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SESSION 2: U.S.-CHINA COOPERATION ON NUCLEAR ENERGY

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P R O C E E D I N G S

MR. FORSBERG: Does that work? I can't tell from here what works and what doesn't. Well, I'm going to take us in a slightly different direction today. I should mention my background is both nuclear and chemical engineering, so I'm going to address some longer-term issues and some things that may or may not happen, but would have very large impacts on nuclear energy and the relations of nuclear energy and fill cycles in the United States and China.

The U.S. and China will be driven by two coupled energy markets. Markets are generally driven by the major players. And there are two markets that are dominated by the U.S. And in terms of consumption, the first one, of course, is liquid fuels. The second is the nuclear fuel cycles -- that's because we both will have large nuclear enterprises.

First out, I'd like to briefly point out is liquid fuels and nuclear energy. They're actually -- they may actually be very tightly coupled. That's not generally appreciated. And the starting point, of course, is that oil is the world's primary energy source. That's important from a historical sense. The French nuclear program was driven by liquid fuels and viability of Mid-East oil. After the French-Algerian war, the '73 oil embargo -- the French, who had an oil-based electric system decided they couldn't trust the Middle East for oil and essentially their program was driven by oil security concerns. And I'd like to suggest that this may happen -- there's a potential this may happen in the future.

And of course the reason that's important to the United States and China is that they drive liquid fuel prices. Now, a couple of things I want to mention about liquid fuel prices. High-priced liquid fuels, like we have today -- $70 a barrel oil -- raises natural gas prices. And of course the singular most important event in the Mid-East in the energy game these days is the fact that the Shell Pearl Project is coming online. I mean, this is the mega project of the century: $18 billion to convert natural gas to liquid fuels in Qatar. It's got a four-year payback period. If oil goes back up to $140 a barrel it will have an 18-month payback period.

Now, you may have probably heard that Abu Dhabi is in the business of buying a couple of reactors. And I would suggest the reason they're buying a couple of reactors is they're getting very scared of high-priced gas in the Middle East. And if natural gas prices start going

through the roof because Shell and Chevron decide to build a couple of these plants, it changes the energy game rather dramatically. So be aware, there's some people out there who are busily coupling natural gas to oil prices. So, all this talk about cheap gas may or may not be true, but wait and stay tuned and see what they -- what the Chevron and the Shell have to say.

Now, the last not in this context I'd like to mention is that massive energy -- it takes massive energy consumption to convert other fossil and biomass feed stocks into liquid fuels. Thus, a central question is, what will that energy source be? A brief observation here is that unconventional liquid fuels production requires energy. I show four types of feed stocks for oil products -- heavy oil, oil sands, oil shell, and biomass. And the right column I show the fractional heat energy input required to convert these feed stocks into liquid fuels. And what you see from these numbers is when you get away from conventional oil -- from 25 to 40 percent of the energy value of the product has to be used to make gasoline and diesel fuel. And thus, if you look out a few years and you begin to see peak oil, that doesn't mean we run out of liquid fuels, it means we go to different feed stocks. Those feed stocks require absolutely incredible quantities of energy to make liquid fuels. And the question is, where does that liquid fuel come -- you know, either we double the CO2 emissions per gallon of gasoline or we find some other way to deal with the energy.

I'd like to end with one slide in this particular area. This happens to show U.S. biomass fuels yield, which depends upon the bio refinery energy source. If you took the nation's expected biomass -- renewable biomass and you lit a bonfire, it'd be equivalent to producing about 10 million barrels of oil a day, roughly speaking. If you decide to convert that same biomass into ethanol or another liquid fuel using the biomass as an energy source for the bio-refinery and as a feed stock, you get about 5 million barrels a day. If you decide to have an external energy source to convert biomass into liquid fuels, you get about 12 to 14 million barrels a day, sufficient liquid fuels to meet the total U.S. energy demand.

