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NUCLEAR RENAISSANCE AND THE U.S.-JAPAN ALLIANCE: FINDING NEW MARKETS AND PREVENTING PROLIFERATION

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PANEL 1: A RENAISSANCE FOR NUCLEAR POWER

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PANEL 2: PREVENTING PROLIFERATION OF FISSILE MATERIALS AND TECHNOLOGY

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P R O C E E D I N G S

CHARLES EBINGER: Good morning, ladies and gentlemen. I'm Charley Ebinger, the director of the Energy Security Initiative here at Brookings. On behalf of ESI and the Northeast Asia Program, we're delighted to have you join us today on a very important topic.

I think this meeting could not occur at a better time or a more interesting time in the future of both the nuclear power industry and the nonproliferation regime. We -- of course, in response largely to climate change concerns around the world -- we have people rethinking the nuclear option as one that does not contribute to CO2 emissions in the atmosphere. And yet, at the same time, that very changed atmosphere which portends good things for the industry, comes along with growing concerns in some circles about whether the world is really ready to have a major expansion in commercial nuclear power in terms of concerns about nonproliferation -- nuclear proliferation -- especially as more Third World countries, and some of which are in very inhospitable areas of the world, are beginning to pursue the atomic power option.

It's also a very interesting time because we have a raging debate going on in the country and the world about the adequacy of uranium supplies with some analysts saying there's absolutely no constraint on uranium supplies until well after 2100. And other people taking grave exception to that, arguing that the cost of bringing on major new uranium mines around the world, which are estimated roughly at a billion and a half dollars, portend potential shortages or at least disruptions in the market and I hope we may have an opportunity to get into some of those issues today.

Likewise, with concern about energy security always on the forefront of the international agenda, we have a raging debate on the wisdom of closing the nuclear fuel cycle as countries look at reprocessing facilities and or acquiring their own uranium enrichment facilities. So we have a debate that will obviously be pronounced in the NPT Review Conference next April about whether we should try to multilateralize enrichment and reprocessing the merits or demerits of that argument. And, of course, we also have the question of the future of the nonproliferation treaty regime in itself, with many countries, including Iran, arguing that under Article IV they should have the right to the full fuel cycle. And, of course, the United States and other powers taking a very different view.

So against that backdrop, we look forward to a very lively discussion. And before we get underway, I want to invite Mr. Iwashita to the program. He is the professor and director of the Slavic Research Center at Hokkaido University, and he wants to make some few remarks.

(Applause)

AKIHIRO IWASHITA: Thank you. Good morning, ladies and gentlemen and distinguished guests.

It is my great pleasure and honor to be here at Brookings Institution once again to host the second joint forum co-sponsored by the Slavic Research Center at Hokkaido University and the Center for the Northeast Asian Policy Studies here at Brookings.

Please allow me to take this time to thank the Brookings Institution, particularly my good friend, Kevin Scott and Dr. Shoichi Itoh here now, the CNAPS visiting fellow. And for their support and the cooperation to provide this opportunity to invite experts to share their thoughts and expertise on today's theme: nuclear renaissance and the U.S.-Japan Alliance.

It was only May 8th of this year when the Slavic Research Center on the CNAPS had our very first groundbreaking joint forum here on the U.S.-Japan Alliance beyond Northeast Asia, where we invited experts from U.S. foreign policy communities on Northeast Asia -- not only on Northeast Asia -- Russia, China, Central Asia, Middle East, South Asia, and even Europe -- to not only discuss reshaping Japan's interests in U.S. foreign policy, but also to reconfirm Japan's commitment in those areas.

I have made it clear then, but I would say that once again here, a joint forum to bring together expertise from various areas -- various study areas to address common concerns that surround and affect us today, and to move toward direction for constructive and rational deliberation to advocate and promote more sound foreign policies are not only important for the United States and Japan, but also the international community as a whole. It is our responsibility to continue this joint venture. The world has witnessed a historical moment for nuclear weapons disarmament. This is the United States' President Obama's declaration in Prague. However, while continuous commitment for nuclear weapons disarmament is imperative, so is a vigorous discussion and cooperation on nuclear energy source.

To quote President Obama, "we should build a new framework for civil nuclear cooperation, including an international fuel bank, so that countries can access peaceful power without increasing the risk of proliferation." We are gathered today here to consider the possibility of a plausible framework to facilitate the peaceful use of nuclear power, I think. The significance and impact of this forum are obvious. To borrow the President's words again, together we can do it.

As director of the Slavic Research Center, allow me to end with a few words on our current projects at the Center. We have just launched the Global Center of Excellence Program on reshaping Japan's border studies, maybe you look at this symbol of the globe. The objective of this project is to bring together area studies experts from not only Slavic and Eurasian regions, but from other regions in the international community, to consider all kinds of border-related issues and topics.

Nuclear issues are also in our border studies project. This project is in line with our ongoing mission to establish a new methodology to compare similar phenomena that transcends the current segregated area studies discourse to promote peace and stability

around the world. This joint forum, to a certain degree, is one of our initiatives for this mission. Part of this forum has been funded -- partly funded -- by this project.

I'd like to extend my invitation to experts here today to join us in this mission. I look forward to your continued support and future collaboration.

Thank you again to the Brookings Institution, and the invited guests, and the audience that have made this joint forum possible. Thank you very much.

(Applause)

MR. EBINGER: If I could get our first panel to come on up.

We are very fortunate today to have both our panels comprise some of the leading nuclear energy experts from both the United States and Japan. So I hope we can have a very stimulating discussion. You have detailed biographies on the handouts, so I'll just make brief introductions.

On our first panel we have Dr. Suzuki, who is a senior research scientist at the Socio-economic Research Center, which is part of the Central Research Institute of the Electric Power Industry in Japan. He is a distinguished professor with a long list of publications in the nuclear energy field. I'm particularly interested to see that he works with the Institute of Energy Economics -- which to show how old I am, I had the privilege of doing a book some 25 years ago. So it's nice to have a new connection again with your institution.

And we also have Dr. Charles Ferguson, who is well known in the nuclear energy and nonproliferation field. Charles is with the Council on Foreign Relations. He's an adjunct professor at Georgetown University, and his vast array of writings, in many fields, include expertise in arms control, climate change, energy policy, and nuclear and other international terrorism. A man of truly catholic interests. We're delighted he can join us here today.

So, I would urge, so we have plenty of time for questions, if at all possible that maybe we'd speak for 20 minutes and then we'll have adequate time for questions.

So, Dr. Suzuki.

TATSUJIRO SUZUKI: Good morning. I should start with this -- I think this is it. Yes.

Thank you very much. My talk is on global trends of the international nuclear market and particularly, issues for Japan. And since the time is limited, I will focus on key issues.

Let's quickly go over what's the status of nuclear power right now. This is the numbers that you want to remember. At the end of April in 2009, which is (inaudible), 436 reactors, a total capacity of 370 gigawatts, and about 80 percent capacity is in OECD countries still. But if you look at the numbers under construction, 60 percent of the new construction is in Asia. When you say Asia, it's basically Japan, South Korea, and China. And now India are coming. So those four countries are the main countries who are planning to increase the number of nuclear power plants. And there are many other small -- many other countries who hope to introduce nuclear power I will introduce later, but in terms of capacity, those are the four countries dominant in the next 10, 20 years. About 16 percent of the power production -- global power production -- comes from nuclear power.

