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DEVELOPING CLEAN ENERGY MARKETS: TOWARD CHINA-JAPAN-U.S. COOPERATION

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ANDERSON COURT REPORTING
706 Duke Street, Suite 100
Alexandria, VA 22314
Phone (703) 519-7180
Fax (703) 519-7190

PARTICIPANTS:

Introduction:

RICHARD BUSH
Senior Fellow and Director
Center for Northeast Asian Policy Studies
The Brookings Institution

SHOICHI ITOH
Collaborative Researcher, Economic Research
Institute for Northeast Asia
Senior Researcher, Institute for Energy Economics, Japan

PANEL 1: CLEAN ENERGY IN THE PARADIGM OF ENERGY SECURITY

Moderator:

ERICA DOWNS
Fellow, The Brookings Institution

Panelists:

DAOJIONG ZHA
Professor, School of International Studies
Peking University

TAKAHIKO ONOZUKA
Special Advisor for Environment Business Promotion
Japan Bank for International Cooperation

TATSUYA SHINKAWA
Chief Representative
Washington, D.C. Office
New Energy and Industrial Technology Development

JOANNA LEWIS
Assistant Professor of Science, Technology and
International Affairs
Georgetown University

Keynote Address:

KATHERINE SIERRA
Senior Fellow
The Brookings Institution

PANEL 2: PROSPECTS AND BOTTLENECKS FOR CLEAN ENERGY COOPERATION

Moderator:

JANE NAKANO
Fellow, Energy Security Program
Center for Strategic and International Studies

Panelists:

GANG HE
Research Associate, Program on Energy and
Sustainable Development
Freeman Spogli Institute for International Studies,
Stanford University

NOBUHIRO HORII
Associate Professor, Department of Industrial and Business Systems,
Faculty of Economics
Kyushu University

JAKE SCHMIDT
Director, International Climate Policy
Natural Resources Defense Council

JENNIFER TURNER
Director, China Environment Forum
Woodrow Wilson Center for International Scholars

P R O C E E D I N G S

RICHARD BUSH: Good morning. My name's Richard Bush. I'm the director of Brookings Center for Northeast Asian Policy Studies. It's my great pleasure to welcome all of you here today and to convene this session on Developing Clean Energy Markets: Toward China-Japan-U.S. Trilateral Cooperation.

In the United States these days climate change is a subject like the weather, people talk about it a lot, but they don't do anything, and, you know, this is a source of great frustration for those of us who accept that climate change is real and is having effects already. I think sort of people who have children and grandchildren, like I do, feel a special sense of helplessness because we can see the kind of world that is developing for them.

Now, it seems to me that in addition to the talk there are some things that can be done. The first is to develop an array of efforts and responses to mitigate the effect and clean energy, the subject of our discussion today, is emerging as one of those important areas.

Second, I think that if any of the steps that are taken are going to have an impact, it has to be on the basis of major power cooperation because they're the ones that have the impact, they're the ones that have the potential capacity to do something about it, and they are the ones, hopefully, that have the sense of responsibility.

And finally, the things that can be done now, should be done right away. And so that's where this conference fits in, and it's how we can push forward the cooperation of three major powers -- China, Japan, and the United States -- in an area that has a lot of potential.

Before I leave the podium, I'd like to express deep gratitude to a few individuals and organizations. One is Itoh Shoichi, who was a visiting fellow at the Brookings Institution CNAPS last year and it's really through his vision and energy and initiative that this event is taking place today. Shoichi came to us from the Economic Research Institute for Northeast Asia, and ERINA has played a very important role in this conference.

Also playing an important role is the Japan Foundation Center for Global Partnership which has provided essential financial support to ERINA for this event, and we're pleased that Carolyn Fleisher from CGP is here with us today.

Finally, I'd like to thank all the participants, particularly those who have come across the Pacific for this event. We appreciate your sort of sacrifice

of time and your coping with jetlag.

So, thank you again for coming. I'd like now to turn the chair over to my colleague, Dr. Erica Downs, who will chair the first panel. Erica?

ERICA DOWNS: Good morning. My name is Erica Downs and I'm a fellow in the China Center here at Brookings. Most of my own research focuses on dirty energy, so I'm very much looking forward to learning more about the topic of today's first panel, which is Clean Energy in the Paradigm of Energy Security, and to shed light on various aspects of this topic we have four great speakers with us.

The first will be Joanna Lewis, who is an assistant professor of Science, Technology, and International Affairs at Georgetown University's School of Foreign Service. She'll be followed by Takahiko Onozuka who is the special advisor for Environment Business Promotion at the Japan Bank for International Cooperation. Our third speaker is Zha Daojiong, who is a professor of international political economy in the School of International Studies at Peking University. And our fourth speaker is Tatsuya Shinkawa, who is the chief representative of the New Energy and Industrial Technology Development Organization's representative office here in Washington, D.C.

Each speaker has about 10 to 12 minutes to deliver their remarks and then we'll open up the floor to a broader discussion. And with that, I'll turn things over to Joanna.

JOANNA LEWIS: Thank you, Erica, and good morning. So, to start off our discussion this morning I'm going to be speaking primarily about U.S.-China clean energy cooperation in the paradigm of energy security. To start, I think it's important to keep in mind the U.S. and China are strategically interdependent and face many similar challenges in maintaining energy security, in combating climate change, and ensuring domestic economic growth and prosperity, and trying to do all these three things at once is often somewhat challenging.

I think we're also entering a somewhat difficult time right now in U.S.-China relations and climate and energy cooperation can be one area, potentially, where although there are sensitivities, I think we can really cooperate well and advance our relationship. This can then help to broaden and deepen our areas of long-term, mutually beneficial cooperation and, in particular, help to build strategic trust between the two countries. And when you start to talk about clean energy in particular, I think the U.S. and China play a particularly important role here because we are both well positioned to lead the global transformation to a low carbon economy and our two countries are currently leaders in renewable energy, in particular, and I'll talk a bit about that today. So, of course, I think it's important to keep in mind that we are the world's top two energy consumers as

well as carbon emitters on an annual basis, and, therefore, the U.S. and China jointly play a decisive role in our ability to globally address global climate change.

Looking at renewable energy cooperation in particular, I think that our two countries are going to have no alternative but to become far more active partners in developing low carbon economies and particularly expanding the role for renewable energy technologies. This is an area where my research has focused quite a bit. Both of our countries are motivated by these related goals that I mentioned. When it comes to renewables, which is not just low carbon development, but the energy security benefits that renewables can provide, the job creation benefits, as well as the local air pollution reduction benefits, and as major technology exporters, we're both poised to jointly lead the way in fostering the greater worldwide use of renewable technologies. And I think it's important to keep in mind as well, that given the size of both of our markets, the actual scale of renewables deployment in both the U.S. and China can help to advance technological understanding and accelerate deployment to reduce costs further in these technologies which will then have benefits for cost reductions and broader deployment outside of the U.S. and China for these technologies.

There are some key barriers to renewable energy deployment in particular in both the United States and China, one being transmission issues including integration into existing electric grids, particularly because of the variability and intermittency of some of renewable resources. There are citing barriers, there are some costs that are actually rising than declining with key materials inputs. We see issues related to technology reliability. And then, of course, a policy framework in both countries that would be consistent, supportive, and set a long-term signal for developers in these technologies as well as for technology manufacturers to invest in the next generation of these technologies.

But I think that these are all topics, because both of our countries are currently grappling with them, that are really ripe for U.S. China cooperation. And you notice a lot of the topics that I point out here aren't about so much innovating and developing new technologies, although I do think that's one area, but deploying and making sure that the technologies we currently have are being operated and maintained well, are performing well. This is an area that I think can be really helpful going forward. I'll come back to that in a minute.

So, while both of our countries are really leaders in this area, I think it's important to keep in mind that there's somewhat different areas in which we both excel. On the manufacturing side, China, in particular, has taken impressive strides to improve its manufacturing capability, for example, both in wind turbine technology and solar photovoltaic technology, although when it comes to solar photovoltaic, most of this technology is being exported, at this point, outside of China.

The United States has, until recently, been the world's top market for wind turbines and a leading supplier of some of the second-generation PV material such as thin film.

On the development side, alternatively, much of the near-term growth in renewable power in both countries will be in wind as well as we're starting to see really exciting large-scale solar generation in both countries. But you're seeing in China a difference in that China is starting to look at central station photovoltaic plants while the U.S. is starting to look into solar thermal technologies and looking at PV more for distributed applications and rooftops.

There's been a few news articles over the last few months that I think really highlight some of the growing tensions when it comes to U.S.-China relations on clean energy in particular. If you remember back in July the International Energy Agency pronounced China the world's largest energy consumer and at that point China rejected these claims calling the IEA data "somewhat unreliable." I think this shows the remaining tensions and somewhat disagreement surrounding energy statistical collection and the need for a lot more attention and cooperation on that topic in particular.

We then saw just a couple days later the Senate pronounced a climate bill dead here in the United States, and on that same day China announcing a plan to start to look at domestic carbon trading. In August, we saw China pass Japan to become the world's second largest economy, and of course we've been seeing news all over the U.S. media about how unemployment has been still a problem, the economic growth not rebounding quite as quickly as we might have hoped. And then last month we saw China named the most attractive place to invest in renewable energy by the firm Ernst & Young, and then the next day we saw the United Steel Workers Union here in the U.S. file a Section 301 petition against China's green technology practices, and the U.S. Trade Rep has decided to pursue some inquiries under that petition.

So, I think competition is a realistic thing. It's something we can't ignore between our two countries, but I think it's important to understand the different ways that it might be viewed. In the United States, for example, when it comes to international trade issues one of the big concerns is about Chinese imports to the U.S. potentially offsetting U.S. technology manufacturers, as well as U.S. market access in China. There have been claims about preference for Chinese manufacturers in the Chinese market as well as potentially unfair subsidies being utilized. In China, international trade is more about concerns of competing with U.S. or EU manufacturers in other markets. So we already see a lot of leading Chinese clean energy technology companies looking at U.S. markets, Australian markets, other developing country markets, and emerging economies in South America and elsewhere, and trying to compete with some of the more established, older technology companies in these new markets, as well as market access in the U.S., where I think it's also fair to say we've had some

preference for U.S. manufacturers as well as concerns about technology performance, not just from Chinese companies, but from newer companies with a lot less operating experience over their lifetime.

So, while I think there are some perceived challenges to cooperation, I'd like to just point out a few areas where I think that there may be some misconceptions. One is that we are competing with China to become a renewable energy technology leader. I think that while China leads in production, there is still quite a ways to go in terms of research and development, as well as in deployment, and this is an area where we can potentially cooperate. If U.S. companies cooperate with Chinese companies, there are these concerns about intellectual property theft and things along these lines, but I think if you look at the actual data you can see that many U.S. companies have very successful cooperations right now in the clean energy sphere, in particular with Chinese companies, and they're benefitting from this cooperation.

One question I get is, well, what can China learn from us if they're so far ahead in a lot of these areas? And I think that it's important to look at while, for example, China was the largest wind energy market last year, there are still serious challenges to the actual deployment of these technologies. We're seeing very low capacity factors as the result of poor citing practices in operation and maintenance as well as other issues that mean that, you know, the wind turbines that are going up are not necessarily performing as well as they would in other countries, and that needs to be looked at because it's not providing a low carbon energy source if they're not generating electricity. And finally that we have nothing to learn from them, I think this is also certainly not true because right now, for example, China is the only country that is pursuing gigawatt-scale wind farm development. This is something we've talked about doing here. But in doing that, in being really one of the leading countries in doing extremely large-scale wind farm development, they're going to be one of the first places where we're going to experience large-scale transmission challenges, integration challenges. And this is something the U.S., I think, in particular, stands to learn quite a bit from as this is tested in the Chinese context over the next few years.

So, we've had, of course, a really interesting year of cooperation with China on clean energy. There's been quite a few new programs implemented and many that have been started in the last decade or so, continued under the Obama Administration. This is just a partial list of some of the ones that were signed last year. And I think one of the ones I just wanted to highlight, which I think is particularly interesting and a somewhat new model for U.S.-China clean energy cooperation, are these U.S.-China Clean Energy Research Centers, or the CERCs. We have heard announcements from DOE in the last few weeks that now all three U.S. sides have been announced -- I have to update this -- for the centers. These are centers that are going to be looking at clean vehicles, clean coal, and energy-efficient buildings. These are all areas where both the U.S. and China stand to really deploy many new technologies in the coming years and

are really ripe for cooperation. And these research centers aim to not just share experiences, but to actually conduct new research and development on new technologies involving researchers from both China, in the United States, based in both countries. So, I think it's going to be really interesting to see how this is worked out, although the details really still -- we need to wait and see how this ends up being decided.

I just want to end with a few thoughts about the bilateral relationship with China versus the international climate change discussions that have been taking place. Of course China and the U.S. are central players in negotiating a multilateral climate change agreement. There was a lot achieved in Copenhagen, but we're now looking at the meeting in Cancun at the end of this year and there's still quite a bit more to be done.

I think multilateral politics are really quite different than bilateral politics, and in particular as it relates to the U.S. and China. I think that bilateral agreements, such as the ones I've just mentioned, can't necessarily replace the multilateral discussions which are taking place, but I think that these actions can really help to achieve concrete steps in the near term, particularly while the climate negotiations are stalled. And I think that in the meantime this can really help to improve the multilateral relationship through this trust building, which is really, I think, quite important.

I think that in the Chinese context it's often pointed out that climate policy and energy policy are two different things, but I think this isn't necessarily the case because if we look at what's been happening in China recently, as you may know, they've had a very aggressive energy intensity target which they'll be looking at meeting by the end of this year. This target was motivated primarily by energy security concerns and aims to really eliminate the wasteful use of energy and has really achieved quite a bit in being able to do this. And this target was so successful that the officials in China looked at this as a model for setting up a carbon intensity target now. So, the metric has changed although many of the ways that they're going to go about actually trying to achieve this target have really remained quite consistent.

And so I think, you know, this is an area where you can look at the clean energy discussion as being a really more cooperative space, a more productive space, for dealing with the challenge of climate change in the near term. I think that energy security, climate change, and economic growth and prosperity are three things that can all be addressed by looking at clean energy technologies. I think there's quite a variety of technologies for the different domestic contexts, but I think these can really create constructive opportunities for cooperation rather than letting them become grounds for competition.

We are, of course, entering a challenging time in U.S.-China relations, as I mentioned, and I think that this is really one area we can't let fall

off the top of the U.S.-China bilateral agenda because it is one area, I think, that we really share a lot of common interests and can, therefore, do something really constructive. And, of course, our two countries are really, in many ways, uniquely positioned to lead the global transformation to a low carbon economy, due, in particular, to the scales of deployment that both of our countries can provide, the potential cost reductions for these technologies, and the opportunities that this is going to then provide for other countries, and, in particular, other emerging economies in developing countries in gaining access to these technologies in the coming decades.

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

(Applause)

TAKAHIKO ONOZUKA: Good morning, everybody. My name is Onozuka from the -- it's very honor to be here, but still, the jetlag is (inaudible), so I try to do my best anyway.

Today the theme is how to develop the clean energy market through China-Japan-U.S. trilateral cooperation. People don't believe that Japan and China have some relationship with, but I try to do that best anyway.

Today I will explain to the JBIC new approach green. Later I show you some program.

With that, I will talk a little bit about JBIC. JBIC is the Japan Bank for International Cooperation, is the international wing of JFC, the Japan Finance Cooperation. It's a legal entity. JFC's a policy-based finance institution, which is wholly owned by Japanese government, so we are a public institution.

Our capital, based on the Japan and U.S. exchange rate, but now there is $11 billion U.S., and outstanding loan is $94 billion U.S. That means that's now almost the same as the size of the World Bank IBLD. And guaranty also we have the $21 billion U.S.

Today, next one is so what is the mission of the JBIC? We used to have the three missions, which is very clear for the first one, is Japan has no natural resources, so JBIC is to have some mission to the access to natural resources. The second one is we need to support Japanese business we say. It's a different way of saying competitiveness of Japanese industry. We provided loan to the Japanese manufacturer, exports credit or import credit, overseas investment credit, to support their business outside Japan.

The third one used to be very trendy for after the Lehman shock, so it's we provided loan to the trading facility for the emerging market or set up

jointly with the IFC to inject capital for the local banks.

Our government is to put into some program regarding to the environmental business, so we started a program for the (inaudible) competitive Japanese industry is, we call that the FACE. I'll show you that later. And also we started then different programs, Life. But from the 1st of this April, our new government is to insist or requests us to change it in our bylaws and to put into their first mission is to challenge global warming, conserving global environment business. And we started to -- newly, to start a program of green.

Firstly, I'll show you what is the FACE, what is the outline of the FACE. FACE is more focused on one of our menu, is providing equity investment for the project and then areas is more focused on Asia's area.