Now, worldwide the situation is very simple -- very similar to this. And the message here, of course, is that whether you're talking about biofuels as a boutique fuel or as a substitute for oil, comes down to the question of where do you get the energy to run a bio-

refinery? If that bio-refinery is fueled by a biomass, biomass is a boutique fuel. Makes you feel good, looks nice, not serious. That's right -- that's the bottom line. If you want to kill off oil, that's your goal, you're going to have some serious energy sources to fire up those bio-refineries. And that decision -- the decision of what fires up those bio-refineries -- determines whether you can get off of oil. So, very big decision -- and nuclear, of course, is one of the options for that -- those energy sources.

Now I'd like to turn to a second subject. Nuclear energy and the fuel cycle -- and make some general observations. The first one. In any technology, the country with the largest domestic market is most likely to drive technological development. Historically, the U.S. has led in energy technologies because we had the biggest energy market. Now, we're beginning to see, of course, in the renewables game the transformation in China. As they become the largest market for renewables they will eventually control the technology. It's unavoidable. If they're driving the demand, there will be Chinese producers to meet that demand. The experience base these guys get will make them unbeatable. That's just an unfortunate reality of the real world. It's very hard to avoid that.

Now, there's a time delay for more complex technologies. Nuclear technology is a much more complex technology and as a consequence, it takes a while for the Chinese to get geared up. But if they get geared up, they will eventually become the leaders in the technology. That implies, in the long run, that China is likely to become a major exporter of reactors. This drives down the manufacturing cost curve, and it learns about the technology.

I want to briefly mention the MIT future of nuclear fuel cycle study, because it has some relevance in the context of this discussion. As I mentioned, it was released yesterday. Key conclusions -- changing understandings of fuel cycles and new technologies are creating a much wider set of options than people have historically understood to exist. In the near term, LWR with a once-through fuel cycle is preferred for economic reasons. Today, we do not know whether LWR-spent fuel is a waste or a resource. And it's going to take some time to sort out longer term options.

In the context of the U.S. and China, a key item to note here is the U.S. and

China do not have large existing investments in advanced fuel cycles. They have not made major commitments yet. Both are thinking through the path forward, and that provides a potential basis for cooperation. If you already have made large investments, you're already heading down a particular path. But the U.S. and China are not, in that case, so the decisions have yet to be made and thus, there's a natural area for cooperation.

Last I'd like to briefly mention some obstacles and some areas of cooperation. Each brings something to the table. First we have the common liquid fuels challenge. As I say, you know, the French got off of oil for their oil burners for their electricity production because they came to the conclusion they could not tolerate the Middle East. You know, quite simple, that one. Simply said, you know, if you talk to the French privately they'll tell you, you have to be certifiably insane to base your energy system on Middle East oil. But that's currently what the U.S. and China are doing.

They may change their minds, you know. They may eventually decide that this is not the preferred way to bet your economy -- your economic future. And if they do, that changes the game very dramatically because if you have to get off of oil -- particularly Mid-East oil -- nuclear biomass, nuclear liquid fuels productions are one of the very short list of options that you have. And of course that market is, you know, half the size of the total electric market. So it's the other gorilla market out there. Hasn't been developed, but it's the other big energy market.

Now, China brings something to the table. The AP 1000, which is only developed by Westinghouse in the United States -- the lead plants are being built in China and the experienced and construction of those plants is being fed back into the AP 1000s that are being built in the United States. Now that's of course because it's the same company in both situations, and it's sort of an unusual situation. But we're now seeing tech transfer from China back to the U.S. U.S. has design experience and developed the technology and transferred to China, but the construction experience -- now they've got a change of construction strategy a little, the sequence -- that's coming back to the United States. We're already -- we're seeing a cyclic loop.