So remember these numbers -- 60 percent and 370 gigawatts. They are key numbers to remember.

And this is the past nuclear power growth. As you can see, the rapid growth in the 70s, 80s, but in the 90s, almost flat. Maybe it's hard to see, but the power production is still increasing even though the capacity of nuclear power remains flat, which means the capacity factor -- the utilization factor -- of nuclear power is improving. And this trend will continue hopefully, even though you don't have to -- even if you cannot build a new nuclear power plant, you can still increase the power production of nuclear power. That is a good thing for the energy and environment.

But if you look at this number, as I said, the share of nuclear power -- global nuclear share -- is only 16 percent. And if you don't do anything, the share of nuclear power declines. Let's say at the bottom --

Do you have a pointer?

Can you see the 50 percent right now? If you don't do anything by 2030, the share will decline 10 percent. Particularly in OECD Europe, the share will decline from 28 percent to 12 percent. So if the share declines, then you have to burn something else for power production, and most likely fossil fuel, maybe some renewable energies. But it's likely that the carbon dioxide emissions will increase.

So in order to keep the power growth of the demand in all the world, you have to maintain -- you want to maintain the share of nuclear power. So OECD is suggesting you have to maintain a share of 40 percent, then you have to build more power plants. So probably roughly 1.5 times the power demand will increase, so that's the goal of nuclear power in order to meet the energy demand from particularly developing countries.

The reason why the share will decrease is that the reactor is getting old. When you build a reactor in the 70s and 80s, the average lifetime -- let's say 40 years -- then you have to retire many reactors before 2025. According to this estimate done by Mycle Schneider and his group, by 2025, 260 reactors and 225 gigawatts need to be replaced. So those numbers itself are very good numbers for nuclear industry. We have to build those reactors.

In order to meet those demands, you need capacity to develop the nuclear power. If you don't do that, the share will decrease. So that's the status of the nuclear market right now.

Further, by 2050, how much reactor you need? This is a good number to remember also. MIT did a study in 2003, and by 2050 the total nuclear capacity should reach about 1,000 gigawatts. Remember, 370 gigabytes is the current number, so it's roughly three times the nuclear power you need by 2050. So, even if you increase this share -- I mean, if you increase three times the global nuclear share, it's roughly the same; a little bit increase, two percent increase, also.

So OECD IAEA also suggested even bigger than this: 1,250 gigawatts to meet the climate change target to reduce CO2 by 50 percent by 2050. So that's the number you want to remember. If you want to increase the nuclear power to meet the climate change challenge, you have to increase about three times the nuclear power in the world.

So that's a big challenge for nuclear industry because in the past it was very difficult to do that. In the 1970s, IAEA -- International Atomic Energy Agency -- predicted by 1990 it will reach -- the global nuclear capacity -- will reach 1,000 gigawatts. It never reached, of course. In 1977, it says by 2000 it will reach almost 1,400 gigawatts. And even in 1982, the expected increase they predicted 1,000 gigawatts by 2010, it never realized. And in 2001, they just thought that the capacity would be flat. It's more realistic. Now, IAEA is projecting roughly 600 gigawatts by 2030. That's the number we are hoping to reach to meet the climate change challenge. So this is our expectation and high expectation in the past, but it wasn't that easy to reach the target. So it's a big challenge for the nuclear industry.

All right. Then I'm going to talk about issues for Japan, basically three things. One is the changing global nuclear energy market -- industry market. This is a very interesting time. And also Japan is more active in nuclear diplomacy. And finally, talk about spent fuel management, which is a big issue for nonproliferation.

In Japan, the reactor -- there are two types of reactor currently in the world. Basically, PWR, pressurized water reactor, and boiling water reactor, BWR. In Japan, the market almost split. GE, Toshiba, Hitachi is supplying BWR; Westinghouse and Mitsubishi is supplying PWR. But the global market is a little bit different. Eighty percent of the capacity is PWR.

So, in the future what's going to happen to those groups? It's a very complicated chart, but until 1980s, 1990s, basically national -- Japan and the U.S., France, Germany -- all countries have their own national vendors. But no longer right now. They are collaborating, merging, so it's a complicated industry structure. If you look at the left hand side, AREVA, the French reactor vendor, is now merging with Germany, and they are supplying EPR, European pressurized reactor. And this is all under construction in Europe.

MHI used to team up with Westinghouse, but now Westinghouse is bought by Toshiba. So Toshiba and Westinghouse are working together to supply 81,000 PWR new reactors. Toshiba used to be working with GE and Hitachi supplying BWR, so now GE and Hitachi are working supplying BWR called ESBWR and also ABWR. So Toshiba can supply both BWR and PWR, so it's a very good position in the global market. Using Westinghouse global market -- Westinghouse supplying PWR all over the world -- Toshiba is now in a very good position for the global market.

This is maybe too small to see, but in the United States there are about 26 reactors under license. And then if you can see, there are many AP1000 Westinghouse reactor-type. Now it's purchased by Toshiba so it's Japanese-American reactor. And also ESBWR, which used to be GE; now GE and Hitachi are supplying. There's an interesting competition right now in the United States.

This Toshiba Westinghouse purchase -- Toshiba purchased Westinghouse three years ago -- has changed the nuclear industry structure very much strongly. As I said, it's no longer Toshiba, Hitachi, GE versus Westinghouse, Mitsubishi. Now, it's so complicated -- there was a talk actually with the shrinking Japanese market, maybe Toshiba, Hitachi, and Mitsubishi can join together to form one vendor group in Japan. It never happened. So the Japanese nuclear industry now is split, fighting each other inside Japan.

The three nuclear groups are fighting in the global nuclear market. It's very competitive. Very competitive. METI used to have a project called Japanese flag light water reactor project, which means, as I said, they want to export the Japanese reactor with the Japanese flag. But it's no longer possible because when you say Westinghouse, it's an American flag -- used to be -- but it's now with a Japanese flag, also. And Hitachi GE is also a Japanese flag and an American flag. AREVA is a French flag and also a German flag. So it's not that easy to define which country owns which reactor vendor.

So, this is no longer a simple market to describe. If the French want to export a French reactor, it's no longer just the French government. You have to talk with the German government. The same thing for Japan and the United States.

The strength and weakness of the Japanese market is the Japanese market was a steady market, so they have a strong knowledge of construction -- manufacturing of a nuclear reactor. So that's a big advantage. Also, they have very good high quality and their seismic design is also very good. In particular, efficient construction management is very -- a Japanese advantage. However, weakness -- this is a key weakness -- Japan doesn't have natural uranium and also fuel exporting capability. Right now, if you want to export a reactor, you have to have nuclear fuel cycle capability as a package. So that's the problem with the Japanese reactor vendor. But now Japan can have a collaboration, a team, with the U.S. market -- U.S. vendor. Then you can have a strong team, including the nuclear fuel cycle.

And since Japan doesn't have uranium, the government wants to secure nuclear uranium fuel and also enrichment capacity to team up with the Japanese vendor.