We set up jointly as private firms to diversify the fund equity to the various projects in Asia, so we set up the fund. This is a track record of the FACE. You can look at in China, we set up the fund with China's government, China Environment Fund will invest in China environment efficiency project. And also you look at in different Asian countries, Philippines, Vietnam, regional approach for the Asia, because it's in our Face is focused on Asia.

Next program is LIFE. It's an obligation of the "leading investment to future environment." This program started after the Lehman shock, so we provided the cash liquidity. So the last program is the FACE, which focuses more on direct investment, but this LIFE program is more focused on providing liquidity, so we started also providing loans as well as equity investment, and we also have some category for more focused of the four different areas. First one is, green power generation and the second one is energy efficiency project. The third one is the water. Water is more like an adaptive approach. And the last one is urban transportation, modal shift is -- we provided some loan to the -- in China, I show you later.

The first transaction under LIFE is we provided loan to India. You see that in a joint venture company in the center, it's set by the Mitsubishi Heavy Industries with the local Indian company, and then this joint venture is to produce very high efficiency boiler we call the super critical boiler. It's a slightly different approach for India and China because I ask my friends working in some Japanese manufacturer, why you didn't set up a joint venture company in China and why you started to set up the joint venture company in India? Because China has already very strong local manufacturer there, so they do not take a risk of competing with the very strong guys, but in the case of the India, they have some room to set up joint venture, so they decided to go there. And they set up the joint venture company and then as the market is very great opportunity to the power plants in the future. So, that is very good for the meeting of the transfer of the technical -- very advanced technical, super critical boilers.

So, I show you the track record of the LIFE. India, just so you know, was a previous project, but you can look at the UAE or Kazakhstan, also the Koreas, its LIFE is not just focused in Asia, more like developing countries in the world.

I show you the -- it's very quite new as I set up the program for JBIC, from the first of this April. We call it GREEN. This is not linked to any Japanese business. We provide a loan or equity participation for the project, very good for reducing greenhouse gas emissions, and also we asked them to accept our methodology, JBIC-MRV is the how to reducing the greenhouse gas. So it's very -- we (inaudible) by JBIC, so that this project is not linked to any Japanese. Now, it's alright if the Japanese are involved, but it's not true requirement for our legal requirement. So it's provided loan for more supporting conserving global environment, so it's more anti loan basis.

But we decided to -- it is a real project for the green, so we are not too specified for these companies. We specify the technology. Sorry, it's a very small character, but you can look at here is a power generation. For example, in the case of the power generation, we list some technologies, high-efficient coal-fired power generation, gas fires, rehabilitation, power efficiency program. If they -- say some company inside developing countries to request us, they decided to take up this project. In that case, it's very easy for our loans or requirement. So, that is the risk of the eligible project or eligible technology for green.

From now, I just mention how can we collaborate with three big countries. One is some hints. This is the resource from the Japanese government, METI. It's some very interesting data. It's very simulation of how we apply for the best commercial practice, in Japan, for the existing plant in the world. In case of the USA, if we applied it in our best commercial practice with Japan, it's reducing the 377 billion pound per year CO2 is really -- could be reduced.

In case of China is 700 million ton, and in case of India, 180. If they are to calculate totally, it's the 1,284 million tons could be reduced. That is a similar of the total emission Japan could be possible. This type of technology is already to transfer through the license by Japanese manufacturer to Chinese manufacturers, I mean that the super critical or ultra super critical technology already transfer to Chinese manufacturers so they can produce anyway power plant. But in Japanese manufacturers, now they just started to focus on the more advanced technology that's made in the integrated coal classification combined cycle. We say that an IGCC. It's very good for the -- for some reason, for the highest thermal efficiency or environmental performance.

So, now, is the Japanese manufacturer is very keen to develop this technology. And I think the coal-based power generation is still -- has a big portion of the -- in the power generation in the future, so still they have (inaudible) to provide CO2 emission, so it's a very necessary for that combined

with the CCS, carbon caption storage, that's (inaudible) my idea. And I think this map is how to collaborate these three countries. USA has so much good track record over the CCS because they don't have oil fields, so the CO2 is gas is injected into the underground to get the oil, so enhanced oil recovery, EOR, is very, very -- is a commercial is very -- you know, mechanic. So, they have a very good track record. And also the legal framework is not clear. So, USA can provide these know-hows and the legal expertise.

Japan, we provided maybe is IGCC and plus CCS technology, is now we are developing some project in Australia. If they can succeed in case in the very near future, we can provide the technology to the market and JBIC can provide long-term financing.

And China, it's very, very big incentive for -- because China has still need to set up new coal-fired plant. If there is no demand for the new coal power plant in case of the advanced areas, it's very difficult to put into the CCS or IGCC, you know, technology, because it's always necessary for the green project is very -- is, you know, is a first to kick off, you know? So, the China has -- still has such a capacity and China is already to more have some technology to produce very attractive cost. That means the construction plant cost is very saving, you know?

I heard that in case the CCS, or the coal-fired project, it's necessary for 20 person is used for the CCS side, so it's very necessary for the -- plant cost should be very -- manufacture is very low cost here.

And also the storage capacity has some big potential in China. Japan has no reservoir in the unfortunate, so this, the CCS, is very -- I would say is one of the challenging to climate global warming. I believe that in this CCS we should more -- to more boost by the three of us.

And finally I think the necessary to try to have some mutual agreement is China-Japan and China-USA to put into some body for the carbon itself. It's mean by the carbon credit.

That is my very, very challenging idea. So thank you very much.

(Applause)

ZHA DAOJIONG: Good morning. Since I don't have a PowerPoint, I'll just project from my throat.

I come to this workshop with a very single-minded idea, that is to say when we try to talk about energy cooperation, either on a bilateral basis between China and the United States or between China and Japan, on a trilateral basis, that single-minded idea is that I want to make an argument that it is the end

purpose of this sort of cooperation ought to be to speed up the deployment of energy saving or climate friendly technologies in China.

This deployment needs to be faster, more extensive. China ought to become a place where we make better use of these technologies rather than just manufacturing and export to other markets. So, that's my single message.

I want to preface this with an observation, that is to say, if you look at the level of industrialization, you look at the overall stage of economic and social transformation, China today is really where Japan was back in the mid- to late 1960s. All these other rows of statistics, the second largest economy, whatever export capacity, notwithstanding, when you look at -- if you can agree with me for a moment that China today is really where Japan was in the 1960s, that is to say, before you actually work on global issues that truly have a global impact, like C02, we have many tangible local things to work on. For instance, acid rain is more tangible to the Chinese, both the people and the government, than C02 that's in the air. I'm not trying to justify the government's position, I'm an observer. So, in that notion, I want to make a case to say cooperating in (inaudible) clean energy toward that goal.

Of course within China we have many competing voices and behind each voice you have different interests. But my job here today is to try to convince possible skeptics in this audience why it's worthwhile to think towards that direction.

Indeed if you look at the post-war history, the three nations, China, United States, and Japan, pursued each, you know, its own path towards energy security. We have very low levels of mutual dependence on each other in terms of energy supply. And when you think of the future, because of geographic differences -- geography -- we cannot be exporting electricity to each other.

Back in the early 1960s, as in the middle of the first oil crisis, there was some excitement, especially in Japan, that China was going to become the so-called Saudi Arabia of East Asia. Now history has shown that China's oil export peaked in 1985. In other words, China as a major energy supplier to the rest of the world, or to more specifically Japan and the United States, is very limited. And today we talk about China as in a global scramble for traditional resources, and as Joanna just mentioned, even in the area of clean energy there is a lot of competition and sometimes that becomes a source of trade frictions.

So, then why do we need cooperation? Again, I go back to my own point, that is to say, we need to cooperate because energy consumption in China is part of a global demand. Consumption within China is what drives Chinese programs to go overseas. When you try one of these arguments within China, that's always self defensive, is to say, well, wait a minute, we have such large portions of what's called embedded energy export. If you look at some

Chinese scientists put this to be anywhere between 24 to 30 percent of China's energy import actually goes back in the products we make for export, right, and those kinds of observations are there and it prevents more meaningful discussions about global responsibilities.

So, it's more meaningful rather than just to talk about overall consumption in China, to focus on efficient consumption and to focus on diversifying the energy mix in China to reduce the amount of coal which the JBIC has been doing, to increase nuclear power in the overall electricity generation, that's where U.S.-China collaboration has helped the Chinese, you know, make great strides, and we need to work more on renewable energy use in China as well. If you take note of one of the most recent developments, that's Boeing and Air China, they're testing bio fuels that are manufactured in China in civilian airplanes. These are all great areas of progress. We can do it, we can make energy consumption in China more diversified.

In addition to this, more -- products level, China must have, at least one of the things I see as a scholar, that is desperately needed in China, is not more ideas. We need more action, especially in the demand side management. Scholars can do a great job doing policy lessons, but we do need to have extensive involvement of international business actors on the ground in China. Given this atmosphere especially the oversimplification in the media discussions about overall formulations is very tempting, but sometimes successful to argue that, you know, things -- the Chinese market should be left for Chinese companies, better state own the monopolies and that we have had a -- we had a history of this turn out to be rather disastrous for us before China opened up. We need not go back to that. If there was one thing that has been proven to be so beneficial to the Chinese economy and society for the past 30 years, it's that we involved foreign business actors.

Also, if you don't have foreign businesses to be involved on the ground, then it's very easy for this populist instinct to do it easy, get it cheap, and often that translates into -- and sometimes our academics or even diplomats just argue, you know, China is at this stage of development, we have no other choice but to do it cheap and easy and dirty. That's not good for us.

Now, so that's the rationale. Now, does China have a record of -- in other words, does China have a record welcoming international cooperation? Or how receptive is China to this idea of -- to this notion of international cooperation? It depends on who speaks for China. In other words, whose voice you pay more attention to. We are not short of "thinkers," we have 1.3 billion. Everybody can claim to speak for China. Many of them get quoted in the media, but I want to draw your attention to those scientists and the engineers who do the real work. Those are the people who don't always get quoted in the media and those voices need -- their actions need to merit more attention.

If you look at the historical trajectory of cooperation, China learned from the United States going back to the 1970s. If you look at our first lowest government foreign direct investment into China that had to do with setting up contracts to attract international penetration to the Chinese market for offshore drilling. ARCO, you know, many other American companies were the first to be awarded contracts in China. The first joint oil development project was between Chinese and Japanese companies, in the field called the (inaudible) in 1983. That's still running, actually. There is a long history of doing this, and between China and Japan we have long term trade agreements that really was for China to -- since 1973, to guarantee particular amount of sales of oil and gas -- coal and also grain, in exchange for equipment from Japan. So, there's a long history in doing this. Sometimes we forget that. And more importantly, of a downstream level, that is to say, in petrochemicals, in electricity generation, earlier I mentioned a civilian-use nuclear power plant. If you go back it was during the Reagan Administration, China and the United States signed a nuclear cooperation agreement. Between China and the United States the usual reference is, we have 30 years of cooperation, some 40 different agreements in science which resulted in (inaudible) projects.

I think we're happy to have the JBIC presentation here. Japan, in that sense, has done extensively, JBIC being one of them.

But there is today the challenge. In other words, we have a rich history of cooperation, the challenge is that the paradigm of cooperation is changing. Joanna just mentioned this new initiative. She put a question mark on the Chinese side, the commitment is unknown. I'll try to explain some of that. Back -- if you look at the history of cooperation between China and the United States it was more like this, that is, you have individuals in the science community, and on the American side, if you look at the very beginning, I'm talking about the late 70s, early 80s, it was more the Chinese Americans who were working in universities in research labs that started this. So, the individuals formed a community that identified the projects.

Step two, they got endorsement support from the home institutions of these individuals on both sides. On that basis, you had government support, so it was also during that process, it was more the United States leading China, providing a type of, should we say, tutelage, the rationale being to assist China to move away from communism, I suppose, so the result was China got to upgrade its research facilities and level of expertise. The focus, in that process, was on basic energy science, and that was, of course, in addition to the geopolitical rationale, that was before intellectual property rights became a major issue. That was also before the competition from China was an issue. Today that's under change, and before I talk about what changed on the Chinese side, let me take a quick note of the pattern of cooperation between China and Japan.

The energy cooperation between China and Japan, especially the

downstream, the consumption side, follows a very different pattern, agencies like JBIC is more industry based. If you look at China and Japan trade and investment, it's more Japanese companies investing in China and shipping some of the semi processed products back to Japan, so it's more intra company or more intra industry trade, and in that -- around that process you have built a pattern of transfer of expertise and then with government, endorsement. That's quite different from China-Japan. And on the China side, we changed fundamentally in the mid-1990s, so after about 10 years it's very difficult to go back to the old pattern of cooperation with the United States. The change was known in the Chinese phrase *shi chang huan ji shu*. That is to say, we opened up our markets in exchange for importing technology. So what that means is the relationship between the government and our research institutions has changed. If there was any serious research on the Chinese side or innovation in technology or even in basic science, that innovation does not necessarily come from government funded research institutes. Innovation takes place around products or in privately funded companies. So, it's more product-driven.

So, actually, that explains some of the difficulty in this latest idea of China and the Unite States coming together, if you look at it on the Chinese side, it's the Ministry of Science and Technology.

Now, the Ministry of Science and Technology does not relate to laboratories in China the same way as the Department of Energy relates to energy labs in the United States. So, that explains, even today when the United States is so forthcoming, whereas details on the Chinese side is still a little bit vague. So, my argument is that that is not necessarily bad. Going back to what I said, did we need foreign involvement in the Chinese market so that later on, as we move forward, if we think about three-way collaboration, whatever way collaboration, I would say, three key words: one is that probably we are better off to make these project-centered, market-based, and government-supported. So, in that order I think we have a good chance of seeing the faster and more extensive, more effective deployment of the latest technologies and equipments in China, in a truly rationale sense, to my own understanding. It's conducive to this larger policy goal of increasing domestic demand in China rather than having the economy more -- so much more reliant on exports.

So, on that note I should stop my presentation. Thank you.

(Applause)

TATSUYA SHINKAWA: Good morning. My name is Tatsuya Shinkawa. I am the chief representative of NEDO Washington office. First I'd like to do a short introduction of NEDO. NEDO is a Japanese governmental organization to promote around the activity in industrial energy and environmental. NEDO is established in 1980 and about 10,000 -- sorry, 1,000 people are working in NEDO, and budget of NEDO is approximately $2 billion

U.S.

Today my presentation is concentrate to the Japan-U.S. economic cooperation on clean energy. I was asked to make a presentation in Japan and the U.S., but we have -- Japan has a lot of cooperation with China, but today's presentation is concentrated only in Japan and U.S. Sorry.

So, first I'd like to mention the background, and secondly I'd like to talk with the contents of the cooperation with Japan-U.S. clean energy technology. And finally I'd like to mention the APEC activity.

The first is background of the cooperation of clean energy. To reduce the world's CO2, it is very difficult. This is an IEA blue map scenario, so many technologies will contribute to the world's CO2 emission. But energy efficiency and renewable energy will contribute over half of the world's CO2 reduction.

Also, this is based on the IEA blue map scenario. We need a tremendous investment for renewable and energy conservation technology. This is very amazing because this is a gigawatt per year, not the total amount of the gigawatt. This is per year, so we need more investment in the CCS or nuclear, hydro, or biomass as renewables.

This is also a world perspective of energy demand. From 2002 to 2030, world energy demand increased by 1.4 or 45 times, and China and India, we account for over 40 -- 50 percent of this increase. And we'd like to achieve a low carbon economy in society, but we still need economic growth. We should improve the known for civilization of energy supply and energy efficiency, so we should improve renewable energy technology and energy efficiency technologies.

Japan has formulated "Cool Earth - Innovative Energy Technology Program" and we identified 21 key innovate energy technologies. In each technologies we made a road map, and in each road map we developed a target, technological target, and for the cost of target and the timing for commercialization.

So, Japanese government policy and the U.S. government policy is very similar, so we'd like to make cooperation in the Japan and the United States. Maybe the strengths of Japan and the strengths of United States is a little bit different. Japanese strengths in the clean energy maybe is applied technology, manufacture technology, but our strengths of the United States might be the basic research and system engineering, so we'd like to make a collaboration in this area.

Prime Minister Hatoyama and President Obama, I believe in November 2009, two clean energy technologies cooperation, and METI and DOE identifies initial area for joint activities. This is called Clean Energy

Technologies Action Plan. The theme of our partnership is seven: One is cooperation between national labs and second is carbon capture and storage; third is energy efficiency; and fourth is Okinawa-Hawaii Cooperation; and fifth, smart grid; sixth, electric vehicles; and finally, nuclear energy.