Now they have a high temperature reactor program. It's also a possibility for

liquid fuels production. And they are building some very major test facilities, including a fast reactor, on a very short schedule which prevents -- provides capabilities that we do not have. United States has some areas that can help the Chinese. In operations and safety experience -- the only way you get operational experience is to operate a lot of reactors. We've operated more reactors than anybody else for a longer period of time. We certainly lead in large scale modeling and simulation, and in some areas of advanced reactor design, such as the AP 1000, which is essentially designed in the United States.

There are, of course, a couple of obstacles. The first is commercial competition, although the nuclear business is rapidly becoming an international business. And the second one is the fact that neither side has really thought the path forward -- they have not thought about what the long term implications are where you have a nuclear enterprise that may have two or three major partners.

Thank you very much. (Applause)

MR. TAPPERT: Testing? All right. Third time is a charm.

Okay, good morning. Again, my name is John Tappert. I'm with the Nuclear Regulatory Commission. I appreciate the opportunity to speak with you this morning and share some of the Nuclear Regulatory Commission's perspectives on the importance of our relationship with China and our cooperation going forward.

Real briefly, I have a short presentation today and I'd like to give you a little background about the NRC and what we do. And specifically, about our new reactor program and our construction and vendor inspection programs, which are really the principle means for cooperation with China at this time -- at least from our perspective.

Okay. Here's the mission of the Nuclear Regulatory Commission. We're an independent regulatory agency, by that I mean we don't report to any cabinet officials. We have an independent commission who serve fixed five-year terms on a staggered basis. And the idea is to have some continuity and some independence from political pressure. And that's important to us because our mission is purely one of safety. We do not have a nuclear advocacy mission, so from our standpoint it's not the decision we would deploy or not -- it's not ours. But we -- if it is

-- if we are going forward with nuclear energy in this country, we're going to ensure that it's done safely.

And these are our major activities. First and foremost is the oversight of reactor safety in the current fleet. As been noted earlier, we have about 104 operating reactors today, which represents about 20 percent of the nation's electricity and the lion's share of the non-carbon-emitting electricity in the united states. And we had the world's largest nuclear power at this -- program at this time.

Recently we've gotten into the business of licensing and construction -- oversight of new reactors. And which I'll go into a little bit later. We also have missions associated with materials, safety oversight -- this would be radiography sources or medical isotopes used for medical treatments, as well as managing the waste stream which includes nuclear fuel and other waste items.

Again, as been noted earlier, there has not been a lot of new reactor activity in the United States, really, since 1979 until just a couple years ago. We had the accident at Three Mile Island in 1979 and that really kind of marked the end of the golden era of nuclear power within the United States. We completed some construction projects throughout the '80s, but there was really no new interest in that technology, for the accident and other economic factors.

And that was a long time ago, that was 30+ years ago. That was before many of our staff were even born. So, this really is kind of a sea change moment for us as we go forward in the nuclear renaissance, and we have to develop strategies to take that into account.

That did change a little bit in 2005 with the Energy Policy Act of 2005, which created a number of incentives for nuclear as well as other renewable technologies. And that kind of spurred renewed interest within this country for nuclear power. And currently we have about 18 license applications for reactors across the country as well as 3 design certifications, which are just the reactor technology itself -- and 3 amended design certification applications to kind of upgrade previous certifications.

This is a little top of four design certifications, which have already been issued, as well as four early site permits which just look from a safety and environmental standpoint. We

either give a location that will be suitable for a future reactor project.

This is the goals of the reactor construction program itself. It's pretty straightforward. We want to make sure that the facility that's constructed is consistent with the license and other regulatory requirements that the operational programs are in place to allow it to operate safely once that's authorized. And as with all things with the nuclear regulatory commission, we try to do things as openly, as transparently as possible. And engaging all stakeholders.

