily bad for the United States, and it's really good for the globe because they're going, you know, we can eliminate all the coal in the United States and maybe that's where we're going. But China will still have a fleet of coal-fired power plants for the next 60, 80 years that in and of itself will pose a challenge to the global environment.

MS. LEWIS: I think just to add to that, I mean, innovation is now very much a core component of the Chinese government's plans on science and technology at the highest level. And so I do think the leadership recognizes the need to really improve in this area.

In terms of some tangible results of this that I would see from another case looking at the wind industry, whereas in the past just a few years ago when you

looked at models of cooperation between companies in that sector, typically you would have a Chinese company licensing one model of the technology from a German company or whatnot and just manufacturing it with no changes. Now that model has really -- is no longer the dominant model in that industry where you actually see now joint development being much more frequent where you actually now would have a Chinese company partnering with a German company to jointly develop a technology. You still are likely that it's going to be a manufacturing company on the Chinese side and more of an engineering company on the German side, although I think you're starting to see a shift where now the Chinese company that primarily had excelled in manufacturing previously is now actually taking on innovation and design capacity in that project, whereas the German side is also now moving more into the manufacturing area. So that's at least one sector where I think you see some signs that innovation is really increasing.

MR. LIEBERTHAL: Let's open it up to the floor. There are microphones, and I'll ask you to briefly identify who you are and then ask your question. Feel free -- I'm sorry, feel free to direct your question to a particular panel member or just to the panel as a whole.

Right back there because the microphone is right next to you.

SPEAKER: Hi. My name is (inaudible), PFC Energy.

Sir, you talked about the 11th 5-year plan and right now China is formulating the next 12th 5-year plan. I was wondering if you could share with us what you think is going to be included in the next five-year development or plan for energy.

And secondly, what do you think Chinese needs to include in it in terms of structural changes, regulatory changes, environmental incentives, and so forth, for China to meet its energy targets and environmental goals?

Thank you.

MR. LIEBERTHAL: Thank you. If there's a two-minute answer to that. Dejan?

MR. OSTOJIC: Simple. Simple answer to that is we don't know. We've tabled some suggestions. We provided some input to the government. What the World Bank thinks is, you know, some areas (inaudible) I would not in two minutes try to summarize this note that we prepared for the government of China. But I think what China is now facing is almost, you know, changing the paradigm, a paradigm shift. Because part of the economic model that served them so well over the last 20, 30 years is probably getting to the end of its, you know, usefulness that it used to be. It was a model which the GDP growth was driven by investments and China needs to move from investment-driven to productivity-driven economic model. That's pretty much along the line of the first question. And China does realize this. They are moving towards shift from investments to increasing productivity as the main engine of GDP growth.

That would, of course, go hand-in-hand with using the predominant -- currently predominant share of industry in the GDP and increasing the share of services, which is something that we would expect in that respect to happen in China. And of course for energy this is a huge shift. You're talking about a significant shift in the energy structure because when we look at energy efficiency potentially in China, we are basically saying one-third is technology-related. We can improve all kinds of things, changes the lamps, et cetera, and maybe we'll get one-third of the energy potential. Two-thirds is a structural change. Without the structural change this energy efficiency or energy intensity cannot be dealt with. So that's basically in a nutshell where it is. And renewable energy has a big role in that respect, but that's a different question. Thank you.

MR. LIEBERTHAL: Thank you very much.

Yes, right here.

SPEAKER: (inaudible)

MR. LIEBERTHAL: Please make it one. Okay. I'm sorry. We just have a lot of hands so one question, please. Your top priority question.

SPEAKER: My priority, maybe to Bill, recently Secretary Chu announced around $600 million (inaudible) and I would like to know the progress of this project or program and when this kind of technology can be commercially (inaudible) however the cost of CCS in U.S.

Thank you.

MR. LIEBERTHAL: Bill?

MR. TYNDALL: Well, carbon capture and sequestration involves carbon capture and then sequestering the carbon. And the capture part of it is a technology challenge that has been successfully dealt with with regard to other pollutants that we've cared about coming out of an emissions stream from a coal-fired power plant or from other types of power plants. And in that sense it's a universal engineering problem. You have this -- you have the emissions flow and stream and what is the most efficient way of removing the carbon from it. You know, there are different types and then that challenge gets broken down between existing -- I mean, both countries have a huge fleet of pulverized coal-fired power plants. And so it's a retrofit challenge.

And then the question is also for going forward for new coal, if we're going to use that fuel, what is the most environmentally benign way to deal with it in terms of the CO2 formulation and then removal from a stream? And maybe it's integrated gasification offers advantages or the technology that the secretary just announced he was going to fund for the Future Gen project.

So that's one part of it and that's one cost. And then the second part is

sequestration and that, I think, involves a whole much more local series of issues and local -- and sort of national issues around ownership, liability, catastrophic insurance, all sort of things come into play. And at that point I think the cost numbers break down and don't become comparable.