This is Japanese more active nuclear diplomacy. And particularly interesting is resource diplomacy. This is -- three years ago, Koizumi, Prime Minister Koizumi, for the first time in Japan history, he went to Kazakhstan to make a deal to purchase uranium with a big package -- financial package -- to help development in Kazakhstan. This is a new trend, the Japan is more active in resource diplomacy, and also the help -- the U.S. reactor market -- the Japanese government is willing to provide loan guarantee for nuclear reactor export to the United States. This is also very new.

And now they are also very active in negotiations with reaching a bilateral agreement with developing countries. And, yes, this is in Japanese, but if you see national flag, Japan is now collaborating with different -- very active in negotiating bilateral agreements with Vietnam, China, Kazakhstan, UAE, France, of course, and Indonesia. And this is, unlike 10 years ago, the Japanese were very cautious in negotiating with bilateral agreements, but that's no longer the case. It is very active now.

But the key country, India, Japan is still very cautious. And although they support it unanimously with Nuclear Suppliers Group meeting with the U.S.-India cooperation, right now they have not committed to export reactors to India. And also, the Japanese introducing stronger export control and physical protection issues.

Let me go very quickly. This is the complicated nature of the Japanese market. If Japanese vendors want to export to India, they cannot do it right now. But they have a team with the USA. So if the USA has a bilateral agreement with India, if they sell a reactor, Toshiba possibly can export. But it's not clear because there is a component still in Japan. So they cannot export a component without bilateral agreements.

Meanwhile, Russia and France already have an agreement with India. So under the competing market, this is a very difficult situation. How long Japan can say no to cooperation with India? The vendors are willing to export to India, and so this is a tough situation right now in Japanese market.

Okay, let's move on to the spent fuel waste management. This is key issues for both civilian nuclear power program and nonproliferation. Because spent fuel -- 1 percent of spent fuel is plutonium and if you want to recycle plutonium, you have to separate plutonium. Then the plutonium can be used for weapons purposes. So spent fuel management is key for both civilian nuclear power and the proliferation issues.

The problem is that the spent fuel is piling up in the reactor site. And the pool capacity, if the pool is full, you cannot operate nuclear power plants anymore; you have to shut down. So you have to move out the spent fuel to somewhere else. And for Japanese case, the best place is for a reprocessing plant to recycle plutonium. And that's why plutonium is piling up in Japan. And how to reconcile the spent fuel management and also proliferation risk is a big issue. And also for civilian purposes, reprocessing is very expensive. So back in the fuel cycle, the financial political risk is very high.

So, the best solution to my mind, my idea, is to securing the spent fuel storage. If you have capacity to store spent fuel storage, you don't need to reprocess. So that's the best way to avoid unnecessary reprocessing. But that's easy to say, but in reality it's very difficult.

If you reprocess, you have (inaudible) plutonium. This is the plutonium stockpile from civilian sources, as well as military stockpile. Globally roughly 500 tons of plutonium are now in stock and half of it is civilian. As you can see, France, Japan, Russia, and U.K. are piling up the plutonium because those are the four countries that continue to reprocess.

And the stockpile is increasing. And France, Japan, Russia, U.K. -- those four countries continue to reprocess. And they have -- France and Japan are planning to use those plutonium, but it is not catching up. So the stockpile is increasing. So that's a huge concern for proliferation.

And Japan continues to reprocess -- if Japan continues to reprocess, it's going to pile up until more than probably 40 tons in 2010. And eventually going down. Germany stopped reprocessing, so if you use plutonium, the stockpile is going down. So there's a need for Japan to control their stockpile management, which means also spent fuel management.

And one of the approaches, the so-called multilateral nuclear fuel cycle approach, is proposed by -- which is proposed by ElBaradei. And I've been studying the condition for successful multilateral approach. I propose three conditions. One is universality because the past proposal mostly proposed by countries who have nuclear fuel cycle facilities. So that's why the countries who do not have a facility oppose it. They never work out.

And also it's important to have a transparency. And also the economic viability is very important.

And I don't have much time to go into detail, but we formed a group this year to propose specific recommendations for a nuclear fuel cycle arrangement from Japan. I proposed -- we proposed five packages. The first one we have to reduce the sensitive nuclear materials, particularly plutonium. So don't reprocess before you use an existing stockpile. And if you want to use plutonium, you have to specify the demand. Otherwise, you cannot reprocess. That's the first principle.

The second one, all nuclear fuel cycle facilities should be internationalized without any exception. And the countries who want to have a nuclear facility -- nuclear fuel cycle facility, you should seek for international partner to make sure that transparency will be increased and also number of facilities will be decreased in the future. And also the suppliers and the recipient countries should develop a joint stockpile for nuclear fuel assurance.

The third is a voluntary code of conduct for nuclear industry for nonproliferation. And also we propose that the government and industry should develop a nonproliferation disarmament fund.

The fourth proposal is to -- it is a good time for Japan to reexamine nuclear fuel cycle policy. Right now Rokkasho reprocessing plant is stopped. It's a good time to think about what the future of the nuclear fuel cycle. And an advanced nuclear power program which does not involve sensitive nuclear material should be developed further. Japan has a very good technology base for that.

And finally, for nuclear security, Japan should apply the best practices and promote such best practices in the world through international cooperation.

Okay. That's the end of my presentation. Thank you very much.

(Applause)

CHARLES FERGUSON: Well, good morning, everyone. And thank you, Charley, for such a great introduction. He said my vast publication record. It's kind of publish or perish. But it's kept me off the street.

This has been a very exciting time for nuclear energy and nuclear issues in general, especially nonproliferation policy. And I'll hope to segue into the nonproliferation panel at the end of my remarks today.

Well, I was in Tokyo last week with Dr. Suzuki and Professor Akiyama and other dear colleagues. And when I got the invitation to speak here and I saw also David Albright was going to be speaking on the next panel, I was reminded of that famous line from the movie, Casablanca, "First, round up the usual suspects." (Laughter)

So, here we are. So hopefully we'll provide some insights to you today.

You'll also get a feeling of déjà vu when you see some of my slides. You'll see Dr. Suzuki and I did not coordinate in advance. In fact, I was working on this yesterday evening. I told my class at Georgetown I had to hurry home because I'm still working on my talk. So I have some of the same slides, so I'll kind of breeze through some of those and just dwell on some other things that he said or some other things that weren't said.

Well, here's the agenda. So, I'll cover a brief overview of historic and current use of nuclear energy worldwide. Then we'll get into projections for future use and ask will there actually be a renaissance. I think Dr. Suzuki has raised some question marks there, as well. We'll look at increasing globalization of nuclear industry as he mentioned, as well. We'll look at then, getting into the subject matter of today's workshop, how effective have GE, Hitachi, and Toshiba-Westinghouse, those collaborations, been in gaining market share and potential future market share, especially looking at India's opening market and

other markets. Especially, if we have a couple dozen new countries express interest in getting nuclear power plants.

And then we'll segue into my closing remarks, looking at not just nuclear energy, but kind of the bigger picture -- security and energy use worldwide.

We've seen this slide before. (Laughter) So moving right along. You've seen a lot of this already, as well. He said about 16 percent. It depends on kind of what year and figures you use, 15, 16 percent. Pretty much in the same ballpark. But we both agree -- we're both citing the same source -- 370 gigawatts of electrical power as of the end of last year. And here I have a bullet point showing you basically what a gigawatt of electrical power can provide. And certainly in developed countries. Think of a city, like Washington, D.C. -- sort of metropolitan areas. So D.C. proper has roughly half a million people. You look at surrounding suburbs, roughly a million people. So you need basically kind of a large nuclear power plant to provide the electricity need for this area, to give you a reference point.