This is the cooperation of smart grid technology. Japan's strengths might be the home appliance, PV cells, power storage, energy management technologies, and maybe the U.S. strengths is on communication networks, data center, smart meters, information security technologies. So, we'd like to mix these strengths for the development of smart grid, especially the standardization is very important for both U.S. and Japan. U.S. and Japan, we'd like to make a cooperation in standardization of smart grid, and also joint R&D are also important, I think, and we are now trying to make a demonstration in New Mexico. And also we are talking about Okinawa-Hawaii Clean Energy Cooperation.

This is short figure of the New Mexico project. New Mexico has one of the greatest potential for renewables energy and host -- Los Alamos and Sandia National Laboratories. Also New Mexico launched a "Green Grid Initiative" which consists of five sites. NEDO participated in two sites of five, and we would like to contribute to collectively such, and not only demonstration. We'd like to contribute to the standardization for using this data, so we are now talking about the use case of this site -- this site data for the standardization.

And this is a short picture of Hawaii Okinawa Clean Energy Cooperation. Okinawa and Hawaii are very similar, so geographic condition is very similar and climate condition, also similar, and energy structure, also similar. So, we'd like to make a cooperation with these islands in energy world.

And we are now trying to do cooperation in the CCS area. Japanese strengths in the CCS is separation and capture technology using chemical shields absorbent and monitoring technology. Maybe the United States strengths is on the solid absorbent and long-term simulation technology, so we'd like to mix these strengths for the improvement of CCS.

So, new research cooperation topics is on the advancement of shields and separation and capture technologies, and the second one is advancement of shields behavior prediction method.

And also, we'd like to make a cooperation in the energy efficiency area, especially in the commercial buildings, but this is a potential cooperation area. It's not decided. We are now talking about the cooperation in this area. Japan has some technologies for energy conservation such as sunlight control or heat pump technologies. But this is a potential cooperation area.

And last one is electric vehicles. We are now talking about a joint

proposal for international standardization of electric vehicle charging equipment, so JARI and SAE are now talking for the cooperation of the standardization of quick-charge connectors.

And last one is nuclear energy. Nuclear energy has a long history of cooperation of United States and Japan. We learned PWR technologies and BWR technologies from United States. And -- but after Three-Mile accident, Japan still continued to build nuclear power plant, but United States stopped to build a new nuclear power plant, so now Japan still have technology to build a new nuclear power plant. So we'd like to make a cooperation in nuclear energy world, so research and development area, and also construction area, and introduction into (inaudible) country area.

Finally, I'd like to mention the APEC, 2010 APEC will be held in Yokohama, Japan, and theme is change in action. Next year, APEC will be held in Hawaii in the United States, so the cooperation in clean energy area -- Japan and United States might be very important, so the cooperation in the clean energy might continue to the Japan and United States in APEC area. So, it might be very important.

And APEC low carbon model town project, we are now talking in APEC, so half of our population live in cities, and cities consume most of energy so, the local carbon model, model town project, might be very important, so APEC would like to promote the low carbon model town project. Japan would like to contribute 1 billion yen, this means $10 million U.S. dollar in 3 years. Tianjin City Project proposed by China, this might be the first case of the low carbon model town project in APEC.

This is the end of my presentation. Thank you for your attention.

(Applause)

ERICA DOWNS: I'd like to thank our speakers not only for delivering such interesting presentations, but also for helping to keep us on schedule.

Before I open up the floor to questions, I have one. It's for Joanna, but I also welcome responses from our other panelists. Any my question is: Joanna, one of the themes that I took away from your presentation was the relationship between bilateral cooperation on energy and climate change and its implications for the broader bilateral relationship, and specifically, you mentioned that more robust cooperation in these areas could help build trust in the bilateral relationship and conversely I guess a lack of cooperation could erode trust. And, so, I wanted to ask you: Is this view about the relationship about cooperation, energy, and clean climate change and its impact on the broader bilateral relationship also widely held in China? And, if so, what are some of the dominant views about

where things stand right now? Thank you.

JOANNA LEWIS: Thanks, Erica. Well, I'm happy to start, but I'm sure that Daojiong has some comments on that, as well. I mean, my impression from speaking to people in China about the history of bilateral clean energy cooperation and where it might go in the future is that there's a lot of interest certainly on both sides.

There have been a few examples of mismatches at the institutional level, as was mentioned, which I think is an important point in that the nature of the cooperation, if it's primarily technical versus more political versus what you're trying to accomplish, the matching the ministries on the U.S. side and the Chinese side or the agency with the ministry is not always an easy task, and I think that the Ministry of Science and Technology in China, which has been where a lot of this cooperation has been housed in the past is in some ways maybe wasn't the right agency, and that as you have a new era of cooperation which is being at least, in part, facilitated by NEA, that this might maybe change things going forward, though I'd be interested in your thoughts on that.

But more on sort of how this is viewed in the broader context, I think that, from what I've heard, there's been a little bit of discontentment with past cooperation in terms of follow through. So, we have, if you go look at the history of bilateral cooperation on clean energy, depending how you scope that with China, you can come up with a long list of agreements, of official agreements, of umbrella agreements, of MOUs, of protocols, and when you then start to really tangibly measure what's come from all these agreements or how much money was put in on both sides or how people, resources, personnel, et cetera, you find things really all over the place on that. And a lot of time and resources and energy have gone into them, but many have sort of fallen through the cracks, I think, for various reasons. It could be that the reason they were assigned in the first place may be there wasn't a lot of political backing on either side, and, in other cases, it may just be these institutional barriers which really prohibited some concrete cooperation that come from them.

So, I think that the current administration, in my opinion, is paying a lot of careful attention to that, and I think that doing things like having more U.S. staff in Beijing, having more Beijing staff in the U.S. are making sure these programs are going forward, that that's their full-time job, to make sure that this large portfolio of agreements that we've now assigned with China don't just become one in a long list of all of our other bilateral cooperation we've got going on. Of course, China is not the only country we're cooperating with, and, so, I think that would be maybe one reason why things have fallen through and why there's been this sort of lack of trust in purpose in the past.

DR. ZHA: The last thing I want to talk about is climate change. Well, I think I was trying to be more honest than most Chinese. There is a huge

gap in what you can afford at this point of time. We have more open disputes with the Europeans on this, that is to say given the limited financial resources -- I mean, on the ground. Also, limited technological capacity, we have to deal with more pressuring issues like sulfur acetate first than really dipping deep into the pocket and start funding projects like CCS.

With technological aspects of the collaboration, for instance, my university, the School of Engineering, they're working with Stanford. There's also in Tsinghua with Waseda and others, scientists are working on that, but to translate that kind of scientific exploration to a policy commitment, there is big disparity in terms of international expectation versus Chinese readiness.

On the more bilateral side, when you talk to Chinese government officials about U.S.-China energy collaboration, there is a tendency to highlight their disappointments in some of the programs where Chinese scientists, funded and supported by Chinese government agencies, participated, and some of the projects did not follow through.

I suppose if you look at the broad policy interest, there is always interest. I suppose on the Chinese side, we have to recognize there is a huge gap in capacity. One is the actual science, technological capacity. I don't think this is overstating. When you ask people like Kelly Gallagher, who had worked with the Chinese on auto transmissions, electric vehicles, what else, they can tell you more bluntly.

Back in the '50s to the '60s, we spent about one generation and used the Russian expertise trained, a generation of our scientists. Later, this collaboration with Americans trained a newer generation of scientists. So, this real indigenous capacity of doing science in China remains to be very weak, and we have, overall, this get rich fast pursuit.

So, you do have that limitation human resource wise. That means, in addition to that, our energy governance institutions have kept changing. So, it's often very intriguing not just to foreigners, but to ourselves. If you want to get something done, move forward, which agency to pursue.

And you said probably a point, full-time U.S. offices in Beijing might help. I think that's one way to do it. That's why I may be just trying to do too much to justify myself. I go back to say this has to be more project-centered and market-based. And then, last, but not least, government supported.

DR. DOWNS: Thank you. I'm now going to open up the floor to questions. I think we have until 12:15, so, that gives us almost an hour. And please state your name and institutional affiliation before you ask your question. Thank you.

QUESTION: My name is Masaki. Takahashi Masaki in Japanese and (speaking in Chinese) in Chinese. I am senior power engineer of the World Bank. I have one comment on Erica's first words, and a couple of questions to Onozuka-san.

First, comment on the dirty energy. I do not think there is energy which is clean or dirty. For example, coal is a natural resource which has happened to have some ash content, sulfur content, but itself is not dirty nor clean. We can use it wisely or efficiently clean. When you use it in appropriate way, it has environmental impact. But we can make it very low sulfur emissions, NOx emissions, particular emissions as low as gas fire power plant. C02 is another issue, but too much concentrating C02 is a wrong way, as I agree with the Professor Chow.

Another example, wind energy, solar energy. When it is used as extensive as the fossil fuel, it has an impact of local climate definitely. As an engineer or the scientist, when we use the energy in some way, it has some impact. So, we should not use the dirty energy or clean energy. It is misleading. That's the comment.

And a couple of questions. Two questions, actually, to Onozuka. One is the joint venture model is India. And another is CCS.

First, joint venture, Larsen & Toubro and Mitsubishi Heavy Industries. I was not quite sure what is the role of JBIC in that model, and, in China, you showed the presentation of licensing, and, also, there is a joint venture in China. Hitachi has a joint venture with (inaudible) for the USC super critical technology, and what the difference of the India and China, I am not quite sure and about the role of the JBIC. That is the first question.

And the CCS, that's very interesting or your own view, and we have in the World Bank a trust fund which is going to have some studies in China, Indonesia, and some middle, or Egypt, Jordan, these countries. But it is still very early stage of study, and we are not going to finance the CCS in the World Bank, yet, CTF, Clean Technology Fund, has created by Japan, U.S., and U.K. and other donors, but the Japanese Government itself is prohibiting us to use that fund for the CCS, and that is because it is not demonstrated in Japan, and that is a very reasonable way of approach, and it's not demonstrated commercially in the U.S. It's also a good approach.

Japan is saying that we should demonstrate in developed countries first, and my question is: IGCC per CCS, Japanese side, is contributing, that is the JBIC's idea, and there is other technology like super critical, ultra super critical, conventional boilers plus CCS that is existing in Japan, anywhere else, but why JBIC is picking IGCC as the first technology, that used to be or still is the approach of the U.S. because GE is pushing IGCC. I'd like to hear about the

JBIC's position on that.

MR. ONOZUKA: Thank you for question for my part. Firstly, sorry, it's not to explain that clearly. The way of the involvement, the JBIC for the joint venture in India, we provided loan to the joint venture company. And I'm not sure that in the case of the joint venture in China in the statute about some local company, I'm not sure. Sorry. Maybe it's not true the involvement at all in the case of the China, but in case of the India, we provided loan to the joint venture, using overseas investment loan menu. So, and the first question is downside.

And then you're talking about a CCS. Yes, I understand the situation of the CCS. Still, it's a stage of some project is experimental trial or something. But, firstly, that maybe it's depending on how to think about it that you commercialize the CCS technology itself. Maybe if we can put into CCS technology, it's the existing (inaudible) coal-fired project.

For example, if they can manage to burden for the additional costs for CCS, and, okay, maybe it could be possible for us to finance it. It's (inaudible) for that check due diligence of the cash flow, and it's not a matter of the technology or something, it's really is it bankable or not? And I'm talking about say the CCS very near future aspects may be we should do this type of structure, it's very practical. That means that is a CCS just cost, like to extract it, say (inaudible) something is the environment cost maybe. It's much easier to understand the CCS (inaudible) with the CCS technology.

But I like to more step up for CCS as itself to more self-sustainable project itself. So, in this case, it's very necessary for putting some value for (inaudible) itself. It's sometimes they might use it, in case of the USA, is to use for the inject of the gas to the oilfield, or sometimes, it might be possible to using the geothermal project, and I went to the Iceland. They're using C02 gas to (inaudible) more high pressure steam from the geothermal project. So, it's necessary to squeeze any possibility for the how to use the C02 gas itself.

But, finally, it's very necessary for support for the government, regulations, or some agreement of a mechanic CDM or I am very much to expecting for more bilateral agreement with the big measures like China or U.S. and Japan to more boost for the CCS Project. Anyway, that's in my presentation is more backed by my expecting myself or hoping for the more to challenge the climate change. So, I know that, as you mentioned, some negative point or some (inaudible) for that.

And the last point that you mentioned, I don't know that's how the government is not permitted using the Green Tech Trust Fund for the World Bank. Sorry.

DR. DOWNS: Okay, the gentleman in the very back.

QUESTION: Hello. Dr. Zha, you mentioned action-oriented and practical application. Oh, my name. Alexander Chapman, Max Chapman, Susan P. Chapman Energy Foundation. You mention action-oriented and practical application. Elements of the Chinese press are reporting now that China may be building as many 330 pebble-bed nuclear reactor power plants by 2038 using mass production techniques.

Does China believe that this massive source of clean, safe, and dirt-cheap energy will result in greater independence and security? Where does it fit in China's future? Thank you.

DR. ZHA: I must admit I know virtually nothing about this pebble or nuclear reactor. I've heard from scientists there are a lot of debates about it, and 2038, that's a long -- and, also, frankly speaking, energy independence is just too rhetorical.

DR. DOWNS: Okay, back here, please.

QUESTION: My name is Omar Chattertee from Safe Foundation. This question is addressed to our friend from China, even though he's not representing the government. I gathered from Joanna's presentation that even though the seminar title is China, Japan, and U.S., it was more U.S., China, it seems to have been the topic.

However, I think geopolitics plays a big part in a lot of these relationships, and China has done very well after Nixon's visit almost beating Japan in a much short period, what Japan was able to do from when the war ended to this day. Now, there is a tension now between Japan-China relation, and it seems it is a grassroots problem in China against -- I'm not sure why against Japan only and not against United States.

So, I'm wondering if this situation could lead to now China -- first, Nixon's visit was to change China from communism, which, of course, failed. Now, is China going to change the United States and its policies because of this particular push in China that is generating? Is China going into a much bigger process of changing the United States' policy?

DR. ZHA: I don't know. It's too wild a card, is it not? (Laughter) No, I don't think. I think those are very imaginary scenarios down the road. Both China and the United States are too complex and big. Before they can change anybody else, they have to sort out their own domestic challenges first. That's true for both.

Now, China-Japan relations are far more resilient than what's

being portrayed in commentaries. Yes, we do have tensions, but you have to look at what has become possible in spite of these tensions. And, frankly speaking, if you go back to the China-Japan relations, beginning about 1953, that was the first time when officially an official trade agreement between China and Japan was signed, even at the height of the Cold War, and what else? The two societies have a very complex web of mutual independence. As we speak about, where about 30 percent of the free vegetables consumption on a daily basis in Japan are produced in China. You don't do that if you are so distrustful of a neighbor, right, on the part of Japan.

So, yes, there are some tensions, but with each of these tensions, I would say the lesson for China and Japan or Chinese and Japanese scholars or government officials to look very pointedly is whether this is more of an accident or is the pattern of deliberation. But, most of this time, most of the cases, these tensions are cases of accidents.

MR. SHINKAWA: Yes. As Professor Chow mentioned Japan and China has a little bit of tension, but clean energy field might be a good area for cooperation. So, and, also, we have a very long history to make a cooperation with China and Japan. So, I believe the cooperation will continue in this area.

Thank you.

DR. DOWNS: Shoichi?

SHOICHI ITOH: I'd just like to argue, because first off, to what Mr. Shinkawa and the Professor Chow noted, as one of the organizers of this event, is, I'm sure some of you are just wondering what are they talking about? What about what's going in the East China Sea? Beijing and Tokyo have had such a big (inaudible), but just let me give you a simple, concrete idea what we have listed just recently the fifth brand of Japan-China energy conservation, and the (inaudible) was held in Tokyo. And the one third of the people who participated, including about 350 Chinese representatives from private and public sectors, and we agreed on 44 projects, including 36 new ones. It's just an indication. When we talk about security, people tend to approach this particular concept from only (inaudible) oriented, your political point of view. But as we have seen, lots of cases until today, energy security can be interpreted in many ways, and clean energy is just one of the -- and this period is very prospective.

Thank you very much.

DR. DOWNS: Back here, please.

QUESTION: Thank you. My name is Gene Owens. I'm with Tetra Tech International.

About three or four years ago, we were doing a biomass project in China, and one of the more fascinating aspects we found out was that, particularly

in the provinces and the districts removed from Beijing, there was a willingness to adopt the renewable energy technologies, but from the governmental side, there was a reluctance to give direct instructions and technologies and so on. And the provincial people involved realized that if they adopted certain technologies, particularly in the biomass sector, and it succeeded, then they were given a lot of praise, and, perhaps, promotion and so on. So, there was this willingness to go, but very little coming from the central government. I've seen this.