As I mentioned -- so it's been a generation since we've had -- been involved in construction in the United States. It started earlier this year at the Vogel site in Georgia, where they're building the AP 1000. And if you want to know -- we've employed a number of strategies as the NRC to get ready for them. We've tried to look to our past to try to learn the lessons from the '70s and '80s to how we could do our jobs better, and we also look to contemporary experience overseas where people are actually constructing today. We can look to Europe, where there's programs that are reengaging after a long hiatus similar to ours -- you know, like the Finns and the French can be particularly instructive. The UK is moving forward as well, looks like. And we could also look to Asia, where Japan and Korea have never stopped constructing. So we can learn how the lessons they've learned over the years.

And instructively for this session is, we looked at China where you see the Sanmen site there, which is the first AP 1000 under construction in the world, right? So they're two to three years ahead of Vogel. So if you want to know why I care about our cooperation with China, it's this. We need -- we want to learn that we want to have access for the information -- we want to learn the lessons they are learning from the construction of that project so we can feed them back to our regulatory structure and also to the licensees and constructors so we can be as efficient and effective as possible going forward.

Another program which we're responsible for is our vendor inspection program. This is a program where we send inspectors to manufacturers of the various components that are going to be going into the reactor plants. I would say, unfortunately, we've lost a lot of that manufacturing base in the United States now, so a lot of our trips are overseas to see major --

component manufacturing to ensure that quality assurance requirements are in place for future deployment.

It's a fairly modest program. We do about 10 to 20 inspections per year. And because many of these things are overseas, we try to partner with the host nations' regulatory bodies.

Okay. Now, to the main topic, which is our cooperation with China and with the nuclear safety authority there and NSA. We've had a relationship for some period of time. The first protocol was put into place in 1981. But I will say that that relationship has been really re-invigorated since China's decision to deploy the AP 1000. And we signed a memorandum of cooperation for nuclear safety in 2007 to support that.

Additionally, we've had some agreements to share safety codes, which is what that Kemp and CSARP thing is about. And earlier this year we reaffirmed some of our coordination activities for the construction and vendor inspections programs.

There's a number of forms for this cooperation. The one that the NRC is principally responsible for is the annual U.S.-Sino Steering Committee meeting. This is nuclear safety-focused, and that's what the peer-to-peer regulators. There's also the biannual U.S.-China joint commission meeting on science and technology cooperation. This is principally under the auspices of the White House and the State Department. And then finally, I think you heard about the PUNT process -- the Peaceful Uses of Nuclear Technology. And that's principally the Department of Energy and State Department participating in that activity.

We've done a lot of things since the 2007 agreement on the AP 1000. The NRC has sent a number of staff over to China to lead training seminars on the design certification and review to share our lessons learned from that review and to leverage the work that we've done.

We've also been cooperating through the multinational design evaluation program. This is a multinational, multilateral arrangement for regulators who are reviewing the same technology. There's a group for the AP 1000, the Westinghouse 1000. There's also one for the French EPR that the China and the United States are both members of. So that serves as a means to share information.

There's also issues specific committees under the MDEP umbrella, and most notable for us is the vendor inspection group where we benchmark best practices and cooperatively conduct inspections.

We have actually had staff exchanges with NSA over the last several years. I guess we've had about six NSA staff come to the United States, both in our headquarter offices as well as some of our field activities to observe some of our inspection activities. And we've actually sent some of the NRC staff to China. We had an inspector at the Sanmen site earlier this year as well as at the Shanghai regional office. And we're going to sit down with their inspector later next month. And to my knowledge, this is one of the few exchanges where we actually have American government employees going to China to share their knowledge in that manner. And then of course we have periodic annual -- semi-annual meetings and video conferences to update ourselves on the status of the agreements.

Again, we are gaining insights from this relationship to date. The AP 1000 being the principle case of interest for us. There have been lessons learned from that construction project as far as techniques and use of module fabrication technologies, which are being fed back to the United States. Conversely, going the other direction, NNSA is doing an independent review of the AP 1000 design. But they're leveraging and taking advantage of the work that the NRC staff has done in that area.