Eleven countries are involved in the enrichment business of uranium, and five countries are involved in reprocessing spent fuel, extractable plutonium, for either use in mixed oxide or MOX fuel or proposed use of MOX as in Japan. And it's very important to point out no countries, right now, have a permanent geologic repository for spent fuel. But, you know, some countries are getting close. Sweden, Finland in particular this year said they're getting close, moving along. France has a very active program. I was in France in April. They're getting close to perhaps making a decision sometime soon. But the first repository probably isn't going to open at least until 2020. And I won't get into Yucca Mountain. We could spend all day talking about that.

Here's a slide you haven't seen before. It shows you all the 30-some countries using nuclear energy to generate electricity in the world. And here are figures as of the end of 2007 showing net electrical energy that had been generated. And you see the United States is in the lead. Often people think France is in the lead because France is generating 77, 78 percent of its electricity from nuclear power. No, indeed, the USA is still number one in this area with our 104 nuclear reactors. But 19 percent of our electricity comes from nuclear. France is second. Japan is in third place. And then you can see going on down the line.

Well, Dr. Suzuki mentioned a number of reactors currently under construction. I'll get into that later on in my talk, but I think it's important to briefly look at how this has fluctuated over the last decade or two. And you see anywhere from a high of 53 -- we're back up to around 53 now depending on how you count -- down to a low of 26. It's important to realize, a lot of these reactors under construction had been on the books for a couple of decades, in some cases more than three decades as in the case of Watts Barr 2. That project began in the early 1970s here in the United States and has yet to be completed.

Well, just looking at very recent developments in the past year or two, as of summer this year, International Atomic Energy Agency listed 436 operating nuclear reactors

in the world. And that's eight less than in 2002, which was the peak year. But as Dr. Suzuki pointed out and you saw on the other slide, the previous year was actually a peak year of power generation because of the capacity up-ratings the capacity factor has gone up, and there have been a lot of safety improvements and kept the downtime at plants, you know, low. And so nuclear power has been able to still maintain the level it has been over roughly the last decade.

It's important to note that last year for the first time in commercial nuclear power plant history, no new unit actually went online. That may change dramatically in coming years, especially with a lot of the construction going on in China. Also in 2008, three reactors were actually shut down, and the total installed capacity that last year actually went down about 1,600 megawatts of electrical power. And that's equivalent to one EPR -- European pressurized water reactor -- that AREVA is building in Finland and France.

Here I'm taking something that I worked on with my research associate, Michelle Smith, and that we published in Foreign Policy Magazine earlier this year. This -- these numbers are a moving target so don't focus too much on some of the specific figures, especially China and India, because those figures are changing almost as we speak. But this gives you an interesting snapshot of the expressed interest in a number of countries that don't have nuclear power plants. You see they're kind of colored in that sort of tan brown shade. And then you'll see about 30-some countries that have nuclear power. The triangles represent the number of reactors that are under construction. And that's changed somewhat since we've done this graph, but it's roughly where it was about a year ago. And you also see in the numerals the number of reactors that are proposed in various countries. And you see in the U.S., we have up to 32 reactors that could potentially be built if all the licenses are approved, if all the funding goes through, everything goes through smoothly, we might have that number under construction in the coming, say, 10, 20 years or so.

Well, there are a lot of barriers to nuclear construction, as many of you know. Three of the big barriers are financing or cost, long construction time -- actually long project time, don't look at the construction time but the whole project completion time -- and the number of personnel, highly qualified people that are required to build these high technology projects. And so you can see the range of estimates of the cost figures -- the so-called overnight costs -- and the project completion time. That project completion time may be much shorter in China, for instance, with the labor cost and their ability to streamline things because of one-party rule. They've been able to shrink that construction time much faster than we've seen in the U.S. or some European countries.

Well, nuclear power usage also depends pretty significantly on governments and government policy, government incentives, the ability to streamline regulations or not, the ability to offer loan guarantees through federal programs or other types of programs offering credits on companies' taxes, and there are all sorts of other additional incentives that could be offered. I'm not saying that this is right or wrong; I'm just saying it's a fact of life. It's a fact of life for any energy source industry. So we need to be honest about it.

It's also probably true that if we can get some type of fee on carbon emissions -- greenhouse gas emissions -- in the United States and increasingly other countries, nuclear power is going to look a lot more competitive compared to fossil fuel sources. However, that depends strongly on fossil fuel availability and pricing, especially when you look at natural gas availability and prices. Natural gas prices are pretty low right now. Yeah, I know we're in the doldrums in terms of the economy and that has a significant effect, but we've seen a lot of new natural gas reserves being discovered. And that is going to have a major effect on the ability to finance and get new nuclear projects off the ground.

What we see is that when you look at capital construction costs, they tend to be high for nuclear, very low for natural gas, and somewhere in the middle for coal. And it's an inverse relationship when it comes to fuel costs. Nuclear fuel costs tend to be low, natural gas costs historically have been kind of high, but they fluctuated a lot. Now they're kind of low. And coal prices are somewhere in the middle. And so this really comes down to financing. It reminds me of a presidential campaign slogan, "it's economy, smarty."

Well, even if we get a lot of new reactors being built in major developing countries, such as China, Brazil, and India, that's good. But we need to realize that for the next couple of decades those countries will still generate a small fraction of electricity from nuclear power. And they're going to rely, especially in China and India, increasingly on coal. Brazil has a lot of hydra they can draw from. But we need to just face the fact of life that China and India, in particular, are going to be using a lot of fossil fuels.

Well, to try to put some numbers on the rate of construction needed to try to just keep pace with 15 or 16 percent of global electricity generated by nuclear, if we just want to keep running on that treadmill on an even pace, how fast do we have to bring online nuclear power plants? Well, you can do the calculation. And if you have a benchmark of 1,000 megawatt electrical power rating plant -- I know some of the newer plants coming online are higher rating, so some are up to 1,600 megawatts electrical. But just as a ballpark figure, if you bring online a 1,000 megawatt electric plant, you need to bring that online roughly every 16 days for the next 21 years in order to keep pace with the global share of electrical energy from nuclear.

Now, let's look at climate change because many people are saying nuclear can play an increasing role in countering climate change. And nuclear has played a significant role so far in reducing greenhouse gas emissions. That's a fact. Can it do more? It can, but in order to do more -- to take even a one-seventh slice -- and I pick one-seventh because I'm calling on the Pacala-Socolow Wedge Model from 2004 -- two Princeton researchers published a seminal article in Science Magazine showing 15 technologies that we could deploy and if you pick seven of them and one of those seven would reduce a billion tons of greenhouse gas emissions per year by 2050 -- mid-century -- if you just look at the nuclear slice, you would have to bring online one of these 1,000 megawatt electrical plants roughly every 14 days or every two weeks between now and mid-century.