This is, of course, the case in China. It's also the case in the United States, where we have a rhetorical desire on the part of the central government, oh, you guys go and adopt new climate change and renewable energy technologies, but we're not given direct technologies or instructions about what they should do, and so on.

How do we get the national government to build upon the desires really at the local and district and provincial levels to move in this direction?

I wrote a paper on this, and I called it, in China, "The Tail Wagging the Dog," in terms of renewable energy. Here, we have the provincial leaders motivating national level development in this area.

Dr. Zha and Dr. Lewis, if you wanted to comment on that. Thank you.

DR. LEWIS: I'm happy to start. I completely agree with you, and I've seen many examples of similar cases in other renewable energy technologies, as well. I mean, I think that some of the central level renewable energy policy that we've seen China adopt in the last five years or so really stemmed from experiences, innovations that happened at the local level and trickled up, as it were, rather than the typical sort of top-down that we tend to think about happening in China.

I know, for example, with wind energy, which is an area I look at more than biomass. There were several, small-scale wind projects. You saw mayors of towns who had experience with this technology getting it started. These really became pilots for what then was scaled up essentially.

I think that there are some things that are best done at the central level. I mean, the Renewable Energy Law, which was passed in 2005, has allowed for pricing support at a much broader scale than we would be able to see at a very piecemeal level locally, but that said, even the central level laws have a lot of provisions written into them that give a lot of discretion to the provinces and the localities to really do what is right for them. Of course, with renewables, there's no one-size-fits-all model. You can set targets, but resources vary from province to province, and, so, you can't set a technology-specific target.

There have been plans that have been required, where every province has had to come up with a renewable energy plan to look at how they're going to meet central level targets, and this, I think, has been really effective at encouraging the sort of bottom up again innovation. If you've had a successful technology pilot there, this then gives support from the central level to really expand that.

So, I think that has been an interesting success story of what's come out of this, and then I think that that is recognized at the central level and that the types of policies you see enshrined there really do try to take into account these local differences and local innovation.

DR. ZHA: Actually, what you note is a trickle up process, is actually one of the key features of own entire reform program. If you look at the special economic zones, going back to the early -- there were told to be different. They tried to be different. Then others learned from them.

I would encourage you not to lose heart. Actually, if you look at the World Bank, it has China as one of its largest customers in the developing world, at least. It has a very simple ideology that says it works with willing partners in China. You don't really get endorsement from the system first. Whoever is willing, you work with him.

And, also you look at the Asian Development Bank. It begins with feasibility studies, it begins with involving the experts. It does not begin with the big officials or just policy frameworks.

At the end of the day, what you said, we seek truth from facts. That if you can demonstrate this works, it will be there, and it's, I would say, a matter of how committed you are in going through the ups and downs, and like earlier, I think it was one of the offering points, Joanna was just mentioning it, China is not the only country the United States needs to cooperate with. Actually, the bigger challenge on the part of China, to be more supportive of these kind of trickle-up projects.

DR. DOWNS: Over here.

QUESTION: Yes, thank you. I'm Kevin Massey with the Energy Security Initiative here at Brookings.

Thanks to the panel for their presentations, and my question is to all four panel members. We heard during your presentations a lot of detail about bilateral cooperation, either U.S.-Japan, U.S.-China, or Japan-China. I wonder if you could comment any formal institutional mechanisms for trilateral cooperation and the potential for such institutions to take this clean energy development strategy forward.

DR. ZHA: I already mentioned the APEC mechanism for cooperation not only is a bilateral cooperation, APEC mechanism might be very important for the clean energy cooperation, and not only in APEC, might be IEA-based cooperation, might be important for corporation in this area.

Thank you.

MR. ONOZUKA: Yes, honestly, this idea -- a very quite new feeling for us, for me. But to try to think about everything, it really makes sense. U.S. is a very good (inaudible) for the political or sometimes as a business framework, is very good for the U.S. And China is very big domestic in the market for the coal fire project, and Japan has some technology. It really makes sense for the three guys is to come together. But as you mentioned, which (inaudible) to the background or base for institutional basis may be necessary to promote this concept. It's very -- the next step is very necessary for us, back to the Tokyo or to Beijing. It's very necessary for that. But I think it's a very good example is maybe we should promote some project, I think. Yes, project, I think. So, we should talk about is it doesn't matter (inaudible) as a coal-fired project anyway.

DR. DOWNS: Right here.

DR. LEWIS: I'm sorry.

DR. DOWNS: It's all right.

DR. LEWIS: I was just going to quickly add, I mean, I think that we've heard today a few interesting ideas of specific technological areas where it might make sense for the three countries to come together. Whether that would be at a sub-national, more research-technical type of cooperation or whether it would enshrined in something more high level, I think, is an open question, but Japan is clearly a leader in many areas surrounding energy efficiency and industrial and in power plan efficiency, and we're heard some interesting cases of that. and some of the models that came out of Japan have been applied in the U.S., have been applied in China. So, that would be one area.

Another is this area, of course, of carbon capture and sequestration in various applications. And then we heard the smart grid, looking at different technologies there that are, again, things that the U.S., China, and Japan are all very actively looking at. So, those might be areas in particular where the three countries have mutual interests.

QUESTION: Adina Rene Adler Rochelle. You've all talked about, of course, the potentials of a cooperation between the three countries, but Rare Earth hasn't come up yet, and I just wanted to know if any of you or some you can talk about the expansion of China's rare effects for controls and how that

might impact not just the atmospherics and relations between the three countries, but, also, just the impact on the potential for actual research and development of production of the actual technologies themselves.

DR. ZHA: Well, I'm just so happy that I once directed a graduate student to look into this matter way before this erupted in the international media. For many, many years, Chinese industrialists and scientists were saying that China was setting Rare Earth Elements as too pricey and was also going to be detrimental to industry development.

Finally, this cost got government attention because one of these retired professor in my university, Juwong Chen, he got the National Science Award in the year 2008, and I believe he's in his late 70s. His research was to have increased the Chinese capacity to make better use of the Rare Earth Element by, I believe, 2 or 3 percentage points. I'm not a technician. When this group of industrialists, whoever, environmentalists got him to cosign the letter saying we must pay attention to Rare Earth, that finally got the central government's attention.

There are so many more details. At least it does seem to me for the government to try to put China to work, that is to say to curtail the runaway extraction of Rare Earth Element, as you know, the process of doing this is very dirty and also it destroys a lot of farmland, what else. That in and of itself has a rationale to it. There are several issues, as you said. One is whether or not this kind of production quotas announced with sufficient pre-warning to the rest of the world that imports this from China.

A second point is that if this is just a curtailing of production and without any meaningful, real progress in more efficient use of the raw materials, then it would miss the point. I also heard this is -- on the record or off the record? (Laughter) Oh, it's on the record? No, nothing is off, right? There was some talk that was -- this is purely unofficial. I'm a bit loose-mouth scholar. (Laughter)

That there was an interest in some sort of tradeoff, that is to say for those foreign companies that are better than Chinese companies at extracting more of the dirt out of the dirt. They would get a preferred access, but I don't know if that was a real intent. You can have any kind of intent.

But, last, but not least, at this point of time, I also heard from previous visitors to the United States, Washington, D.C., that this Rare Earth Element is getting big. Possibly, what we need to do is to look at both sides of the claims. On the Chinese side, it's very pervasive to claim that the United States or Japan has imported so much from China, say these are the stockpiling by Japan, is sufficient for Japan to use for another 50 years without any import.

Now, does that claim have any basis? Or the same is said about

the United States. In other words, this is the typical politics of victimization in the press. And, also, on the part of the United States, is it so impossible to go back to Mountain Pass in California.

If you remember, before China came into the picture, the United States was the dominant supplier. Or does this have to be, going back to this so-called geopolitical tradeoff, that is to say goodbye to the Chinese, and, instead, poor the money to support the Vietnamese or whatever? I suppose, in the end, we have to come to a sense of some of the basics.

Oh, by the way, the last point I would want to say, maybe you guys can help me understand when you read the Japanese press, that out of the recent stories, especially out of complaints from Japan, I think I actually challenged those who came to ask me. I said, okay, can you show me some evidence of how many shiploads of Rare Earth export from China to Japan actually failed to arrive on schedule? And was the tonnage affected? What was the explanation given? I don't think there's a lot of solid evidence of how many shipments to Japan was actually affected.

Maybe you can tell me better. (Laughter) Is there something more in the Japanese? I really cornered who came to my office. I said, give me the evidence. Then we can talk.

QUESTION: Hi. My name is Yewon Kang, a reporter with Medill Service. I just have a question for both Professor Zha and Lewis about sort of your response to the steel workers' petition and allegations. The U.S. steel workers' petition, alleging the sort of China's, the subsidy for its domestic product on clean energy and how it kind of got into the Trade Representative's investigation. So, I'd like to hear your response to it.

DR. LEWIS: Well, I think that, I'm not a trade lawyer, so, I'm not going to speculate at all on what sort of standing there will be under WTO going forward, but bigger picture, I think that some of the policies that China has put into place, which have really led to the emergence of domestic industries and renewable technologies are being called into question. I think that it's important to point out that these are not policies that are specific to China.

There's actually a sort of a parallel case happening with Japan and Canada on wind technology and several other things out in the open there. So, I think all these cases sort of show an increasing tension among a lot of countries as these industries become more mature, as Chinese industries start to look abroad, and I think that this is not going to go away. So, I think that it's all the more important as these trade issues come up that we have a really solid foundation for discussions with these countries between the U.S. and China, between China and Japan, between the U.S. and Japan about clean energy technologies going forward because we're all going to be playing in this sphere, we all have an important role

to play in these industries going forward, and you can't just look at this competition element out of the context of the much broader, political cooperation framework that's happening.

Of course, all of our countries need to figure out how we're going to transition to a low-carbon economy, and these technologies are going to play an important role. We're all going to be making them, we're all going to be playing a role in manufacturing, in the (inaudible) and innovating, and there's going to be some overlap and there's going to be competition. So, I think that, going forward, we need to make sure that there's some constructive discussion happening and dialogue, and that we don't just launch into a trade war preemptively.

QUESTION: Hi there. My name is Andrea. I worked with the *Epoch Times* newspaper.

I wanted to ask more about China Government's role in the manufacture of clean energy technologies, specifically solar and wind. I understand that this is a local, Chinese company sort of success story.

Mr. Zha, you spoke a lot about transfer of technology, I guess, from the U.S. to China, but it looks like China has taken these during your talk as being important for China, but it looks like China has taken technology or developed technologies specifically in the area of solar and wind, and developed quite a large industry, captured a significant market share. And to do so, the government must have been very supportive of this initiative. I think this is related to other questions. This is an opportunity for you to talk about how a success story of the government getting involved in a specific industry.

DR. ZHA: (inaudible) (Laughter) No, but, seriously, Joanna is the known expert on those issues. I have more complaints about this rather than success. Let me make a very brief point, and then she can correct me.

We are too good at manufacturing rather than innovating. Actually, some statistics in China tell me that with the wind turbines we install because the turbines were manufactured according to industrial specifications that were imported from Europe, these wind turbines actually break down far more quickly than China because of the local wind situations, including the dust that gets into the turbine engines. Very different. So, if you are talking about government subsidies, I don't know if these so-called clean energy industries get any special preference. I need to investigate into that because I just don't know as much. She knows better.

DR. LEWIS: Well, I guess I would just say that I think that you've seen a real shift recently in just the last year or two with the Chinese Government in terms of the types of policies that they're using to promote renewable industries, in particular, wind from previously where you had the focus really just

being on the localizing of manufacturing, and, now, that's happened, and the focus is really much more on increasing the quality of the technology, promoting innovation on the next generation of these technologies going forward.

So, what you're seeing is specific R&D type programs that are helping to support both public and private sector innovation in these fields, you see increased national programs to help to certify tests, demonstrate technology to make sure it's actually performing as it should. And then you see a lot of direction towards sort of the next generation in wind, for example, offshore wind technologies. I mean, you may have heard China has quite an aggressive plan to develop offshore wind energy. This isn't just because -- most countries looking at offshore at this point, it's because they're out of onshore sites, and that's not the case in China. China still has quite a ways to go onshore. But they're looking to offshore anyway because this is where the more advanced technology lies, they want to be demonstrating it, they want to encourage their companies to start manufacturing that technology and developing it for the next couple of decades, and, potentially, for exports. So, I think that that's been a really strategic move. I don't think that's a controversial one. I think it's one that a lot of countries are starting to look or really should be really following some of China's insights there or some foresight.

DR. DOWNS: The gentleman in the very back, please.

QUESTION: My name is Kunio Kikuchi with Masaoka and Associates. My comments and question is to Professor Zha. I was intrigued by your statement that, overall development of China is at the level of Japan in the late 1960s. I think this may be very appropriate in terms of per capita incomes, household income levels when you compare China and Japan today. And that is China finally achieved about one-tenth of Japan's per capita income, and, therefore, it is now slightly larger and rapidly getting better overall in terms of economic size than Japan.

But the important thing is what happened in Japan in the 1960s and '70s with the growth of income level at the household level, there was an explosive increase in the demand for household appliances, especially refrigerators, air conditioners, and then things like rice cookers and what have you. But the main power user might be the air conditioners in summer, and half of China is very hot in the summer. And not to mention what may happen in India going down the line.

Is China prepared to provide energy for that kind of explosive growth at the household level or is there any sort of disincentives, tax measures to hold down that kind of growth? Or since Japan and Europe has the most advanced technology on efficient air conditioners and so forth, is that where the route goes? Thank you.

DR. ZHA: One very meaningful step in that direction is that, actually, within the last 10 days, the national government has announced a plan to implement progressive electricity pricing for residential use. This is based on experiments in Guangdong, Fujian, and Szechuan Provinces.

In other words, there is a program to try to curtail runaway consumption at the household level, although, I go back to what I said about deployment of technology of ideas in China. One of these programs is still in debate. Public policy in China now also involves a consultation stage with the general public. Usually, you have references. Okay, in the United States, per capita, electricity consumption, this much, or, in Japan, per capita consumption electricity is another much. And then you have all this, should I say industry-based or whatever based interests in China that's saying somehow criticizing the Chinese Government or scholars like me as denying an average Chinese a comparable share of electricity, comparable to the American citizen.

Sometimes, these numbers in China are so manufactured. I happen to be one of the few Chinese who read English, right? For example, in China, one of the popular stories that have been sold is that per capita in the United States, a person has 150 square meters of floor space. That's the average comfort level in the United States. That's wrong, right? If you encounter the lawns and yards. So, you do have that kind of purpose for this distortion of what life is going on in the rest of the world. And that also is part of the complication of public policymaking in China.

But going back to your quick point is that all these ideas, we very carefully follow the Japanese trajectory of doing things, dealing with industrial waste, dealing with environment, also including electric appliances, but, finally, we have taken this what's called gigantic step in trying to regulate peak use of electricity, including summertime, but the international factors can come in, that is to say, to educate the Chinese research people, Chinese policymakers, the Chinese general audience about the life cycle cost of energy and also what, like (inaudible) in Japan that went through in doing this rather than this straightforward comparison that sometimes is presented in erroneous manner to the Chinese audience in general.

DR. DOWNS: Okay, over here, please.

QUESTION: Hi there. My name is Levi Telamundic, and I'm a Ph.D. student at Johns Hopkins CISE. I am researching electric vehicle policy promotion programs in Japan, China, and the U.S., and doing a comparative study on those industries in those three countries.

My question is regarding a comment that Tatsuya Shinkawa made about a joint program between the U.S. and Japan in promoting policies, in promoting standards for the electric vehicle industry. I know that there's a similar

program right now underway inside China to promote actual standards for the electric vehicle industry domestically, as well. So, I was wondering if you could each talk about those two programs and talk about what is the strategic goal in producing a bilateral standard rather than a more multilateral standard for EV policies.

MR. SHINKAWA: Sorry, I don't know the cooperation with China and Japan, a cooperation in the field of electric vehicle standardization. But I heard from the Japanese automobile company, the quick charge connector is very important for the electric vehicle, and the frequency is the same in east part of Japan and United States, also. Is the same, but voltage is a little bit different in U.S. and Japan. So, the DC charge is very easy for the quick charge connector. AC is very difficult for making standardization. So, U.S. and Japan are working on the quick charge connector, means a DC charge is very important for standardization. That's all I know.

DR. DOWNS: Okay, I think we have time for one more question. Okay, if I don't see anyone else who hasn't asked a question, then okay, I'm going to go again with the gentlemen from the World Bank.

QUESTION: Just a follow-up of a previous question.

DR. DOWNS: Okay.

QUESTION: The success story of the renewable. And that is also some clarification questions of Joanna's slide. I may have misread that the China has nothing to learn from us, something like that.