And Westinghouse has fully designed the AP 1000 to support the Sanmen project. It's one of the lessons learned from the past -- is to complete the design as much in advance of the actual construction as possible. So, Sanmen is driving that detailed design activity, which is going to be beneficial to the U.S. customers going forward.

And I didn't mention the ITAAC before, but that's a special part of our new licensing process. They -- it stands for Inspection, Test, Analysis, and Acceptance Criteria. Basically, those are the confirmatory tests to assure that the facility was constructed as consistent with the design and the licensing base. Now, that China has incorporated that into the license requirements -- it is not clear how they're going to be implemented to the regulatory processes. So we're just kind of monitoring that to see how that plays out going forward.

I mentioned that we're sending an additional inspector to Sanmen later this year. We also are sharing information on the vendor inspections -- we'll probably be doing some cooperatively (inaudible) perhaps later this year. And we intend to send a vendor inspector, actually, to Beijing probably next spring to observe activities in China.

And so that kind of concludes our remarks. I just kind of ran through that quickly, but to save us some time. So, thank you. (Applause)

MR. EBINGER: Can we get all the panelists to come up, please?

SPEAKER: (inaudible)

MR. EBINGER: 12:10? Okay. We have about 20 minutes for questions, and if I may exercise the power of the chair to ask the first, which will be somewhat controversial.

What are the chances with all the assistance that we have provided to the Chinese and the NRC and other bodies on the Westinghouse reactor that what we're going to see is a few sales and then down the road have China basically replicate our technology in the international market making it very difficult not only for Westinghouse but our other vendors to compete effectively?

MR. KONG: Well, I think there's certainly that possibility. But in the contracts signed between Westinghouse and its Chinese counterpart, as the SNPTC -- State Nuclear Power Technology Corporation. There are clauses that say that Chinese -- the Chinese nuclear company certainly has the authority to indigenize the technology. Westinghouse has to transfer all the technology 100 percent to SNPTC. But as SNPTC is also working on CAP -- CAP 1400 and CAP 1700. But when it sells that technology -- sells AP 1000, it has to work with Westinghouse, of course. And the Chinese have perfected the generation 2 and generation 2+ technologies, and I think they will sell technologies. They have already sold technologies to Pakistan. And they will be selling technologies to other countries as well, possibly Vietnam and other countries. But all those technologies -- Chinese companies don't have intellectual property rights over those technologies. And Chinese companies don't have intellectual property rights over any technologies so far. I think CAP 1000's probably the only one so far.

And so I think there -- you know, what American companies also get the money.

I -- it's just -- the issue is whether we can make sure that the process -- the Chinese exports of nuclear technologies -- are monitored and regulated in the safe and -- safe manner that's consistent with IAEA safeguards.

MR. EBINGER: Well, I'll open it up to the floor for questions. If you would identify if there's a particular panelist you'd like or the panel at large.

MR. NELL: Yeah. I don't know who to direct this to --

MR. EBINGER: Identify yourself?

MR. NELL: I'm Bill Nell with the Aspen Institute. Perhaps Dr. Forsberg. How does China dispose of their nuclear waste or plan to? And other environmental or proliferation concerns about that?

MR. FORSBERG: Near term, they're storing on site. They're working on a repository in the Gobi Desert. But I don't have any recent information of where that stands.

And they're looking at closed fuel cycles. But I don't think they've made any big decisions yet.

MR. RIMELS: Good morning, hi. Rich Rimels with Babcock Wilcox . I have a question for John. In your presentation, John, one of the things that I didn't see or hear -- maybe it's buried in the detail is -- is there a move to make an international licensing standards so that if you license a technology in any country it would be accepted in other countries?

MR. TAPPERT: I mentioned the multinational design evaluation program. But that started out as the multinational design approval program, and that was the original vision is that you would get an international stamp of approval that would be honored throughout the world.