Well, is that impossible? No. It's been done before. If you go back to the heyday of the 1980s, especially when you look at construction going on in Japan, and

France, and even in the United States and some other countries, we were basically building pretty much at that rate. What I'm saying is you have to then replicate that rate of construction for the next four decades or so. That's going to be very daunting and it's going to require a lot of, you know, serious thought about industry competitiveness and collaboration and competition with other sources of energy.

Looking at energy capacity projections, here I'm using EIA figures -- Energy Information Agency figures. And you look at -- I'm using 2006 as kind of a benchmark projecting out to 2030 -- it's kind of a business as usual-type projections -- you'll see that nuclear -- they're projecting it's going to go up somewhat, but it's important to note nuclear compared to coal or especially liquids, i.e., mainly petroleum, is still a very small fraction of worldwide energy use.

And here is another kind of look at in the bar chart and showing how nuclear compares to renewables. Renewables here includes hydro, as well as wind and solar. So most renewables are actually hydropower, not wind and solar. Wind and solar are still pretty much niche technologies. Natural gas, increasing share, and coal you can see also keeps going up. The liquids, i.e., petroleum, pretty much stays relatively steady compared to the other ones.

You've seen this chart before and I title this more of a pessimistic or maybe realistic-type projection based on Mycle Schneider's take. Now, here it's important to point out the fine print is that this is based on a 40-year mean lifetime. Now, that's based on kind of historical practice and nominal licensing, but we've seen that begin to change, especially in the United States. Because if you plot out -- if you assume that we get 20-year life extensions for all the existing 104 reactors in the U.S., that's going to extend out for another 20 years of the 40-year lifetime. And we see roughly a 30 or so, maybe up to 40, of the U.S. reactors either having received a license extension in the last few years or on the verge of getting one. And I'm going to project that most of these reactors are probably going to get life extensions. Let's be generous and say all of them get that.

And so assuming that and assuming that there's no new construction, what we'll see is that we reach a retirement cliff just a few years after 2030. We don't get additional life extensions, say out to 80 years -- and there's some talk about that, but that's still very speculative. We're going to be forced to start decommissioning a lot of these U.S. reactors. Now, they say, you know, that's 20-some years from now, you know, that's almost a whole generation in terms of the human lifetime. Well, but those of you who follow the industry know that's almost tomorrow. We need to start planning for that today in order to be ready for this event. Otherwise, we're going to see a steep declining share of nuclear energy to produce electricity in the United States.

Okay, getting into the whole issue of the alliance between Japan and the U.S. and how competitive it is compared to other vendors. And as Dr. Suzuki mentioned, it's a very globalized industry now. It's very complicated. A chart -- a diagram you can use here -- I'm just showing some pictures just to indicate what's at stake. If you look at the market share by vendor, and here I'm using data from AREVA. So, I don't know, maybe take it

with a grain of salt. I think it's good data, but here you'll see -- Dr. Suzuki was mentioning AREVA offers the whole suite of services.

The frontend, the enrichment, fuel services, reactors, other services to maintain the reactors, and then the backend which involves spent fuel recycling or reprocessing as some would say. And then you see AREVA, if you add up the market share they have on all those three areas, they surpass the other vendors. And then the FAAE is basically the Russians. The Russians are also vertically integrated. They offer all three areas of services. And then Westinghouse Toshiba, that collaboration is -- if you put them together, they're number three. But actually, if you put GE Nuclear and Hitachi, if you stack them together, they would actually be number three in this list, and then Westinghouse Toshiba, and then Mitsubishi Heavy Industries. Then USEC, the United States Enrichment Corporation, which basically just does uranium enrichment and a few other services, and then URENCO, another enrichment company and Canaco, also on the frontend as well. And AECL is the Canadian-owned nuclear industry.

All right. So now if we look at what's happening today in terms of reactors under construction and what designs are actually being built? Who are these designs? What are these designs based on? Well, it depends on -- the number of reactors under construction actually depends on how you count it up. So if you look at the IAEA, their database says 53, but a number of those are sort of kind of oddball reactors because I know Dr. Suzuki mentioned 45 or 46. There are seven or eight in there you can say, hmm, you know, they've been on the books for a while. There may be some smaller reactors in Russia. And so if you just look at the larger commercial reactors -- so the PWRs, BWRs -- there are roughly 45 or 46. So that's why if you add up the numbers in my bar charts here they don't quite add up to 53.

What you'll find is that more than two-thirds of the reactors under construction are in four countries right now -- China, India, Russia, South Korea. And you'll see that also two-thirds of the reactors under construction are either of Russian design or Chinese/French-derived design. Because China had a tech transfer agreement with France, so China has been making a lot of these replication reactors some people call them -- the CPR1000 series. So there are several of those right now that are under construction.

So then when you go away from the Russian and Chinese plants being built and you look at the U.S.-Japanese collaboration or what the U.S. and Japan have done individually, you'll see that they have about 12 reactors right now under construction, and the Indians have three of their kind of indigenous/Canadian-derived designs under construction. And the French have two of their EPRs under construction in Finland and in France.

Well, if you exclude the reactors that have been on the books for, you know, more than 20 years and you just look at the activity, say, over the last 10 years, you'll see that the Russian column goes pretty far down based on where it was before. The Chinese column is still pretty high because China has been recently entering into this new construction in the last really couple of years, especially with their designs based on the

French tech transfer design. And then you'll see more than a quarter of the other reactors under construction in the last 10 years are from the U.S.-Japanese commercial alliance or from U.S. and Japanese companies prior to alliances being formed.

So then I was asked a question of how does the U.S.-Japan alliance compare to what the French and the Russians are doing? And it appears to my look at the data and also my research associate's look at the data that the French and Russian firms have a bit of an edge right now in signing up agreements or nearing agreements with countries in the emerging markets. And we have in particular seen that since 2006, that President Sarkozy and AREVA CEO Anne Lauvergeon have been very active in trotting the globe, especially in the Middle East and North Africa, signing a lot of agreements. And now also signed some agreements in Southeast Asia with Thailand and Vietnam. And they seem to have a bit of an edge with the United Arab Emirates. That deal has -- it's going through. Just a few days ago it basically quietly passed Congress. There were really no major objections raised. So there are $40 billion projects at stake right now in the UAE. And it could be a winner-take-all situation. So we're talking about maybe four or five, maybe even six reactors they want to bring online say in the next maybe 10, 15 years. And so, you know, AREVA appears to be somewhat in the lead right now according to a lot of analysts. U.S.-Japan collaboration does have a horse in that race right now, and so does Korea. So really those are the three entities right now where they're trying to get that $40 billion market.

The Russians have also been pretty active. They've signed agreements. Belarus, Jordan, Nigeria, and Turkey -- it's not clear whether they'll actually build reactors in those countries, but as we know, they have been building in India and also Iran. The U.S. hasn't been too far behind. Professor Suzuki already talked about Japan's agreement, so I won't mention that. I'll just say that the U.S. has signed some new agreements with countries in the Middle East and also other parts of the world; Egypt, Indonesia, India, Morocco, and the UAE are worth mentioning.

So, speaking of India, how does that stand right now? I know Dr. Suzuki mentioned that as well. Let me just focus on what's been happening recently since the deal has been signed. I know a lot of angst was -- appeared here in Washington over the last few years about this deal. And it's gone through. And part of the deal is that India has agreed to put those new reactors under safeguards. But it's very important to mention that there will still be no really real constraints on India's weapons program. They can still make plenty of plutonium for their bombs if they wanted to.