DR. LEWIS: Opposite.

QUESTION: Yes, opposite. Okay. Then it's a confirming. (Laughter) Wind in the United States takes us to California, Colorado, western states. They have installed a huge capacity of wind. And that is not only create the wind industry's employment, but also created GE's -- well, not on the wind, wind GE, (inaudible) and Wartsila, diesel manufacturing employment, I have heard from Wartsila. When they have a very hard time after Lehman shock, Wartsila could not sell the diesel engine for the marine use. The wind energy saved their company because when wind blow stops, there is requirement of a backup capacity. And with that huge installation of wind capacity, there is less backup capacity.

So, there are a lot of orders to the GE's aero divertive gas turbine and Wartsila's diesel engine, which can start up very quickly in five minutes or something. So, the order to these companies, besides the wind employment that created another market, but the other side of the coin, the rate payer pay for the backup energy. So, that is what China can learn if they want to install big wind

fund.

DR. LEWIS: I agree. And, just to clarify, my slide had said "myths about cooperation," and I said that China has a lot to learn from us and we have just as much to learn from them.

So, I think that's a perfect example of something that might be helpful. I know that in China, in particular, there is an issue with balancing wind particularly in provinces where there's a very large penetration right now. In or near Mongolia, you're seeing situations where the grid can't absorb all the wind that's being generated. Part of this is because it's not gas or diesel, it's coal that's balancing the wind, and that's much less flexible resource. So, that's one example of where they'll be some interesting lessons to be learned.

DR. ZHA: I just want to add to what Joanna just said, what China can learn from the United States or from Japan in that regard is two specific areas: One is what's called smart grid. The whole concept, technology equipment, everything. The other is how to calculate the business side of the gains and losses because we have too many wind farms that are just erecting out there looking good, but they're not connected, they're just rusting away. That's really a waste of resources.

DR. DOWNS: Okay, it's 12:15. So, I'm going to declare this panel closed, and thank all of our panelists for a very thoughtful discussion and all of you for coming here today.

(Applause)

[Recess]

JANE NAKANO: (in progress) National Security program over at the Center for Strategic and International Studies.

First I would like to take a quick minute to thank Shoichi Itoh and my friends at Brookings for having me here today to moderate this panel on Prospects and Bottlenecks for Clean Energy Cooperation. This afternoon we are very fortunate to be joined by these experts. They've done various -- they've been doing in-depth research on various aspects of clean energy, and many have also been promoting clean energy cooperation primarily in nongovernmental capacities for a number of years.

So without further ado, to my -- well, so what I'm going to do is I will read all the panelists' bios very quickly, and then, then invite Jake to do his presentation. So let me -- so to my immediate right, Jake Schmidt is the International Climate Policy director at the National -- I'm sorry -- Natural Resources Defense Council and has more than 10 years of experience in

international climate policy.

Mr. Schmidt leads NRDC's policy development and advocacy on international climate change focused on the development of the post-2012 international response to climate change, and the actions in key regions of that world to delivery on that agreement. He has actively worked in Brazil, China, India, and Mexico with key research institutions and government officials to analyze greenhouse mitigation options and develop strategies to implement most promising options.

Mr. Schmidt holds a bachelor's degree in economics from Muhlenberg College, and MPP in environmental policy with a certificate in ecological economics from the School of Public Policy at the University of Maryland.

To his right is Nobuhiro Horii. Nobuhiro Horii is an associate professor in the Department of Industrial Business Systems, faculty of economics at the Kyushu University in Japan. He has over 14 years of professional experience in analyzing, consulting on legal, institutional, financial, and economic issues facing China's energy industry.

As a visiting research fellow at the Chinhoyi University in China from 1999 to 2002, Mr. Horii gained extensive knowledge of the legal and institutional aspects of China's coal and power sectors. He has published a number of articles and reports concerning China's coal, power, and environmental protection industry. His research interests include energy conservation, the environmental protection industry, and renewable energy industry such as the wind power industry.

To his right is Gang He. Gang He is a research associate on energy and climate policy in the program on energy and sustainable development at Stanford University. His work focuses on China's energy and climate change policy, carbon captured and sequestration, domestic coal and power sectors, and their role in both the global coal market and in the international climate policy framework.

He also studies other issues related to global climate change and the development of the lower carbon energy sources. Before he came to the United States, Mr. He worked for Peking University and the Center for Environmental Education and Communication of China's Minister of Environmental Protection. He holds an M.A. from Columbia University on climate and society, B.S. from Peking University on geography, and is currently a Ph.D. candidate at UC Berkeley.

To his right, last but not least, is Jennifer Turner. Jennifer has been a director of the China Environment Forum at the Woodrow Wilson Center for

nearly 11 year. Besides putting on meetings and publications focusing on a variety of energy and environmental challenges facing China, she has coordinated several research exchange activities in China, the United States, and Japan bringing together Chinese, U.S., and other agent experts on issues of energy and climate challenges, environmental nongovernmental organizations, environmental journalism, among others.

Her current projects are focusing on U.S.-China energy and climate cooperation, environmental governance in China, and pollution challenges in Lake Tai. Dr. Turner holds a Ph.D. in public policy and comparative politics from Indiana University, Bloomington, her dissertation, "Examining Local Government Innovation in Implementing Water Policies in the People's Republic of China."

Now please welcome Jake.

(Applause)

JAKE SCHMIDT: Thank you, and thank you very much for joining us this afternoon. We always have the toughest slot, the post-lunch slot is always the hardest because you're in kind of comatose, so I'll try to make it as lively as possible, although I'm going to be talking about energy efficiency, so that's not always the most exciting aspect but it is very critical.

You've heard the facts this morning. China is the world's largest greenhouse gas emitter. Depending on whose statistics you believe, it's the largest energy consumer, but in any case it's a big source of both energy use and emissions. Obviously, the U.S. is a key player in that sphere as well.

These are two critical countries. You've heard many of the rationales for why they're critical and also why they're critical to move together. So I won't sort of give you that snapshot. What I wanted to do is give you a bit more of a sense on energy efficiency, both opportunities in China, some of the things that we've been doing, and also the opportunities that the U.S. and China have been working on together. There's quite a bit of energy efficiency opportunity that the two have been working on together.

Just very quickly before I do that, I wanted to give you a quick snapshot of NRDC. We're an environmental advocacy group. We have five offices throughout the U.S. and one in Beijing. It's our only foreign office, and I guess in some sense that gives you the realty check on why we think China is so important: It's so important that we opened an office there, and we've been working there for about 15 years and have a staff of over 30 now in Beijing.

So I wanted to give you a quick sense of what China's doing on the energy efficiency front but also on the climate front because they're very related.

Then I wanted to give you a bit of a sense of some of the existing cooperation that's been going on and some of the opportunities that that provides, as well as some tangible opportunities and some examples in a couple of fronts, one on green buildings, another on demand-side management, some on industry. and some on supply chains.

So China is embarking right now in the final moments of a major energy-intensity effort. I'm sure you've heard of it. They have commitment in their current five-year plan to reduce their energy intensity by 20 percent over the period between 2005 and 2010. They're in literally the final months of that undertaking. As of the end of 2009 they had made about 15.6 percent cut, so on a significant track to meeting that, but in the early parts of the year, they saw their energy intensity start to tick back up and go in the wrong direction.

And so this has led to a series of very significant efforts of late to try to turn that course correction in the right direction, some of which are not energy policies that you'd necessarily want to copy anywhere else, including shutting down power to whole cities or to whole power plants. But I think in some sense that shows the very serious nature in which China's undertaking this effort and that the commitment that it's making towards that.

They also have a program called "1,000 Enterprises Program," which is looking -- working at the 1,000 largest energy consumers, state-owned enterprises, their significant source of energy use in China and trying to work with those individual facilities, both in terms of them having targeted reduction commitments, their goals for each of those facilities, and to improve the energy use of those facilities.

And, lastly, as they've moved in and came out of Copenhagen, they made a commitment to reduce their greenhouse gas intensity by 40 to 45 percent cut and have talked about and lots of rumors floating around having a continuation of their energy-intensity target, with recent reports of 17.3 percent. But somewhere in the 15 to 20 percent is what people expect will come out in the next couple of months in terms of their energy-intensity target for the next 5-year plan which runs through 2015.

Similarly, the greenhouse gas-intensity target in some manner will be reflected in this next five-year plan with the same expectations for the kinds of enforcement and implementation programs that have been used in meeting their energy-intensity goal.

So let's give just a snapshot of why energy efficiency potential. This is a chart from McKenzie, so I can't take credit for producing it, but what you can see in the top is the McKenzie analysis of China found that energy efficiency potential was equivalent to the potential in clean energy and renewables and carbon-capture in storage in China potential in 2030. So it's a

pretty significant source of their emission reduction potential and therefore a key piece of the puzzle.

U.S. and China have had a long history of working on energy efficiency with over about 20 years of collaboration. I haven't been working on it for those full 20 years, but our folks suggested that as about that long. And what you can see is I think the kinds of fits and starts that were discussed this morning is that it is very prime in the energy efficiency. There's dating way back many energy efficiency collaborations including the Department of Energy helping administrate science technology build the first green building in China.

But I think what we're seeing, and you'll see this evident in the commitment from the Obama administration in terms of its collaboration is to try to not just go and sign a memorandum of understanding but to actually deliver upon that in a meaningful way. And I think that that's a true example of how things are evolving in some sense. There's these long histories of MOUs use. Government bureaucracies in D.C. can move relatively slow sometimes, but I think in a very fair assessment the pace at which these MOUs are leading not just from signing but signing to implementation is moving very fast in some sense.

One of the key pieces of that collaboration between the U.S. and China has been these clean energy research centers. You heard about the three from Joanna this morning. We're a part of the U.S. side of the green buildings initiative, which is a major effort to try to look at green buildings across the entire country of China, and we're waiting to implement the details of that. But we think it's very promising.

The other piece that collaboration has been discussed and it wasn't mentioned this morning is the state of California and Jiangsu Province have had a long history of collaboration between the two. They're very similar in terms of their structure, in terms of their size, and so they have sort of naturally had a partnership for years, starting with energy efficiency and recently moving to climate change. And this is both signing memorandums of understandings but also working in a collaborative way to try to be problem solvers.

So taking some of the models that California has used to keep its energy use very low compared to a very significantly growing GDP in the state, and trying to work with counterparts in China to see how best to either copy and paste those proposals, or oftentimes take pieces of them and mold them to a very different Chinese regulatory and legal context, but in some sense a very strong collaboration between the two and that's continued over the years.

The next piece I wanted to give you just a bit a sense of is building. So you saw that slides for total energy efficiency, but building energy use in China is significant and, obviously, China is building a lot of things, and one of those things that it's building is buildings. There's a lot of, if you've ever been to

China and I imagine many of you have, it's amazing always every time I go there how many cranes you can see just popping up. And in the U.S. we used to have quite a few amount of these cranes, but they've kind of all tapered off. And I was just in Beijing and Shanghai, and I saw no slackening of the amount of cranes. Now, that wasn't a very scientific survey, but I think in some sense you can get a bit of an example of how China's building major investments.

So we did an analysis looking at building efficiency in China and looking at if you applied some of the best technology to Chinese buildings, and then if you just simply took the kind of most common standard across China and applied it throughout the entire country, and what we found was very significant opportunities to reduce both energy use and greenhouse gas emissions.

And many of these opportunities were extremely cost-effective, which is the big blue bar basically shows you that everything that you're doing on building are a huge amount of the potential, is essentially going to save dollars over the life of the buildings. So these are very smart investments to make, and one of the key challenges is to work on the enforcement and to work on the technical level to try to get these adopted across the entire country of China.

So one of the pieces that have been sort of unfolding to try to actually implement some of this potential is a couple of fronts: As I mentioned, China -- U.S. and China work together on building the Agenda 21 building, which was the first green building in China and have been since expanding those efforts across the country.

China has a current standard to reduce energy use in buildings. It's a 50 percent reduction for new buildings, and they have targets for retrofitting of existing buildings. And one of the challenges in China has always been the enforcement and in ensuring that buildings live up to the codes that are enforced. We've seen some improvement in that enforcement over the years and that sort of anecdotes about the lack of enforcement isn't fully true anymore, but there's clearly a ways to go in terms of enforcement, And, obviously, the farther you get from the major city centers, the more enforcement is a challenge.

And so one of the things that we've been working on with Shanghai is to basically do a labeling program to try to put in buildings the actual label so that you can physically see what the building's specs are supposed to be and then working on some metrics to try to track that over time, to try to improve the actual delivery of building efficiency on the ground.

The next piece which is very related is significant efforts on demand-side management in China, working on energy efficiency in the ground as well as energy conservation measures across the different provinces and regions. When we looked at this and the way we tried to make the case is the amount of savings that you can get in terms of the need to invest in new plants

versus energy efficiency, and when we've analyzed it, the cost savings of doing energy efficiency measures far outweighs the cost of building a new coal-fired power plant in China. And so trying to convey the message that there's a huge opportunity, you've got to think about this in a bit more of a long-term perspective, and then trying to implement a set of policies and measures across the country.

Once again, a tangible example of that is California and Jiangsu Province developed a partnership to deploy demand-side management set of guidelines and strategy for how it was going to implement these measures throughout the province. While it hasn't been adopted across the entire country, it was recently held up by Wen Jiabao as a model for others to copy, and so we think that there's a huge potential. And if you ever, you know, might sort of example of how China generally works, or at least how I perceive it from the outside, is once they figure out that something works, they tend to copy it very quickly throughout the different parts of the country.

And then we work very collaboratively throughout six provinces in China with demand-side management team looking at both the tangible impacts and challenges of doing energy efficiency in local provincial level as well as trying to think about the policy solutions both at the province level and at the national level. So thinking about how would you structure financial incentives in the right way to try to ensure that when our facilities discovers it has energy efficiency, it can now go to a bank and actually get a loan for that and/or tap into some other government funding sources to invest in that up-front cost.

The last piece of the energy efficiency puzzle that's sort of key to think about is the industrial opportunities. I'm not going to spend much time talking about the whole suite of things that are, you know, an opportunity and challenge, but I wanted to highlight one thing that we found a very practical way to go about this.

We worked with a set of apparel manufacturers that were multinational companies, GAP and so forth, that had major operations and got a lot of their supply from China, and we worked with them and their suppliers to look at the energy use, the water use, the pollution from those supply chains, and then to try to begin a series of steps to implement those concrete solutions to these challenges.

And what we found was if you apply kind of standard 10 practices that are sort of best practices for apparel manufacturing, you could cut energy use by about 31 percent in electricity. I think it was 30 percent; it says three percent, but I think I got a little delete-happy there. And you can see the totals are pretty significant for a couple of these different measures.

The last piece that I think creates some opportunities, and this

might actually be more of a China helping the U.S. figure out how to move forward, is work on low-carbon industry parks. And I just had a chance to see one of those that we're working with in Shanghai, and I must say it's quite impressive.

China is basically turning a number of these old industrial plant sites into low-carbon economic zones, low-carbon energy zones which will combine sort of state-of-the-art research and development, education on energy efficiency and renewables with kind of state-of-the-art real world examples of how you do energy efficiency. So the buildings in these, on these sites, will be built to, hopefully, the top line in terms of energy use. Suzhou has an industrial park that's been doing this for years.

China is now embarking on doing 12 of these throughout the countryside, and I visited one in Shanghai which is turning an old iron and steel plant into a clean energy economic zone. The government of China is going to invest $750 million over the next 3 to 5 years, which it's not in the billions that we were talking about at lunch, but it's a very significant investment.

And I was sitting next to my colleagues who's done a lot of energy efficiency work throughout the world, and we are trying to come up with an example of such a project that the Chinese could go and visit and see sort of first hand to get a chance to visualize it. And, frankly, we couldn't come up with an example that was on this size scale and with this amount of resources to invest. I think it's a pretty significant investment. There's a huge opportunity to ensure that those buildings are kind of state-of-the-art energy efficiency, and then I think there's also some examples that China can bring to the U.S. in terms of how to move on some of these converting old industrial plants to clean energy zones.

So with that, I'll conclude with a couple of key take-home points. Many of these are pretty obvious. There's a huge energy efficiency potential in China. They're building a lot of buildings; they're building a lot of industrial plants; they've got a lot of existing building stock which is ripe for improvement and retrofits, and I think the Chinese are making significant investments in trying to deal with this challenge, but are not going to fully sort of tap it on their own.

And so I think there's a huge opportunity for collaboration between the U.S. and China on this front, and I think that this administration has seen that opportunity and despite these often significant tensions both in the climate negotiations and now with things like the steel and just kind of general economic with the currency, we haven't seen those spill over into the bilateral relationships between the two in the sense that these bilateral efforts continue in a very significant way to be implemented.