I don't think the world was ready for that. I think it's important that the national regulator maintains its authority and responsibility to ensure the safety of every technology. So, to the extent that we can work with each other and try to leverage each other's experience and knowledge with these technologies, that's good. But I think ultimately it's going to have to be the national authority that's going to have to make a decision about whether a design is safe or not.

MR. SCHREIER: I'm Jonathan Schreier from the U.S. Department of State

policy planning staff. It's a question, I guess, largely for Dr. Forsberg, but others may have comments as well.

In cooperation on advanced fuel cycle technologies and other pre-competitive advanced reactor designs -- or other future-oriented nuclear technologies, are we better off embedding cooperation with China in a multilateral context -- for example, through mechanisms like the newly-renamed International Framework for Nuclear Energy Cooperation, which was formerly the Global Nuclear Energy Partnership and other multilateral initiatives? Or, are we better off doing it bilaterally? And if so, whichever way you go, why?

MR. FORSBERG: I don't -- haven't really thought the problem through on the multilateral. Of course, as the vendors are all becoming international. They're everywhere. And the idea of a U.S. vendor is becoming an obsolete concept.

The bilateral has an advantage. Of course, it's much easier to negotiate because you only have two people at the table. Ten people at the table makes it very hard to get an agreement, particularly if you've got some sensitive technologies that you're concerned about. So I suspect the initial route will be some bilateral because of the -- because of some of the sensitivities.

MR. MCVEIGH: Eric McVeigh, the Institute for Foreign Policy Analysis. I've heard rumors of waste disposal sites, places like Mongolia. Is there room for cooperation between the U.S. and China in developing those? And is that a realistic alternative?

MR. FORSBERG: I don't think anybody's ever approached the Chinese about that subject, so I don't know if anybody's got any current or valid information to make a judgment on it.

MR. KONG: Well there's -- the Mongolian government certainly has made announcements about its intentions to be the hub for nuclear activities, particularly in terms of nuclear waste management. But it hasn't had any action yet, and the Chinese are looking seriously at nuclear waste management programs and the -- for example, CNNC, China National Nuclear Corporation, is in cooperation with Arriva to look at some waste management programs in Western China. And so far, most wastes are stored in either onsite pools or dry casks.

MR. FRIEDMAN: Julio Friedman, Lawrence Livermore. A question for Dr. Kong. I saw on your map of where these plants are designed to be built in China -- or where the expectation is they'll be built. Surprisingly large number of them are close to very large active earthquake faults. And given the recent experiences in Xian Du, I was wondering if you could comment on either china's capacity to manage those kinds of sitting efforts well, and also in the truly unfortunate circumstance of a problem, what their capacity to marshal a mitigation response action is.

MR. KONG: Well, thank you for bringing up that question. As I said, the NNSA's -- the primary organization that is responsible for siting nuclear reactors in China. It has only a staff of 300, although it relies on a separate organization attached to the organization -- attached to NNSA. That means there are only about 1,000 people or so working on nuclear safety issues. And NNSA has to go back to some of its retired staff to get them involved in the siting process. And some of the reactors, as I said -- the one in Lushan, for example, Shandongprovince, was announced without NNSA approval. So there is this element of reckless push by localities that want to build reactors to create jobs and to grow their economy.

But I think overall, the siting process has been pretty robust. And I think that's where NRC's cooperation is essential. And when we were in Beijing we were told that the NNSA folks still do manual review processes. And they don't have the software to look at siting issues and approval of nuclear reactors.

As I understand back then, they already requested -- they sent their request to NRC for the sale of that software. I don't know the status of that purchase. I don't know if NRC has already sold that software to the Chinese -- its Chinese counterpart.

MR. TAPPERT: I don't have the status of whether that happened.

I will tell you that seismic hazards is a major element of the siting review, of course, because that's one of the biggest concerns.

MR. EBINGER: Alan?