But in terms of actual commercial contracts, Secretary Clinton went to New Delhi in July, and she basically got a diplomatic agreement from the Indian government that certain sites would be open to the U.S.-Japan collaboration. And, in fact, just two weeks ago -- you'll read in Nucleonics Week -- that GE Hitachi with their ABWR technology is slated for a site in Gujarat State. And Westinghouse Toshiba with the AP1000 is slated for a site in Andhra Pradesh. And I don't know exactly how many reactors may be built at those sites, but it appears that the U.S.-Japan collaboration will get some slice of that emerging market.

Dr. Suzuki mentioned some hurdles on the Japan side for this deal. Let me mention two that are relevant for the U.S. side. India has still yet to finalize a liability agreement that's needed for U.S. vendors. And I know there's a lot of different liability agreements that are out there in the world. The U.S. prefers the Convention on Supplementary Compensation -- CSC -- and is still trying to get India to complete that. It's my understanding -- I'm not a lawyer, but if there's a lawyer in the audience; I see some actually. They can correct me if I'm wrong, but that's a major stumbling block. And the other one is that India would like to reprocess U.S. origin spent fuel, and we still have yet to resolve that issue.

Now, quickly turning to larger global issues and segueing into the nonproliferation topic, I think we need to understand that nuclear energy is embedded very much in a global energy system and also a global security concerns. And I mentioned Iran previously, so that's an outstanding example of that, and the concerns that if Iran goes ahead with a nuclear weapons program, we might see a so-called cascade of proliferation in the Middle East.

Well, 31 years ago a law was passed in the United States called a Nuclear Nonproliferation Act. And in Title V it said that the United States should carry out an assessment of alternative energies, fossil fuels and nuclear energy, considering nonproliferation and economic factors. We have yet to follow through with that law. Now, this is something that really needs to be done, especially as the developing world is desperate for new energy sources. And we've got to be realistic. Most of the developing world is not going to be ready for nuclear power plants. And they're going to have -- need other means of support. They might have to turn to some more efficient use of fossil fuels, as well. As well as renewables. So we need to really look at this in a very comprehensive way.

Dr. Suzuki did a great job talking about the fuel cycle issues. I'll just amplify one of his points. We need to pursue a nondiscriminatory approach when we talk about these -- not just talk about it, but when we actually truly implement and design these proposals for the developing world. We saw major pushback in July at the IAEA from a lot of developing nations saying they felt that their rights were not being respected.

Well, speaking of the developing world, there's an urgent need to really do a comprehensive integrated assessment of these countries' energy needs and weighing all the costs, all the benefits, including security costs, safety, every cost -- environmental cost, as well. And looking at the energy security standpoint. And that could be a whole workshop in itself. So I've got to be very brief because my time is running out.

I will mention though in terms of the nuclear area, there is some interesting work being done, especially by Toshiba. They've been investigating what are called micro nuclear reactors, and also the 4S reactor, which are down to a level of about 10 megawatts of electrical power. And they can also be upwards of the small and medium power reactors, a couple hundred megawatts up to 400-600 megawatts electrical power. And depending on how these reactors are designed, they can offer some proliferation resistant benefits. You

can have, in fact, a nuclear battery; you can deliver to a country; and you can basically plug it into the grid, pretty much leave it alone is my understanding -- of course, you have to be fully carried out -- and then you would have power for anywhere from 10 to 30 years depending on how this thing is fueled. And you could then once it's done unplug it, take it back to the supplier country, and so the client country would not have to deal with any of the nuclear waste issue as well. That would all be worked into the package.

So, there's a lot of hurdles to cross for those technologies to see the commercial market. One of the big ones is the regulatory hurdle. And the Nuclear Regulatory Commission was asked a couple of years ago by Toshiba to begin to review these types of reactors. And the commissioner said we'd be happy to, but it's going to take a while because, one, we've got a big backlog of license requests here in the U.S. for the standard reactors. We've got to get through those. And this is a brand new technology and we've got to be very careful and make sure we get it right. And then there's the whole issue of will these things actually be cost effective. We don't know, but it's worth researching and developing them to find out.

We'll close with a view of the Earth at night showing what's lit up and what's not lit up. And you'll see that certainly in the eastern part of the United States and the West Coast and most of Europe and very much in Japan and South Korea, and increasingly in India and in a good part of China, a lot of lights are on. And lots of other parts of the world, there's a lot of deserts out there, too, and mountains. A lot of people aren't going to live there, but there are a lot of parts of the world -- look at North Korea -- it's very dark. There's a patch of darkness there pretty much. And then lots of Africa and good parts of South America. So if you want a good visual of emerging markets and where we could be providing more electricity -- because it's been estimated that around a billion people don't even have access to electricity. And more than a billion and a half people don't have reliable access to electricity. So you put those together, so you have about a third -- a little bit more than a third of humanity either doesn't have access to electricity or has no reliable or very little reliable access to electricity.

Thank you for your attention.

(Applause)

MR. EBINGER: I want to thank both Dr. Suzuki and Dr. Ferguson for two very provocative presentations. Knowing some of you in the audience, I would be very surprised if there weren't some good questions.

I would just like to start to get us going with -- take the prerogative of the chair -- and ask the following. What are you gentleman's respective views on the effectiveness of the IAEA and the Nuclear Suppliers Group in terms of really obviating further weapons proliferation? And I'm thinking particularly, you know, when we look at the fact that we know there's been leakage in North Korea from some companies in Japan and perhaps elsewhere despite all the safeguards agreements. We know that South Africa, at least initially when they were building a bomb, were able to get past all the agreements.

We know the AQ Kahn network, of course. And I ask it in the context of what you think we need to do to strengthen the IAEA as we look towards the NPT Review Conference and why have these mistakes been allowed to occur in the past?

DR. SUZUKI: Not because Mr. Amano was elected as the new director of IAEA. (Laughter) I've always been a fan of IAEA.

IAEA, actually inspection technology and personal professional staff, the expertise are very excellent and they have been improving technology quite well. Their monitoring capability has been increasing. Additional protocol was excellent too to look for so-called undeclared facilities. So I believe if IAEA has safeguards in place in countries, it is very difficult to develop a weapons program.

The problem is that some countries who do not accept IAEA safeguards, so our efforts should be to universalize the conditions to accept IAEA safeguards and additional protocol as much as possible, as soon as possible.

But still, export control is a different thing, which is very difficult. And the Nuclear Suppliers Group was not good enough, as you mentioned. I think we have to come up with probably more enforcing export control rules in the global community. And particularly, in the Japanese case, I've been studying the so-called third-party -- how do you call it? Third-party export? There are some small specialized small-medium companies selling sensitive material, like sensitive equipment to Thailand or other countries who have much less stringent export control, and then export to North Korea. So that's our concern. And we need to have, again, more global uniform export control rules with some kind of enforcing mechanism.

DR. FERGUSON: Charley, I was reminded of Hans Blix's thoughts on what the IAEA needed. When Dr. Blix was IAEA director-general, he said he needed three things. And Larry Scheinman reminded me of this yesterday when he talked to my class at Georgetown University.