So with that, I'll thank you and we've got some places where you can find some more information if you have any questions. Thank you.

(Applause)

NOBUHIRO HORII: Good afternoon, everybody. The title of my presentation is "China's Frugal Innovation." It is not often used in daily conversation but it's very close, you know, price is very cheap innovation. And the driving -- it's "China's Frugal Innovation: Driving Force or a Bottleneck for Clean Energy Deployment?" This is the title of my presentation.

The main theme of this presentation is -- the key word is frugal innovation by China. And, you know, *The Economist*, the English magazine, is especially important innovation in emerging markets. This is published on 15 April 2010. Pointed out China's frugal innovation is in the process, in manufacture -- in many manufacturing industries, including automobile and, you know, home application, electronics and so on. The economists' articles demonstrate that the surprising cheap price and enough quality, not necessarily best but enough quality for the demand of emerging markets of Chinese products fitting with the new demand of emerging markets in developing countries. And this special report forecasted that Chinese industries will also emerge as a very competitive rival for that of developed countries.

In my observation I would like to say in some case in my presentation, energy conservation and environmental protection fear industry. Chinese companies are accomplishing frugal innovation. Also, China's frugal innovation is a driving force in promoting energy savings and environmental countermeasures in China's domestic market. This is a very good thing. A fantastic thing, I think, I believe. But for the companies of developed countries, including the United States and Japan, it is a threat against their future business.

In my presentation I would like to try demonstrating China's frugal -- this innovation is the outcome of structural factors, not exceptional case. In many industries and many products China is accomplishing this frugal innovation and I would like to analyze its reason, background. And I will raise some points of discussion in the last of my presentation to consider whether China's frugal innovation is a driving force or a bottleneck for clean energy deployment.

In my conclusion I'll say firstly, Japan and United States' companies have no choice but to deepen cooperation with Chinese companies to utilize their frugal innovation. And it will be good for reducing the cost of energy saving on the environmental countermeasures.

However, the business environment in China's market also should be improved, not to hinder sustainable technology innovation and advance labor by protecting intellectual property rights and reducing government's intervention. Maybe this -- my discussion is very similar to Joanna's this morning. However, therefore, my conclusion would be in short term China's frugal innovation should

be a driving force for clean energy deployment, not only in China's market but also in developing countries' markets. However, China's frugal innovation model might become a bottleneck for clean energy deployment in longer term.

And I would like to explain more about frugal innovation by taking some examples. This is a graph showing sulfur dioxide emission and unit intensity, energy intensity of China. You can find a bar line, bar graph is indicating the emission of sulfur dioxide and the line bar is indicating the energy intensity. I mean, energy consumption to unit GDP. And you can easily find that in recent years China's energy savings, just as Jake said, very big improvement. And also I would like to focus on the success of sulfur -- reduce sulfur dioxide. And you can find already in four years China succeeded in reducing the emission of sulfur dioxide, cut by 30 percent, already surpassing their target in the 11th Five-Year period.

And the background, there is some reason in background. This is very simple. The reason for such a very dramatic reduction of sulfur dioxide is possible is that the introduction of new technology of sulfur and FGD, flue gas desulfurization equipment. You can find that from this table in 2004 FGD, the installment capacity of FGD was increased so much explosively, almost compared with last year, 2003 it's increased by seven times -- more than seven times. And actually, the reason of this kind of deployment, rapid deployment of FGD is de facto policy. In 11th Five-Year period Chinese government sets the target for the installment of 355 million kilowatt FGD and this is the breakdown.

And actually, in reality, at the end of 2009, 461 million kilowatt FGD was already installed occupying 71 percent of total profile power plants capacity. And maybe you know FGD is kind of a very expensive technology and many people researchers, actually including me, that's the year of 2000. The year 2000. We believe that China couldn't be -- maybe China can't install such a huge amount of FGD in only several years.

So my question is how come it's possible to install FGDs in such a short period because, you know, FGDs are a very expensive countermeasure to reduce sulfur dioxide? The answer is here. You can find down the lower side of this slide. You can find the unit investment cost of FGD per kilowatt. Actually, at the year 2000, the unit investment cost of FGD was very expensive, around 800 yuan to 1,300 yuan per kilowatt. However, only after five years the unit cost, investment cost of FGD was sharply decreased to 150 to 250. It means, in China's FGD market the price of FGD equipment was decreased by 80 percent. Only, you know, 20 percent of pricing can be bought -- can buy FGD equipment compared with 5 years ago.

And I feel very interesting is that, you know, yes. There is a background of this sharp price decrease of the FGD. The competitive market in China's FGD market you can find, you know, (inaudible). That's the middle of

2003. There are only seven to eight companies in China's FGD market and most of them are joint ventures with foreign companies, including Japan and Germany. But at the beginning of 2005 there are 46 companies producing FGD equipment. And at the end of 2006 more than 100 companies -- more than 100 companies producing FGD equipment. So through this very harsh competition, Chinese companies can accomplish sharp price down.

The next question is how come was such a big cost down possible? Actually, I have conducted a field survey of FGD makers, visiting seven to eight makers three years ago. And through the field survey I come to know the critical point factor is that the first is technology modification. Many FGD, Chinese FGD companies did technology modification. I mean, simplifying some process which is not needed in China's market. For example, gypsum for making gypsum process. They changed the design or spec and simplifying the process of producing high quality gypsum and it also contributed the cost down so much.

And also more importantly there are so many grants and enterprises which can produce very low-cost materials to produce FGD. For example, FGD consumed very many stainless steel, I mean, corrosion-resistant stainless steel. And originally, in the year of 2000, more silver materials were imported from foreign countries. At that time the cost is about 14 million renminbi for 4 power units. However, five years later there are so many not on one front, originally there is only one steelmaker who is able to produce this stainless. However, now there are so many steelmakers who can produce these materials. Due to this domestic enterprises emerging, the domestic materials cost was also cut by 90 percent. So very surprising, only 10 percent of cost buys this stainless materials. And also low cost for assembling. This is very important that in FGD cheaper labor is not a critical one actually because most assembling cost with only 20 percent of total cost over producing FGD and more than 40 percent to 50 percent is input materials cost.

So, maybe everybody knows that Chinese companies enjoy labor -- cheap labor costs. However, in FGD's case, not only cheaper labor costs in assembly but also more importantly the low cost of materials, material cost is low is a very critical factor. And this is a table of the top 20 FGD makers. It's the year of 2008. And fortunately, we can easily find that in the rest there is a very huge name over Japan. Mainly, Germany, the United States, and some also (inaudible) and so on. And my understanding is Japan and Germany are the most advanced countries in this FGD technology. However, that's 2008. In China's FGD market Japan cannot occupy, you know, enough share, enough means from the labor of technology. And the third one is -- the technology of the third one, the third company is coming from Japan but the other is coming from Germany and so on. And the reason is, you know, the business model of Europe and U.S. company and Japan company were different. Actually, European and USA companies let Chinese companies modify technology because they provide technology mainly through patent.

However, Japanese companies, the way of technology transfer was mainly through joint ventures and they stick to setting their own products without any modification. But actually, in China's FGD market the price is a very critical thing, a key factor. And, you know, Chinese enterprise companies can modify and change the design of, you know, make some supply chain or low price materials. They can succeed in getting pricing down. However, Japanese companies stick to joint venture business and they fail to succeed in pricing down in China's FGD market. And European and the United States companies businesses maybe not so success -- of course successful because the market is very huge, but they get returns of course by licensing and in addition they get returns by software, including training programs.

So, Japanese companies, I would like to say that, you know, Japanese companies (inaudible) the business model to sell their own products which constrain Chinese companies' technology modification resulting in a small range of price down on the losing market. So it's of great pity. Japan's government actually promoted -- has long years for this kind of FGD, including clean coal technology on the clean energy cooperation, including FGD. There is a long history starting from '90 to '92. From '90 to '92 to now. However, there are so many technology was transferred to Chinese companies. However, in commercializations staged by Chinese government -- Chinese companies don't see the Japanese technologies and they choose maybe technology from the United States or European countries through licensing.

Maybe Japan technologies should be some problem, you know, in market competition (inaudible) high cost (inaudible) and they stick to joint venture investment, the inflexibility in business negotiation, and less competitive (inaudible) Europe and so on.

And I would like to mention about another case, wind turbine manufacturing industry. But this was already mentioned in the morning session so I would like to skip, but you can find that in China's market, the installment of wind turbines accomplished such a huge growth in reaching to the 60 percent over total world share already and the long second following United States.

And now I'm conducting the field survey of the wind turbine manufacturing industry in this year and I've come to know the reason for outstanding growth of wind power development in China is -- one factor is the government's degration. Of course, for power producing companies to install renewable energy with (inaudible) to total install capacity. Also, there is frugal innovation. I like to mean, you know, the unit cost of wind turbines is decreasing from 600 to 500 yuan per kilowatt in 2008 to 4,600 to 4,800 yuan. I mean, you know, 30 percent cost down was accomplished in the wind power turbine. The background of this price down is also growth of domestic maker was key for frugal innovation.

Although 82 percent of installed capacity was produced by foreign makers in 2004, but in 2008, only 4 years later, the share of foreign makers was dropped to 38 percent. And the domestic makers emerged with a dominant share and also more importantly components because wind turbine composition is almost 80 percent to 90 percent (inaudible) is 80 percent to 90 percent is the cost of input components. And this is very interesting, you know. For most components, such as (inaudible), gearbox, turbine, are now produced by Chinese companies. And there are two or three companies occupying more than 80 percent to 90 percent share in the components market. And the Chinese government and companies are enjoying economy of scale. And this kind of frugal innovation cost down can also be observed in coal-fired boiler and turbine, photovoltaic, nuclear power plant, and so on.

And this is your share of the companies. (inaudible) is the first one. This was established only in 2006. Very new companies. But in only two years they ranked third in the world when you're talking production which is very amazing.

In summary, the factors to make frugal innovation possible are -- the first one is lower cost in producing but not only assembling but also more importantly in producing components. The second factor is technology modification fitting with market needs. And third is economy of scale owing to domestic huge market. But the fourth one is simultaneously harsh competition is also functioning, even each company enjoys economy of scale due to the domestically huge market. But also there are so many companies doing harsh competition is also competition. And the fifth one is Chinese governments' policy to exchange market with technology and forcing falling companies to promote technology transfer, also including the target of domestic production ratio. For example, in wind turbine, more than 75 percent of all components should be supplied by domestic maker. This is regulation of the Chinese governments.

My conclusion, from my analysis, China's frugal innovation should be good actually, firstly, in promoting the deployment of energy savings and environmental technology widely in China very speedy. And the second one is perhaps it is very good perhaps in contributing for wider deployment of green technologies in other developing countries, in the future, due to the low cost of products.

So, in short term, China's frugal innovation should be a driving force for clean energy deployment, not only in China but also in other developing countries. However, China's frugal innovation model might become a bottleneck for clean energy deployment in longer term because the first one is hindering investments over developed countries for technology innovation. (inaudible) because less profitable not only in Chinese market, but also in third-party

countries through China's export.

The second reason is that, you know, (inaudible) which means once lower efficient technology was introduced, the loss of environmental improvements should amount to huge -- before it was replaced with new ones because many environmental technology takes more than 20 years or more.

So, the business environment in China's market should be improved, not to hinder sustainable technology innovation in advanced levels, such as protecting international property rights and China's markets should be less influenced by government's intervention.

Thank you for listening to my presentation.

(Applause)

GANG HE: Good afternoon, everyone. Thanks for Jane's nice introduction and thanks for the invitation. It's my honor and a pleasure to be here to share some of my observations and the research findings from my research.

So, my topics will be China's progress in energy efficiency in the emission reduction and the implications for U.S.-China-Japan cooperation.

So first I will share the -- to give you some background on China's transformation, to try to share more ideas on why China's energy and the climate problems is so challenging. So then I will give you some progress -- to share some progress on China's energy efficiency and emission reduction. And then I will use a specific case about my research on carbon capture and sequestration to use that to show how domestic political economy has big impact on international cooperation, no matter its bilateral or trilateral, whatever. And then, to some conclusions and implications.

So, if you use one word to introduce China, you might use transformation. So this 30 years of economic -- fastest economic development is greatest transformation, to my understanding. There are four major socioeconomic transformation in China. The first one is the so-called industrialization. If you take a look at the statistics, you can easily find that China is the biggest producer of -- and the consumer of -- steel, cement, all those products. And all these products are also energy-intensive. So this means energy was consumed in the industrialization process.

And second, the keyword is the urbanization. From 1980, China's open rate -- urbanization rate is 16 percent. And by 2009, this number becomes 46. So just imagine, this is about 30 percent change. Think about 1.3 billion people. It's about 30 to 40 -- 300 to 400 million people move from rural area to urban area. And what does that mean? Three hundred million people is the total

population of the U.S. So in the past 30 years, China move U.S. from rural to urban area. And in the coming 30 to 40 years -- by 2050, this number will be 75. So this means that China will move a second U.S. to urban area. So, all this included the energy consumption and emission.

And the third transformation is the so-called motorization. By 2009, the total ownership of vehicles is about 180 million -- not electric -- vehicles, cars. And just in Beijing, 2,000 cars is sold every day. So think about this number. What does that mean for the energy consumption?

And the fourth transformation is the modernization, occurs in lifestyle. So all these people move to urban areas to lead consumptions, they need to buy electric appliance or facilities. All this relates to energy consumption.

So this gives you some idea of why China's energy and climate are extremely challenging. And I don't need to go to too much detail just for the energy background. It's -- 70 percent of China's primary energy depends on coal. And for electricity this number is 80 percent. So this coal dominates China's primary energy and power supply. And for the economy, this also has an implication that this -- China's economy is export-oriented, which means that the resources consumed in China -- energy consumed in China. And this product is consumed outside of China. But this energy is on the account of the Chinese energy consumption. So, this -- and the other perspective of the economic development is China's economy is also energy intensive economy. So, the -- all this has big implications for China's energy and the climate challenges.

So even under these situations, China is still doing a very well job in contact the climate change and to do energy efficiency and emission reduction. We honor that China proposed 20 percent energy intensity target for the 11th Five-Year Plan. And by 2009 -- these are some numbers shared by the statistic -- we can always argue that there is some water in these numbers. But we should admit that all this -- China takes all these efforts for making progress.

So here is some highlights I want to share with you. That by -- in 2009, China shut down 10 gigawatt small and inefficient power plants. What does that mean? The total capacity of the Three Gorges is 18 gigawatts. So, China shut down half of the Three Gorges capacity in 2009, one single year. And other numbers, including the forestation and they are using -- and as Jack shared in the industry efficient -- energy efficiency, all those progress.

So if China achieves the 20 percent energy efficiency targets, that means during the 11th Five-Year Plan the total energy savings will be 600 million tons of coal equivalent. And emission reduction will be 1.5 billion tons of CO2. So, we have this chart also from McKinsey. They have different scenarios of China's so-called energy future. You can see this is -- one scenario is the reference in the middle. And another scenario, the so-called low carbon scenario

on the right. So, you can see the difference. What China is doing is that China is moving from the reference scenario to try the best to achieve the low-carbon scenario.

So I also want to highlight the development in China's clean energy industry. So you may have heard from -- Joanna shared on the development wind. So, I want to put more evidence to show that in 2009 China was the biggest PV exporter and also the biggest new wind capacity installer. And there's the biggest nuclear capacity under construction. And also, the biggest investor in clean energy.

You can see from the chart that in -- from the wind, since 2005 China's wind capacity doubled each year. So just imagine the exponential growth rate. And this nuclear -- because so many projects are still under construction and it takes some time before to kind of get 2009. So, this we are experiencing another exponential growth when all those projects are ready. And the same story for solar.

So this is by 2009. China is discussing its new energy and emerging industry plan. So by 2020, if we -- there is some discussions. The official number has not released yet, but there is some discussion proposed by different experts. So the wind capacity by 2020 will be 150 gigawatts and the nuclear, 70. For solar it's 20. So, this all put together, including hydro, there's no -- there is some discussion but there's no doubt that China's renewable energy will account 15 percent of total consumption. So just think about this exponential growth rate of this industry.

And also I'd like to share some of China's movement on the so-called green energy or green infrastructure, like the high speed train or the high voltage transmission line. So, this is a network of China's railway. The red line in both, that's the planned high speed train. So by 2009, the total distance of China's high speed train is 14,000 kilometers. And by 2020, this number will reach 30,000 kilometers. Thirty thousand kilometers is the distance from Beijing to Washington. So, China is building a high-speed rail from Beijing to Washington, so -- equivalent. And the high voltage transmission line, too.

So another major shift, as Joanna shared, is China's shift from -- towards a market-oriented environment and a climate of governance. I shared the progress of China's progress in the 11th Five-Year Plan. But we should note that this progress is achieved by -- mainly by the command and control approach.