MR. HANSEN: Alan Hansen, Arriva. The U.S. Nuclear Regulatory Commission recently had Toshiba-Westinghouse -- which, by the way, is a Japanese company, not an

American company -- redesign the containment in order to give better protection against aircraft crashes. It's my understanding from the trade press that the Chinese have refused to go back and change the design of the AP 1000s, which they are building. So I guess the question is, is this an example of what Dr. Kong called recklessness? And for John Tappert, what does this say about the potential for the multinational design approval process if on a major issue like this, two countries are so far apart.

MR. KONG: Thank you, Alan, for raising that issue. It's good to see you.

And well, I think that tells you how complacent the Chinese are about nuclear security. They would tell you, look, we've never had any nuclear security breeches in our system. And terrorism is not a big issue until recently. But I think they underestimated the threat level in the world we live in today -- and particularly after the September 11th attacks. And nuclear terrorism is real, and it's global. That's part of the effort by the Obama administration to enhance nuclear security across the world. And the Chinese NNSA administrator -- LiGanjie, for example -- openly announced that nuclear facilities in China lack the ability to withstand the attack of any -- withstand any large-scale attacks such as launched by airplane or weapons of massive destruction. And I think it probably -- it's going to be a slow process for NNSA to incorporate that design base threat level into the Chinese nuclear security.

And the other thing about nuclear security is to -- you know, the protection systems cost a lot of money. A lot of nuclear power plants simply don't want to pay the money to install those systems.

MR. TAPPERT: Yeah, I mean the -- after 9-11, we did upgrade our regulations to require new applications and new designs to be tolerant of a large aircraft impact. The Chinese have opted not to impose that requirement on their domestic facilities for the reasons that Dr. Kong mentioned. They've concluded that they can manage that threat through airline security as opposed to trying to harden the target, if you will.

I just -- I guess it goes to the point. If every national -- every government has to make its own decisions about what level of assurety and what their strategy is for ensuring that that's going to take place. All the safety systems internal to the reactor are the same. But the

only difference is how hardened it is from an external missile attack like that.

MR. EBINGER: John, what does that do in terms of -- do we put those demands on -- for our domestic reactors on our export sales? And if so, what does that do in terms of our competition when we're trying to sell something and another country will provide a reactor without that added safety and security feature?

MR. TAPPERT: The regulations that we have apply to reactors which are built and constructed in the United States. So, if a foreign vendor wanted to build a reactor (inaudible) -- Mitsubishi is applying for reactors, perhaps the Koreans are going to be coming in later -- those will have to meet our requirements.

Many governments require that design meet all of the host nations' requirements. So, I think a lot of your developing nations, when they're looking at different technologies, one of their requirements is, it meets all the requirements of its host nation. So if it's a U.S. technology that we require it meet all the U.S. NRC requirements.

So in that sense, I think normally you're going to see these things exported the way they would be built here. China is large enough and sophisticated enough to make its own decisions in a different way.

SPEAKER: I don't know how to address the question to whom. How about -- let's see -- cooperation on ETER . Is there any technological breakthrough?

SPEAKER: (inaudible)

MR. FORSBERG: So the question was, is there any advance in ETER which is noteworthy? The main noteworthy advance is that they pushed their schedule back and raised their budget substantially. They are going exactly in the wrong direction.

Contrary to that, both China and the United States and Japan -- all three countries -- have substantial inertial confinement fusion programs. And those actually are making great strides forward and provide an interesting alternative fusion technology.

MR. CHATAR: Somar Chatar from SAFE foundation.

A question -- a kind of a follow-up to what Mr. Bo Kong mentioned during his presentation about visa problems for Chinese nuclear scientists and technologist to come to the

United States. Now, the reason I'm asking that question is, now that India is also entering into a nuclear deal, that particular concern would be so, what -- on one hand, U.S. has a position that there should be free exchange of information. However, this problem of Visa does constrain and India has had a long period of frozen relationship with United States on the nuclear issue.

So, is the visa causing problems for China? And how serious is it? And will that break away China once again to go independent and end the cooperation? And what implication does that kind of thing have for India-U.S. nuclear?