Number one, the IAEA needed greater access to people. People in the know. People working on nuclear programs in various countries.

Number two, they needed better access to locations. Not just declared facilities, but also to investigate the existence of undeclared facilities.

Number three, they needed better access to the United Nations Security Council. That's the body, the authority figure, so to speak, that has to weigh-in on what needs to be done in cases of violation of safeguards agreements. We've been seeing the failure of that, or at least, you know, a weak application of that body to safeguards violations in Iran and also I would say in North Korea. And it could continue if we don't really strengthen those three areas.

In addition, I would say we need to make the additional protocol to safeguards agreements -- or the equivalent of additional protocol in certain countries' cases -- the standard for supplying nuclear materials and technologies. Now, we saw a tip of the hat with the additional protocol and President Obama's U.N. Security Council Resolution 1887 in late September. It was kind of hortatory language. It said basically countries should consider and encourage the additional protocol when deciding whether to supply technologies to other states. We can do better than that.

DR. SUZUKI: Yes.

(Laughter)

DR. FERGUSON: Right. Right now there are only a few countries out there who have been raising some objections. And that's why I said additional protocol or its equivalent in certain cases. I think it's worth considering.

And one final point is about Article X withdrawal clause of the Nonproliferation Treaty. We've seen one country exercise that. It's North Korea. They left in January 2003. I say at least the North Koreans respected the treaty enough to use the withdrawal clause. They didn't just leave sort of willy-nilly. Some may think that. But they did go through the sort of 90-day period. They did it in a funny way, of course. They started the clock back and it was 94, and they got to the 89th day and they stopped and we had the agreed framework. And that lasted for a while. Then that went bust in 2002. And then in January 2003, another day clicked over and they said, okay, we're out. But at least they kind of went through the motions.

So I think we can do better than going through the motions. I think what we need to do is to use the U.N. Security Council to say in cases where countries are in violation of their safeguards agreement and they decide to exercise their sovereign rights to leave the treaty, they have certain requirements. They need to at least undergo a special inspection, which is in the charter of the IAEA. You go back to, you know, when the Agency was found in 1957, special inspections are in there. It shouldn't be such an unusual thing to do. So we could build on our president to get the U.N. Security Council to say, look, countries need to show us that they haven't misused technologies they gained while "a good member of the NPT." And I know a lot of people are thinking, "Good luck, Charles, getting that passed and enforced." But at least the first step is to have a serious discussion about this and try to get this debated.

Thanks.

MR. EBINGER: Okay. The floor is open to all of you. Would you please identify yourself? And if you're directing the question to one particular panelist, please say who that is.

Sharon?

QUESTION: Sorry. Sharon Squassoni from the Carnegie Endowment for International Peace. Thanks for two great presentations. I wanted to follow up on the question of the additional protocol.

For Charles, you said the additional protocol or the equivalent. This is a phrase that the Argentines and Brazilians favor because they don't want to sign the additional protocol. So I'd like you to, if you could, spin out what that equivalent might mean. I'm a little skeptical.

And for Dr. Suzuki, I was told by Ministry of Foreign Affairs officials in Japan in April that Japan actually has adopted the additional protocol as a condition for supply, which is a terrific development. I have never seen anyone anywhere tout this as, you know, a step in the right direction.

So, my question really relates to markets. Do you think that this in any way affects Japan's ability to export to other countries in any way as a hindrance? Because one of the things I'd like to see is that industries -- if countries can't adopt this, that maybe industries, you know, firms could adopt additional protocol as a condition for supply without any adverse market effects.

Thanks.

DR. FERGUSON: Well, your question about Brazil is very apt, Sharon. I was actually supposed to be in Rio today and it went bust. And, well, I'm kind of glad it went bust because I'm glad I'm here today. This is really a great workshop. And it's always sort of the visa issues and everything. Trying to get to Brazil is a whole other political issue. But actually right now what's going on in Rio is the Nonproliferation and Nuclear Energy Conference. And I wanted to talk to some Brazilian colleagues about this very issue that you raise.

And my understanding is that there are two -- I guess two concerns that Brazilians have. One is that proprietary information about their enrichment plant might be revealed through say additional protocol. Two is that they have worries about their naval program. They, for many years, have the dream of fueling submarines with nuclear fuel. And my understanding is that when that second issue -- additional protocol wouldn't really, you know, have any kind of effect if they want to have a naval nuclear program; they can do that. It wouldn't stop them from doing it. That's allowed.

But the first issue about the proprietary concerns, I think we could probably craft something. And I notice people much more expert on this than I am -- in fact, my former boss has been working with the Brazilians on this. So I don't know -- I don't really have a detailed plan that I could tell you and others about how to implement sort of its equivalent in Argentina and Brazil, but I think it would have to involve IAEA oversight. We'd have to have a system where there's enough confidence where those neighboring countries and the world would have confidence there aren't any hidden facilities in Brazil and Argentina that can be used in nuclear weapons program.

And so basically what I'm saying is we need to adhere to the philosophical concept embedded in additional protocol, that the inspection system should go beyond just mere accounting or bank auditing to being like a Sherlock Holmes and being a true investigator and to figure out whether there's anything hidden in countries that we're studying. So I think if we can do that, then we can develop, you know, confidence that there's equivalent of additional protocol in place.

DR. SUZUKI: Thank you for the question. Thank you for letting me know the decision about Ministry of Foreign Affairs. I wasn't aware. If they did it, they did it very, very quietly.

But I know -- I know that they have been pushing very hard about additional protocol as a condition. And I've been talking with the nuclear industry people regarding this -- the impact. My answer is probably not that much because if you look at the global nuclear market, the majority -- the largest majority is in Western Europe and the United States. So for those areas, no effect. But some of the countries, like India, for instance, it's very sensitive. And so some particular business, yes, they may have some worry. But in a global sense, additional protocol as a condition for export is a very good thing to do.

Actually, nuclear industry believes it is better for them to have a safe export business. So I think they are happy with that condition basically in general.

MR. EBINGER: Go ahead. We'll get you all.

QUESTION: Hi, my name is Zack and I'm just a citizen. I'm not associated with anyone.

But my question is actually about the nuclear battery thing. I've actually read that as well, but I don't understand it from a proliferation perspective. I mean, if this is a nuclear reactor that can fit on a railroad car, let's say, and has no containment building. I mean, I don't understand why someone couldn't just dig it out of the ground and drive it around and I mean, just let the reactor run and it would be as bad as a nuclear bomb. I mean, maybe not quite as much, but, you know, it would be just sending radiation all over the city or something.

Can you help me understand how that could possibly work from a proliferation perspective?

DR. FERGUSON: Yeah. Good question. I'm not an expert on these nuclear batteries. I'm saying that there are some who are saying if you do it right, you might be able to make it proliferation resistant.

But I was trying to say that we don't know yet. And this -- really, we need to do a very vigorous investigation of all these different designs that are being considered. I think one question mark is will it be fueled with highly enriched uranium. And you don't

want to do that. And you want to be able to have high burn-up type of fuel, so the isotopic composition of the stuff that's in the spent fuel is very undesirable for nuclear weapons. You want to make it so that if someone actually tried to break-in to the reactor they would get irradiated with a lethal dose of ionizing radiation. So that has a protective barrier against theft.