China also noticed that this approach has its advantages, can move quickly. But also has its disadvantage with its inefficiency, ineffective somewhere. I'll give you a small note here is, you know, we are very close to the 11th Five-Year Plan by 2010. And some provinces or some industries, they cannot achieve the target. They shut down the electricity for the residential or the

industrial use. So, it's weird in some way, right?

So this is -- the note is that this is the inefficient way. So they are discussing those market tools or market approach using in the economy or in the -- or achieving their emission reduction and energy efficiency target. Including, but not limited to, the common tax, the environment tax, and China is also discussing a cap and trade demonstration project.

This -- I also discussed with some experts both here or in China -- it cannot be a big deal because China does not have a physical cap. Without a cap you do not have the demand. Without demand you cannot have a price. But my argument on that is this is -- it wouldn't be a big deal but it's significant. Why? First, domestically this is clear movement of the capacity building. We cannot wait until we have a cap to build all those infrastructures we need for a future implementation of the cap and trade. This includes the MRV -- monitoring, reporting, and verification. We need all those reporting and monitoring, including the rule of law -- all those infrastructures to put that in the future.

And second for the internationally, this delivers a clear message that China takes climate change seriously. And it can be -- and China, we need to work with the international community on these issues. So, for these two messages I think this is significant. We can watch what we are going on and what we are coming out, but I think this is a big shift in these efforts.

So, with this understanding I'd like to introduce my institute in Stanford University. We work some -- the political economy and the institution of perspective -- of the global energy system. And we have active research on the climate change policy and the global coal market and the national oil company. I want to highlight some of our research with regard to China's low carbon future.

First is China's coal and power sector. We have three pieces and with China's clean coal technology, we also do some work on the carbon capture and sequestration. Other work including the reform of the carbon market, CDM, and integrate renewables to this market.

So what I want to hear is, I want to use specific case to show how domestic political economy -- or how domestic policy will impact the international cooperation. So, many researchers including the morning panel, they argued that CCS -- the carbon capture sequestration which capture the CO2 from the biggest emitters in the -- it's the power sector and then storage it to the underground. Then we can have -- try to solve the emission problem.

So the current logic is that coal is the world's fastest growing source of fossil fuel and that China consumes 40 -- more than 40 of global coal. So the conventional wisdom is that we have a climate change problem, and we need to CCS. Without CCS, we cannot achieve the climate target. And where to

do CCS? Because the carbon emission mostly from the coal sector. And mostly coal consumed in China. And China -- we need to do CCS in China's power sector.

These two pie charts from IEA CCS report. Think about that. From the investment by 2050, China has 20 percent. And for the power projects, China also about 20 percent. Which means that all this conventional wisdom thinks China needs to do CCS. But we need to think about what does this all means if China really does it.

The first argument we are arguing is that CCS at scale could harm China's energy security. This map shows China's infrastructure of the coal industry. Most of the coal was mined in the north and west, in the Sanxi/Shanxi and the Mongolia area. So the coal is first transported by rail to Qinhuandao and Tianjin and other seaports around the coast. And then they use seaborne to transport coal from north to south to the consumption center.

So to do CSS, you have energy penalty. And experts explained -- estimate that you will have 20 to 30 percent of energy penalty, which means that to produce the same amount of electricity you need to consume 20 to 30 more coal. So in China, in 2009, China consumed about 3 billion tons of coal. So half of this coal goes to the power plant, which is 1.5 billion. So 20 to 30 more coal is about 300 million tons of coal. This 300 million tons of coal, the oil needed to extract it -- the oil needed to transport it -- you need seaports, you need the railway, you need seaborne. And all this costs -- the coal is not automatically at the gate of the power plant. It needs to be transported, it needs to be extracted. So, through this coal value chain -- this cost will pass through this value chain and its number can add up to $50 billion U.S. per year. So many people trying to do CSS ignore this systematic cost.

The second point I want to make, as my work with my colleagues in Stanford, is this chart. I like this chart. The red line is the average or the leverized coal cost, which means how much you need to pay for coal to buy coal to generate 1 kilowatt hour of electricity. And the blue line is how you can get to sell 1 kilowatt hour electricity to the grid. So, you can easily see from this chart that in 2008, in some months your cost to buy coal is more expensive than you can get from selling the electricity. So this is only the fuel cost. Normally you add the operation cost or other cost. But anyway, the major cost of coal power plant is the fuel cost.

So the point I want to argue here is the power plants in China. They cannot even pass away or pass over the cost of coal. How can they pass away the CSS cost -- the added CCS cost to the end user? For China why the electricity cost is not changed with the fuel cost or the coal cost? It's because first, true power is critical for China's economic development, and to keep the CPI lower in order to keep the social stability.

So, there is a major conflict between the coal and the power sector. To put a long story in short is, there is an uneven reform over the coal power sector. From -- this chart has two paths. One is the growth of the coal and the power sector. I put them in the same chart to give you a comparison. First, you can see before about 1997, 1999 the coal -- the growth rate of the coal and the growth rate of power, it's parallel. But after that you can see the growth rate of power is over exchanged the growth of coal, which means that the coal becomes more -- and the coal becomes more secure in the market. And because the power is significantly important to the government strategy they need to control the power price.

The coal goes to also -- the reform of the sector. The coal also goes to market, which means we have a market-oriented coal sector. But the power sector still on the strong state of control. So, this tension between coal power sector which is exactly what we know from the Chinese domestic political economy and we have impact in the deployment of the CCS technology.

So then the question is, what's China's interest? Okay. Here I put together some ideas. What China cares, right? So when we think about China, first economic growth and the macroeconomic or social stability. For the energy security we need to think about -- we need to ensure the lack of energy does not impact the growth of China's economy, this including the supply, diversification, or efficiency improvement. And the second is to keep the price low enough to end users in order to maintain the economic growth and social stability. And third trying to develop the technology leadership, especially in the new energy development.

And also, as Professor Zha argued, that the local pollution is even more important in some way. So the pollution control or efficiency improvement, you need fuel switch or you argue later to show more ideas on that. And the -- also, the climate change mitigation. China is not isolated from the climate impacts. China also suffered a lot from that, including -- that's another story, but I just need to highlight it here.

So, let's back to the CCS, or the clean coal argument. Let's think about how we can work with China. We -- the best way is you find China's own interest to put here -- to put one thing that no matter what happens, China has the interest or the motivation to do it. Then, China will do it. So the idea here is the strongest motivation emerges where these two align, which means that the international mechanism aligns with China's own self-interest. So, let's look at what does that mean for the clean coal collaborations?

First, we compare how IGCC or CCS might work or might not work in China. We discussed the other day, the key interest of China's concern. So these include in the energy security, technology capacity, and the pollution

control, and the climate mitigation. So you can see from here it's for our super critical or the IGCC, they have better aligned with China's self interest. And for CCS as I just introduced, you will have an understanding. It's not that aligned with China's self interest.

So let's look back to what China is doing on CCS. We can see how this makes sense in the Chinese background. China is doing some demonstrations on -- like in Hunan and Beijing -- solar power. This is a demonstration operation with 3,000 CO2 emission reduction each year, and the Shanghai Huaneng Shidongkou – it's with 10,000 emission reductions. So this is more like -- it's a demonstration. China has an incentive to have this technology. But when you go to scare up the scare you need, the question is, who is going to pay for it?

So -- and here, this question is answered. You cannot say CCS will automatically happen in China. So that's the argument. And another point here is China does care about the carbon use or carbon usage, and they call it CUSS, carbon usage and carbon capture and usage and sequestration.

So, here is just an example on what we learned from this case how we can work with China and how international collaboration and international mechanism can succeed with the Chinese background. So the final comments here, it's the opportunities. This I think many panelists are showing that, I just highlight some key points here.

Firstly, the efficiency. Second, CCS is still there but we need to work -- find a better solution for those domestic and international mechanisms. And also displace coal or increase the use -- the renewable energy. I showed the charts how renewables becomes a miracle development in China. But we also need to note that in the near future China will still depend on coal for its main source of energy and that's a big challenge, too. And also as Joanna and other experts also mentioned, it's not just a matter of capacity. It's also a matter of actual generation.

So here are some things to watch, as I already incorporated in my introduction as those dynamics there. Do pay attention to the 12th Five-Year Plan, what new numbers and a new approach that we put in this 12th Five-Year Plan. And I introduce or I incorporate that there's a major transformation that they will use more market-oriented mechanisms in the 12th Five-Year Plan, and they turn from quantity-based to more quality-based development, from more economic development to more people development. So it's dynamic transformation there, and there's continued booming of the new energy. Some other development is including the low carbon cities demonstration and the environment exchange that carbon tax, the environment tax.

So let's conclude by some take home messages. First at the very

beginning, to understand China you need to understand China's greatest economic transformation and what does that mean for the energy and the climate mitigation. Second, as China is progressing aggressively in the energy efficiency and the emission reduction and it is actually leading the global energy revolution. The traditional wisdom is we use technology to exchange China's market. But the new thinking is using China as a natural renewable energy or clean energy as a research map, because China uses its own money to invest significantly in renewable energy and clean energy. And to bring down the cost of the whole industry, which is what exactly the world needs. So we need to work with China on these efforts.

And so the third point I want to make, as I showed in the CCS case, to understand China's domestic economy and institutional condition is key and very important for a successful international cooperation. And so the best way to work with China is to understand and engage China's coal interest. Thank you.

(Applause)

JENNIFER TURNER: Now, I've been in D.C. 11 years and I've learned, maybe because people come to my meetings, I am always put last. That is because you all need a little bit of perking up out there, right? And so I look out and see you. There is not a single map nor a chart in my power point presentation. Now, contrary to my normal practice, I do actually have some words, okay, so my apology. Usually I do all pictures. Are you guys ready? I've been told I've got to make this quick because you all are just snoozing at the -- I mean, this was fascinating stuff, and I want to thank my colleagues, because I learned lots. See, I'm perkier than you, Jake, aren't I? But you were good.

Yes, but so, okay, as you can see -- well, I'm trying to unseat King Coal, right, and so Gang He and I are a little bit of a slight overlap, but not completely. The China Environment Forum I focused a lot on energy over the years, but in terms of Japan, China, and the U.S., I've really focused mainly on water issues. But I think that that's why I'm excited to be here today to have more folks from Japan talking about the energy, because I think, you know, I'd like to expand my Mafia into that sector in Japan as well.

Now, in our cooperative competitors work that we've been doing -- and that's that top project -- we've been really trying to dive into over the past years how and why the U.S. and China can cooperate on clean energy. So I had to expand my own horizons and kind of look into clean tech companies.

Now, in the course of my searches, a couple of months ago I came across a website called greenmedia.net, which none of you have probably ever heard of. But they did a ranking of the top 10 clean tech companies in the world, and the number one, one was Chinese. Who was it? Come on, shout it out here.

Who was the number one clean tech company in China? In the world? And there's a company that is changing the world in terms of clean technology, who is it? Someone. What? No, you tell me. Come on, no thought?

Of course, it's the Communist Party of China. They are the cleanest green tech company in the world, and you've been hearing all day long, right, about all the policies -- see, I fooled you -- but all the policies that they're doing that in some ways what is the communist party but a company, right? The investments. We've already heard about environmental authoritarianism there from Gang He that, you know, that -- and but a lot of the talk -- and that's why I was glad I was asked to talk about clean coal -- a lot of talk is the solar and the wind, but, come on, you guys, it's coal. Coal is the big issue here. Let's not forget that.

And I think that, you know, we tend to focus in D.C., we're always talking about China's challenges. Let's look at our challenges in the U.S. in terms of coal. We know about the dependence, but I just learned a couple of weeks ago, because I invited Duke Energy to come to talk at my shop, and they told me something that I didn't know and that maybe you don't. Did you know that in -- by 2020, that one-third of the U.S. coal-fired power plants will have to be retired? Some of you were at the meeting, though, that you remember. And then by 2050, ostensibly all of our power plants of all sorts will have to be retired and replaced.

At the same time, we need to increase our electricity by at least 40 percent. Do the math. This is a disaster. And so, you know, so when you're talking about China's serious challenges -- and Gang He, thank you for that great -- you know, the urbanization, you know, all of the stuff that China's doing, but we're on the same path, just at a different stage. So I think that there is a lot of commonality between our two countries. But, of course, you know, suspicions reign.

My first publication here in town, it's still a good line, *Crouching Suspicions: Hidden Potential*. Now, initially, I wrote this talking about how the energy and environmental spheres were ones that where we could build goodwill between our country, and it's been very discouraging for me in my work of the China environment to see that the energy sector is now becoming a source of tension. And you heard a lot about this, this morning, so I skimmed quickly through these like the dragon fly across the water here, that we know about the crouching suspicions, that we got the Copenhagen's tussles, and Gang He and Jake talked about how all the progress, the numbers that the Chinese have been making on improving their energy sector, but the U.S. we don't really tend to acknowledge that.

Sometimes, and, you know, one thing I've thought a lot in my work now, the U.S. Government folks, agency folks are people in my network, and I salute all the work that they do. But they don't get money budgets until

recently having at high-level prioritization of their work, so the Chinese often view what we do in China as the government as very inconsistent and ad hoc. And my favorite line: China's stealing green jobs.

Of these other issues that I'm sure were brought up in the morning as well as kind of concerns about, you know, why we should be, you know, not trusting China, but despite all this, oh, yeah, that's right -- if any of you are Pogo fans out there, you can maybe appreciate this here.

Now, on -- this is up here so just to remind us that we don't, in the U.S., don't want to get stuck about blaming China, because in some ways we need China because there's no other country in the world that is really going through the same kind of coal challenge that we are. And, you know -- but, you know, if we don't work with the Chinese, I think the Japanese and the Europeans will. So we got to take advantage of this hidden potential, right? Crouching suspicions, hidden potential.

Joanna gave you the rundown this morning, right, about all the different types of cooperation, and I've told you about some of the reasons why we should cooperate. But -- and then it was exciting last year with Obama and the Hu agreements, the Clean Energy Center coming forth. But I really think that we don't want to forget that, you know, the folks like NRDC that have been on the ground for the past 15 years and other NGOs, the foundations that have supported them, are really -- you guys are -- I'm looking at you, Jake -- you guys are really the foundation for this kind of clean coal cooperation.

A little, few more details on the hidden potential, yes, we have the bilateral agreements and salute also the State Department, your 10-year framework, the ECO partnerships, those are starting to get a little bit more action on the government sphere. But in terms of coal, you know, clean coal, I mean, we have -- the NGOs tend to be working more on renewable and energy efficiency, which is needed. The foundations, the energy foundation climate works I didn't note down there, have also been kind of supporting the NGOs and some of the policy changes that have happened, the state-to-state issues are good.

But I think what I want to emphasize here which we haven't talked about as much, even though -- Gang He, great chart, I want your chart, that little chart later on -- about the biz, the biz/clean energy cooperation. We've had a few -- again, I've learned a lot over the past year. I could not have given this talk a year ago. We had Bloomberg clean energy folks come and talk about their joined-at-the-hip study, that really, you know, started putting, giving us information specifically how intertwined our clean energy sectors are. We complain about green jobs being lost to China, but overall the solar and winds, those actual, the stuff they're making in China, 15 percent of it is U.S. made technology, the little widgets inside.

We had Duke Energy come in a couple weeks ago, as I mentioned, and they did a study on power sector green jobs. And again, thanks to you, Gang He, stressing that the needs, you know, power sector reform is a big issue. Same thing here. Now, one little factor that, you know, when we talk about green jobs that isn't often emphasized is that when you have two, you know, two countries cooperating -- oh, why, yeah, you could look at him. Here's a nice picture here -- you were getting a little falling asleep out there, so I had to change slides -- that when you install solar, install wind in partnership with China, 73 percent of the jobs are where you put it, right? So if we put the stuff here, that's a good trend.

This is just some of a list. It's not even totally complete about the different kinds of partnerships that we've kind of discovered in our cooperative competitors work, not all are clean coal. But there's a lot going on, and in the middle there, there's that good old green gen, right? You guys recognize it by now? The green gen, which is a CCS-ready IGCC plant in Tianjin, has a lot of international partners which includes Peabody and Duke Energy from our side. And what's really kind of, you know, striking is that, you know -- because I remember the Duke Energy when they first came and spoke for me over a year ago -- I said why in the heck are you guys in China, right? You know, what are you getting out of it?

And they told me that what's important -- and it a little bit amorphous for those of us that aren't in the power sector, but they say that, you know, China's increasing their electricity by 30 percent a year, and the chance to learn about how to scale up those kind of plants, it's like nothing we have here, you guys. But we need that, right? We need all this energy. We're losing a lot of our coal-fired power plants, so it is a big opportunity.