MR. KONG: Well, I don't know much about nuclear energy development in India. But regarding the visa issue, I think it certainly impedes and hinders cooperation between nuclear scientists -- particularly at the laboratory level. But it won't prevent the Chinese from advancing their nuclear, you know, expansion. And as I said, the Chinese have made some serious efforts to indigenize nuclear technologies. They're working on CAP -- China AP 14000, China AP 17000. And called into the CEO and CEO of SNPTC. China will have CAP 14000 ready by 2013. And it will export the -- you know, CAP 14000 will be connected to the grid around 2017.

So I think in about 2020 we will see more exports from China of, you know, advanced reactors. But my worry is whether the world will have confidence about the integrity and the robustness of the Chinese regulatory system's ability to review its technologies. As I said, China doesn't have -- Chinese companies don't have intellectual property rights over their own technologies. So they have to prove to the world that their technologies are safe before they can sell the technologies. And nuclear reactors are not like, you know, steel pipes. That you don't have -- you know, the risks are pretty low. Reactors, you know -- so you've got to be worried about safety issues.

MR. EBINGER: I think we have time for one more question.

MR. GIANNI: Yeah, Bob Gianni , I have an energy consultancy.

Hearing the collective comments of Dr. Kong and Mr. Tappert, I get the impression that there's an awful lot being done on capacity-building for construction oversight and capacity-building on the regulatory side, which obviously will have to be sorted out. But Dr. Kong mentioned the -- what I call an expertise gap. And while they may be graduating more engineers,

they still lack trained and experienced personnel to meet the challenges of the volume of new nuclear capacity they want to have installed and running by 2020.

I mean, and that poses a problem because you can train people in terms of safety culture, in terms of -- at an initial state, but nothing really takes the place of having had the experience of actually running the plant. Where is this gap being filled? Or, how is it being filled if at all, and what's going to be done about it?

MR. KONG: CGNPC -- China Guandong Nuclear Power Company, for example, is working with Arriva to train nuclear operators. And right now, it trains about 900 operators a year. So it's pretty -- very -- it's very good progress. And universities such as Tsinghua and Jiaotong and other universities across the country have all expanded their nuclear programs. And as I said, you know, in 2004 Chinese universities only recruited about 750. Now they probably recruit at least 1,500 to 2,000 students. Then, the retired staff of all three nuclear power companies in China are called back to help out, to train fresh graduate students -- fresh students -- fresh, you know, graduates to become more experienced.

But I think it takes time. And that's where my worries are. You know, China is developing nuclear reactors at such a fast pace. And the training is not up to the speed -- is not able to keep up with the expansion. And we all hope that the -- you know, nothing will go wrong with this particular segment of this value chain. And the regulators certainly have realized their challenges, and that's why NNSA has made it clear that it will expand its staff to 1,000 from 300. But I think it takes time, because expanding the staff is not that easy. Because it involves bureaucratic, you know, reshuffle. And nobody likes, you know, bureaucratic reshuffle. And some organizations -- for example, NNSA is attached to the Ministry of Environmental Protection. Other agencies in the Ministry of Environmental Protection don't like to see the expansion of NNSA at the expense of other agencies.

MR. EBINGER: I want to thank all our panelists for a very provocative discussion, as well as the excellent questions from the floor. (Applause)

MR. EBINGER: I have been asked to tell everyone that there are boxed lunches outside. And if you would try to retrieve them as quickly as possible and come back in, we'll try to

resume the next session as quickly as possible.

Thank you.

MR. LIEBERTHAL: Can I ask people to please get seated? You can eat at your seats, but we'd like to get started.

Okay, those who are still getting lunches, can you please come in and sit down and let's begin the lunch presentation. Appreciate your balancing lunch on your laps and listening to the presentation at the same time. Our problem is we have so much we're trying to jam into a relatively brief period of time. I'd appreciate your cooperation on that.