And so I would also say that in the U.S., the focus of most of the DOE grants have been more around the sequestration side and we have an expert here who will be talking about this later so hopefully he's not going to totally contradict me, but I would, you know, sort of say it's been more around sequestration, less around the capture side. And not to give your country too big a plug, but, I mean, we're very excited about some of the progress we see being made by TPRI and others in China around capture. And I'm sure Julio will be able to talk about this. So that's why we've been talking to -- that's why we've been trying to work with Chinese companies. But at the moment the combination is still very expensive and the sequestration side of it has a lot of challenges and a lot of skeptics still within the U.S. and around the world.

MR. LIEBERTHAL: Thank you. Julio, you had your hand up.

MR. FRIEDMANN: Sorry. Julio Friedmann, Lawrence Livermore National Laboratory.

I just wanted to say that that's actually the topic of our third panel, and we have a set of experts who are speaking on that exact topic on which you asked. So I hope to be able to answer your question more comprehensively then.

MR. LIEBERTHAL: Maybe he can get in all three questions.

MR. FRIEDMANN: He can get in all three questions for us.

MR. LIEBERTHAL: In other words, stick around through lunch.

MR. FRIEDMANN: Yeah. Stick around through lunch and we'll be able to answer your questions directly.

Can I ask a question?

MR. LIEBERTHAL: Yes.

MR. FRIEDMAN: A very, very quick one. We're seeing again this sort of extremely -- I don't know how to say this -- we have a set of signals that are conflicting constantly around this topic. Just over the past two days China has doubled down on their efficiency targets. They're really making new cuts and new commitments to that which will be (inaudible) shortly. At the same today in the *Wall Street Journal* they announced that they're requiring joint ventures for U.S. automakers for electric vehicles in order to share the advanced technology around the electric drive train and that that's got people up in arms around the world.

Capital works so differently in both of these countries. It's just difficult to even talk about this topic in some rational way. It's very nuanced and very complicated. Given that, where do you see the biggest challenges in terms of the structural barriers for cooperation between these countries? And do you think there's a chance to move that forward?

MR. LIEBERTHAL: That presumably applies across the clean energies. Anyone?

MR. OSTOJIC: I can answer very simply. Intellectual property rights. That's going to be the most difficult issue.

MR. FRIEDMANN: Say that again. Financial property rights?

MR. OSTOJIC: Intellectual property -- IPR, intellectual property rights. You know, I was -- the other week I was in Germany meeting with Siemens and, you know, they voiced this concern. They said, you know, we are doing all this business, but you know, when we sell some products we can be almost sure that very soon this product will appear and manufactured with a very good quality. Very good quality.

Because, you know, some manufacturers in China, they are not developing things just by copying. That's not the way how they do it. They basically analyze the situation, study technology. They go to the same suppliers of components. They go to the same German component suppliers because that's a competitive market and they are competing directly one on one. So that's the issue of the intellectual property right is going to be the key issue.

MR. LIEBERTHAL: This will have to be the last question, unfortunately, but we will be coming back to a number of these issues in the ensuing several panels. Yes, over here to the right. No, the fourth row. This gentleman back here. Yes.

SPEAKER: Thank you very much. My name is (inaudible). I'm working for the Japanese Embassy here.

I would like to ask Dr. Lewis, how do you think the U.S.-China cooperation should be translated in the climate change negotiation internationally? I think that in a U.S.-Japan -- I'm sorry, in a U.S.-China, you know, that is a very important partner, important players is the negotiation. If it leads to an agreement that will have a huge impact, a huge, good impact on the negotiations. I know, you know, it's very important that, you know, China and the U.S. enhance a mutual understanding. But I want it to be translated into negotiations.

MS. LEWIS: Well, I think that the way U.S.-China cooperation can really help to improve their own relationship within the international negotiations and therefore how the negotiations go is by really focusing on some of the core technical issues which I think are at the root of both of our countries' concern about taking on any strong targets to reduce greenhouse gas emissions. I think, you know, these concerns are somewhat different in the U.S. and in China, but I think getting at some of the issues surrounding, for example, emissions accounting, measurement reporting, verification of emissions, this

is something that can be done at the EPA level, you know, and can really then build upon what's being done at the international level.

I think that it's a mistake to really bring issues from the climate negotiations into the bilateral discussions because I think it can distract sometimes from the concrete steps that you can take in that type of a forum, but, of course, there is quite a bit of overlap, particularly in getting at the technical issues surrounding, you know, what technologies will be available that will then inform what targets we might be able to look at it in the broader climate context.

MR. LIEBERTHAL: Thank you for your questions. I want to thank all three speakers for staying within their time limits and doing a very, very good job. (Applause)

There is coffee and other liquid refreshment in the back, probably by now somewhat stale pastries outside here. And we reconvene at 10:45.

(Recess)