So here's a partial list. This is not complete. This list, because I didn't want to put it -- I don't teeny-weeny fonts, but to this list here these are mainly the big companies you know of, but also, you know, we could put Intel and Cisco and IBM and Google, who are also working on smart grid issues that relates to my power sector coal stuff. But kind of highlight a few of them in here, Zeep -- the best company name I've ever heard -- Zero Emission Energy Plant, a U.S. company, is working with ENN, too, for the first time to use their U.S. technology in a commercial demonstration project in China.

You should note, whatever's in green are projects in the U.S. What are you seeing here? Very little. And why is there so little in the U.S.? No -- well, with no manufacturing but maybe not the policies to encourage it. Like very -- I was really bummed when Future Fields -- I mean I was excited when Future Fields came to speak at my shop last -- in the summer to talk about how they were bringing some Chinese IGCC technology to Pennsylvania -- go, Pennsylvania -- going to create 300 jobs. It would be, you know, CCS-ready, and, you know, and we talked to them more, you know, in the course of the Q&A, and it kind of came up, so what's next after you do this?

They said, well, this is just to test out our partnership with our Chinese partner, and together we're probably going to go to Latin America and Eastern Europe because there is no incentive to do this here. So a bit disappointing. But I think that that could be a trend in other partnerships that we haven't yet discovered.

I won't go through all of them one-by-one. I mean, that was the main one I wanted to highlight. The Shenhua West Virginia University Coal Liquefaction Plant, because you mentioned that, too, Gang He, right? That kind of raises an issue that I want us to kind of think about, you know, coal. You know, coal liquefaction, this is going to be -- this plant is going to be the biggest coal liquefaction project in the world; will become the largest point source of CO2 emissions in the world; will, you know, it'll -- what's it going to do? -- it's going to -- I cannot read my own handwriting -- it's going to take in, convert 6,000 tons of coal per day into liquid gas. So it's huge. It's a huge project, but it's in Inner Mongolia, which is dry.

Which brings me to my near last slide, right? Am I doing okay, then, on time, now, Jane? Okay, good, sailing through, and they're awake now. They were awake for the other guys, too, but we're perking them up again.

One issue again that my cooperative competitors work, it's a work in progress, and, you know, my assistant, Pete, and Christine and I were kind of like still pondering a lot of gaps, kind of unnoticed hidden potential, if that's not kind of a weird phrase to say. One issue is that through the course of our meetings I've been excited that we've had a number of power sector meetings, and I think that there's a lot of focus on technologies, but we really need to focus more on the power sector infrastructure cooperation. Both countries are reforming our power sectors. We going to have a probably another month, a short research brief, comparing the U.S. and China power sector reform, again looking for opportunities.

There's a lot of talk, with all the companies I speak with, again like Duke Energy and others, saying that China is a laboratory. But I think that this laboratory is going to have to show some results coming back this direction, because I think it's a really hard sell, politically, in the U.S. that we have all these companies going there saying, like, yeah, yeah, we'll bring back good stuff for y'all later. You know, there needs to be something a little more immediate.

The third bullet, there is more of a question for the workshop for you folks here today at Brookings that, you know, looking at more potential in this kind of trilateral. I know that in our next phase of cooperative competitors we're going to look -- we want to bring the EU into the discussion but also, of course, I need to bring Japan in as well to see, like, what are these kind of potentials. I mean just so you know, it's keeping me busy 24/7 just to figure out

just the U.S.-China. angle. So I'm excited to kind of try to dig deeper there.

The last point, we are getting a grant very soon on a project called Choke Point China. And this, again, I'm more setting out agenda for you all energy gurus to think about that in both domestically in the U.S. and China, and in particularly in our bilateral work, there's not a lot of attention played to water.

Now, I'm a big water person, okay? Here's a lovely map from my friend, Ma Jeung that just shows the black. The black is really dirty water in China, okay? That's the main thing you need to know. Black, red, and that -- I don't know what is that, chartreuse or something? -- that's like 40 percent of China's water that basically can't be used for anything.

China is very short on water, be it clean or in quantity. So you need to keep in mind as you are developing. you know, our clean energy partnerships with China, notably include, you know, besides the solar and the wind which don't use much water -- that's good, those are -- and the Chinese government has prioritized that. But again we do have a project on coal that, you know, working with them on coal liquefaction. That project is actually the last project, the natural -- you know, NRDC is saying that they're not going to continue coal liquefaction most likely because of the water demand.

But also, part of our cooperation with China is on biofuels. Biofuels. Oh, I don't know what that's -- oh, yeah, biofuels can use, like, 6,000 time more water than conventional oil, yeah, something like that, I got to get that number there. But also on shale gas, highly water-intensive. And a lot of talk here today on CCS, and I'll leave you with this final slide. This was from the folks here at Circle of Blue. They're who I'm going to be working with on doing some research and reporting on China's water energy nexus. And they've got a great website. They did a Choke Point U.S. Those of you that are U.S. out in the audience should go look that up because you should be concerned where is your water going as we turn green in the energy sphere, right?

You know, carbon sequestration was already mentioned. It uses a lot of water as well as energy. And I kind of think that, you know, that I've -- in my next publication that comes out in a couple of weeks, we have a whole big inventory of all this CCS stuff going on in China. And I don't -- I'm flipping through it and I'm not really seeing a lot of, you know, kind of innovation on thinking on, well, how do we develop a CCS technology that's not water-intensive?

So I probably leave you with more questions than answers, but my talk is done, okay? Thank you.

(Applause)

MS. NAKANO: We've had very rich presentations and there are lots of great points. And I thought maybe I can just refocus a little bit and see, you know, what we should be -- you know, what we can do in the trilateral framework. I guess one of the things that I've learned today, I guess one key ingredient for a successful clean energy cooperation among China, U.S., and Japan is sort of to be creative. I think that sometimes the players are not just national governments; you need local governments, state-level, county-level, and then also perhaps, like, structuring financial incentives. I mean, you need to be creative because so many, you know, some companies, companies from different countries, have different approaches to entering a foreign market or, you know, finding partners to work with in a foreign market.

So I wanted to sort of go over a sort of panel -- well, I wanted to ask some of you what you think are key ingredients for a successful trilateral clean energy cooperation. Any takers?

MR. SCHMIDT: I think that the easiest thing to say, but still the most important, is to actually get busy doing stuff. I mean, there's a huge -- you know, there's been tons of reports written, everybody knows where the opportunities are, everybody knows where the challenges are, where the rubber meets the road is actually getting started in this stuff. And I think it's, you know, it's positive that the U.S. is engaging. I think it would, you know, with China and actually trying to deliver on some of these MOUs. I think there's a huge opportunity to bring in the Europeans and the Japanese and others and kind of, you know, find more collaboration.

The nature of these partnerships tends to be that, you know, one government sort of, you know, just does it, and the other ones that may be honestly doing the exact same thing don't sometimes talk to each other. And so I think the researchers in the countries kind of benefit from that because they're getting paid twice to do the same thing. But I don't think it's for the strongest benefits.

I think there's a -- we need to create some way to actually figure out, you know, who's doing what and where the gaps are in a bit more of a concerted, you know, effort. And then, you know, most importantly, actually start to implement the stuff on the ground, because the more you implement stuff, the more likely you are to find the opportunities and the challenges, you know.

So things that look great on a piece of paper don't always materialize on the ground, and so it's really where you, you know, kind of test these out, that you figure out where your, you know, challenges are.

MS. NAKANO: All right, thank you, Jake. Jennifer?

DR. TURNER: Well, I guess mainly one thing I would say is like

I need to do better work. I mean in terms, you know, like I mentioned that I'm working on the cooperative competitors, and we're working very hard to figure out what's really going on between the U.S. and China. And I think that -- I mean, that's -- it takes a lot of work to be a -- you know, to find that convener. And I don't really know -- you know, I think in some ways we actually need like a China Environment Forum in Japan. That we need kind of a forum there.

I mean, on the water sector I've got my buddy, Kenji, who, we kind of know who's doing what on water. But, you know, that seems like kind of a lame thing to say, but in some ways you do need someone who is really just gathering the kind of inventory and the information.

So I don't know. I know in China, who could be the China Environment Forum in China?

MS. NAKANO: So now I'd like to open up the floor for questions, and please identify yourself and your name, your organization, and ask a question in the form of questions. Anyone? It's too much information, lots of materials I guess people are probably trying to digest, perhaps? Wow.

Oh, yes, please?

QUESTION: Hi. I'm Amber Leonard, Mintzer Energy Group. I have a question regarding the presentation on how big costs went down in China on, I think it was wind, mostly. And it kind of posed the question to me about what about quality control? How good is the equipment as the price drops, as all kinds of companies come in and start making things, where's the quality control? That's my question.

MR. HE: I have no easy answer for that. I think they are trying to do more monitoring and do more research and development, R&D, and a deployment on that. So the question for that is not just on the manufacturer, but also on the (inaudible) because then we are finally recognizing that the quality of the turbine is important because if -- I may buy you one time, but if I come back and find it's problematic, I wouldn't buy it. So the market that we're snagged the best technologies in the long term. So this is evolving as it is also improving in the market.

MR. HORII: With regard to FGD, China region, a Japanese company FGD and desulfurizational efficiency is around 99.9 percent renewable. But Chinese government officially says that they are efficiencies allowing to 93 percent, and but some companies' president or researchers are admitted from my interviews that their efficiency was only around 85 percent.

So as far as the components, I already said, you know, stainless steel originally was imported from foreign countries and then the components can

be used more than 30 years. However, you know, in Chinese companies, steel produced by Chinese companies, and some researcher says maybe this steel can be used only 10 years to 15 years.

However, and the companies' presidents told me that, you know, originally, you know, of course, we know that some quality is lower on some foreign companies. However, the cost is -- the price is only cut by 80 percent. So they says that it is very good. However, I think it's maybe -- this is also not what the Chinese government would like to, because, you know, Chinese government is also has the incentive to reduce enough targeted emission reduction. However, in some cases some FGD cannot accomplish this target.

So I think to promote the trilateral cooperation maybe United States and Japan can negotiate with the Chinese government and to convince them to still in some case install some Japanese companies' technology and to guarantee the, you know, needed quality of reducing and, you know, protecting environmental standard.

QUESTION: A following up response to the previous questions on the quality. I can tell you I am hearing some mixed result. Some cases in Indonesia or India, I have heard some quality issues or the delay of the project issues, but in my own experience in some Botswana project which the EPC construction is China, the owner, the Botswana Power Corporation, is currently constructing the problem with Chinese EPC construction. They are very happy with the quality of the work and the schedule is in advance of the scheduled time. So they are very happy about that.

And Horii-san's presentations has a very important point of the FGD deployment in China. If the price was $200 per kilowatt for the FGD, which was the case when they started in Europe, Japan, and U.S., it would not be split so fast, as he said. But it came to $50, $40, and $20 per kilowatt that is a one-tenth of the original price. So the quality, as Horii-san said, may be just it last only 10 years, 15 years, but they can install a new one after 10 years. That's the way to approach for the lower, a little bit lower quality, and that way of thinking of the power plant component is changing with that innovation of material or the cost-reduction and quality issues.

MS. NAKANO: Thank you. And I think we have time for one last question. The gentleman back there?

QUESTION: Yes, this is not necessarily a question, probably a just trying to get some clarification or more information from Jake. With regard to the buildings in China.

MS. NAKANO: Sir, could you please identify yourself?

QUESTION: I'm sorry, I'm John O. Jim from Beta. Beta, Peking University.

MS. NAKANO: Okay, Beta. Thank you.

QUESTION: In terms of the codes of what our standards, I think the Chinese government has a long history of working with the Europeans, Americans, and Japanese. What we really need, more work. Probably that's where a trilateral corporation can, because it requires government investment, is to train the Chinese workers, especially those that, you know, are getting lower paid than working places far away from Beijing or Shanghai where the foreigners don't go to turn attention to. That's where some basic training, some demonstration projects can really have a big impact. That being done -- that's just for clarification.

Another point which I think some trilateral corporation can work is to look at how some energy auditing is being done in Japan, in United States, and then how to see if we can develop a manual for doing this in China. The World Bank tried to introduce this back in the early 1990s. Now they suddenly start to make this a enterprise eligible for government subsidies in terms of reduced tax, but still just because you have a business model in place does not necessarily mean the people who are handling the business know the actual expertise to do image auditing. Thanks.

MR. SCHMIDT: Yeah. I'll take maybe both of those, actually. I tend to try not to answer questions that I don't know. I don't know if there's projects being done in a far, you know, way, far away from Beijing. We're doing projects in six provinces, and I know that we're doing that. China's a big country so I don't want to tell you if there's -- I don't know if there's other stuff going on. But we try to do our work in enough diverse places that we're getting kind of those lessons, and then trying to think about how you scale that up from the provincial, local levels to the province, then to the central government and sort of policy reform.

So, you know, when we've done these sort of projects on the ground, you know, both training, we -- you know, the stuff we do in Shanghai is working in Shanghai, but then it's -- so think about, okay, well, how would you do that across the entire country? And that's a very different model, but trying to sort of think, you know, about how you'd scale that up.

We actually do a lot of this energy efficiency training, demand-side management. We have a team of I think about 15 demand-side management folks in the Demand-Side Management Center, and a lot of what they do, frankly, is these training exercises. We do workshops around the country to try to train officials on how to do this. We've noticed that the turnout has dramatically increased as we've gotten towards the end of the Five-Year Plan, so much so that

they're -- some of them are oversubscribed and we've had to turn people away.

But I think that that's a sign that on the one hand there's a huge gap in terms of, you know, we wouldn't have tons of people at these workshops if everybody knew what we were talking about, and the flipside is that because there are so many people coming to these workshops, it means that there's a growing interest in actually getting the skills to be able to do this. And I think that's important and, hopefully, will be a lasting impact of the current Five-Year Plan, is that you'll now have a bunch of officials that are better trained in thinking about this stuff, but these things take time.

And so I think there is, you know, huge opportunity for the U.S., and Japan, and Europe, and anybody else that wants to come there to help with that effort, because, you know, we have 15 people in a very, very big country, and I can guarantee you one thing is that we're a pretty significant size compared to many people, and I can guarantee you that we're not enough. So that, I think, is a good example.

MS. NAKANO: Please join me in giving a round of applause to our great panelists.

(Applause)

MR. ITOH: Well, thank you very much for your participation. As one of the organizers of this event, I'd like to say just a couple of words to wrap up today's events.

First of all, I'd like to express my deepest gratitude for the Center for Government Partnership with the Japan Foundation, and the CNAPS at Brookings – my colleagues Richard Bush, Kevin Scott, Jennifer Mason, Aileen Chang, who all helped me to realize this project which I started to work on during my residence at Brookings last year. I think this kind of trilateral programs are addressing energy security, including U.S., China, and Japan is still rather unique, and it is especially unique considering today's international projects. However national, its can be the keys considering the fact that we are three of the biggest energy conservers in the world. Without us it's just nonsense to talk about any kind of energy securities.

Some people -- allow me this -- competition of a limited ability of hydrocarbon resources such as oil and the gas, but even at that rate, a geopolitical rivalry between China and Japan, yes, on the average. But we learned today that there exists plenty of room for cooperation, and cooperation, if you tackle the issue of energy security from the standpoint of creating energy.

Well, actually, clean energy has increasingly become a new dimension of bilateral agents between, not only between Japan, China, and the

U.S. and China, but also it is becoming one of the priority agenda of U.S.-Japan alliance. And, at the same time, both Washington and Tokyo do need our deepest cooperation of Beijing to enhance, to develop our clean energy market.

Well, I agree that it is still too early and even unrealistic to assume emergence of any Sino-U.S.-Japan trilateral (inaudible) at the first track level. Nevertheless, I believe that it is high time we should put more of this kind of second truck balance by the three purchase of concern to substantiate the existing frameworks by reviewing and the sharing experiences to find clues to bring the future for the better. All that we need is strong will and a responsibility just because what we decide.

As of today we are afraid of the future, which our children and grandchildren, we have to survive down the road. Well, I would be happiest if this symposium could be placed as a kind of kick of meeting to develop this kind of trying the discussion among China, Japan, and the U.S. to reach the better world.

With that, let me finish my concluding remarks. Thank you very much.

(Applause)

DR. BUSH: Thank you very much, Shoichi. You've made it possible for me to avoid having any substantive concluding remarks because you've said it so well. I agree with everything you said, and your aspirations I think are the aspirations of us all.

I would like to thank you for all your outstanding work in bringing this to fruition, and I do hope it's the first step in something that's very meaningful.

I'd like to thank all the presenters, panel chairs, the staff who sort of made the trains run on time, and CGP, as well, for its financial support.

With that, the meeting is adjourned. Thank you very much.

(Applause)

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