Now, sure, you know, if a country has some sophisticated techniques and they have the proper shielding, it's possible they could extract it and maybe grab some material out of it. Maybe some radioactive stuff for a radiological dirty bomb. But my understanding, and I haven't looked at these in depth, is you could probably design these things so what's coming out of the reactor at the end is not very desirable for an actual nuclear weapon.

QUESTION: My name is Tak Ohde from Hitachi. I'd like to ask Mr. Ferguson -- thank you very much for your informative presentation -- the reactor manufacturers are doing and promoting from the standpoint of the energy supply and energy security, but our activities face the nonproliferation issues. But this nonproliferation is an issue that the government should take leadership.

So what do you think is the best way or a practical way to coordinate the harmony between government policy on nonproliferation and private sector's business strategies?

DR. FERGUSON: Yeah. That's an excellent question, and I think industry can play a much greater role. But ultimately it's a governmental responsibility.

And one big question is who is going to pay for additional resources for the safeguard system. Because Charley started off with a question about the IAEA and the Nuclear Suppliers Group and what needs to be done. And another thing that I should have mentioned is resources. The IAEA has been starved for resources. They've been on a sort of zero role growth financial regime for many years. That was lifted last year. They got a bump up, I think about 8 percent or so. And they had another bump up, I guess, back in -- was it 2003 or 2004? But it's not adequate.

What we've seen is a growth in nuclear materials that need to be safeguarded by roughly a factor of three over the last 20 years. And there hasn't been a corresponding growth in the ability of the International Atomic Energy Agency to at least even monitor all the growing amount of material.

So what's the role of industry? My view I think is similar to Thomas Shea, from Pacific Northwest National Lab -- a lot of you know of him -- and a couple of years ago -- maybe it's three or four years ago -- he wrote a paper, for actually Henry Sokolski, saying that we should assess the amount of money for safeguards based on each country's proportional use of nuclear energy. And in order to make sure that each country is doing its fair share. And that each country actually is then factoring in that external cost of safeguards into the internal cost of nuclear energy.

QUESTION: Jim Goodby, Brookings Institution.

I wonder if you could comment on the International Fuel Center that the Russians have set up at Angarsk. And speculate, if you would, about whether there's any possibility that the Chinese might consider an equivalent facility where they have been working with the Russians on an uranium enrichment plant in China.

DR. SUZUKI: Thank you. The Russian Enrichment Center is an interesting idea to promote both nuclear fuel assurance and nonproliferation. The problem is that the nuclear fuel bank proposal, which they hope that more countries will join the business, is not so popular. Unfortunately, the recipient countries are not happy with the conditions. I mean, Russia is still controlling the nuclear fuel bank, although it says IAEA can manage the fuel bank.

And also the majority of the center will still be controlled by the Russian government. Although they claim this is a pure business venture, it's not clearly the case. So, as a business, I think it's an interesting idea. But in terms of nonproliferation and the fuel assurance scheme, they still have questions to address.

So, even for Chinese, if China developed a similar center, probably the same question will remain. My idea of internationalization of nuclear fuel cycle facilities is more on the private base, kind of joint ownership by the companies. And then backed up by the government or agreement to monitor those activities, like the URENCO case. That's probably more better accepted by the nuclear industry.

QUESTION: Alan Madian in LACG. I've been working with Ontario Power Generation in terms of their procurement. And as you probably know, having gone through a couple of years of study looking at eight separate nuclear providers, the decision was made that the cost was too high. That's observation number one.

Observation number two is that the reported costs of nuclear power plants in China being built by the Chinese using designs that were originally coming from the West, is between 25 and 30 percent of the cost that is being quoted by U.S. manufacturers for overnight costs. So there are two things that seem to me to be worth asking about.

One is how realistic are the forecasts in terms of increasing nuclear power plants given these very high costs coming from the West? And secondly, looking out between, let's say 10 and 30 years, should we be expecting that a majority of new nuclear power plants may be being built by the Chinese and what are the implications of that for nuclear proliferation?

DR. FERGUSON: Yeah, great questions.

I was in China in April. There were two expositions going. There was an expo going on and there was an international conference sponsored by the IAEA, an Inter-

Ministerial Conference. And just a mile away there was a vendor's expo. And I went to both and it was just incredible what was going on at the vendor's expo. It was more exciting than the Inter-Ministerial Conference. At the Ministerial conference all these energy ministers and nuclear energy officials got up and just made a lot of speeches. You actually go to the expo and you talk to the vendors, especially the Chinese who are working in this area, and they're very open. They'll talk a lot about this. But it's really hard to get them to talk about costs. And I'm skeptical about these cost estimates they have. I think a lot of things are hidden. State-owned enterprises and the Chinese government, you know, may not be quoting us a real figure here.

But as we know, they're sitting on huge foreign cash reserves. And they made the executive decision to go forward with a major expansion of nuclear construction. And I think from their standpoint it makes a lot of sense, especially when you look at their coal industry. They had some serious problems last winter in making sure they got coal supplies delivered to the coal plants. And there's a fairly large distance between a lot of the coal mines and major cities that need the coal power. And a lot of the rail lines couldn't deliver adequate supplies of coal in time, so that was one of the major tipping points that convinced the government in Beijing that they needed to go ahead more aggressively with nuclear power.

So, in some sense it's kind of an internal energy security concern because they still have a good amount of coal. And they're also trying to develop more efficient coal plants as well, which we should encourage them to do that because then maybe eventually they can do carbon capture and storage with it in the future.

Yeah. On your second question, I was going to have actually a slide titled the China Syndrome or the Alternative China Syndrome. Yeah, I guess 30 years ago was the release of the movie, The China Syndrome. And that would refer to a hypothetical situation if there were a nuclear plant meltdown, say in the U.S., and the material could go all the way through the Earth and pop out into China. That's what it referred to.

But now we're seeing a different type of China Syndrome. And China, I think, is going about this from their perspective, in a very smart way, signing these technology transfer agreements. I mention all these replication reactors they're building, most of them based on kind of French designs, which really the French designs originated basically in the U.S. And then they also have an agreement with Westinghouse Toshiba for an AP1000. Their first inland nuclear power plant is going to be of that model. They're trying to arrange a similar tech transfer agreement to get U.S. and Japanese technology transferred there.

So, I think you're right. I mean, 10 or at least, maybe, you know, at least within 30 years, they're going to be up there as a major supplier.

QUESTION: Thank you. Seongho Sheen at the CNAPS, visiting fellow at the moment.

And my question is about this coming negotiation between South Korea and the United States about Atomic Energy Agreement. And given your expertise on Japan's past experience, obviously South Korea is now trying to follow the Japan's footsteps, which happened in the late '80s. And South Korea, given its very heavy dependence on nuclear energy, they want to have some, you know, more fuel cycle capability and nuclear, you know, energy.

So, given Japan's experience in the late '80s, Professor Suzuki, what would you think the most difficult challenge for South Korea following the Japanese model?

And for Dr. Ferguson, what could be Obama Administration's response to this coming very difficult issue?

Thank you.

DR. SUZUKI: That's a very difficult question to answer. Of course, I'm not the government official so I'm talking about my personal opinion.

Of course, the most difficult challenge is the recycling, reprocessing issue. And my personal suggestion is that as I propose in my presentation, not just South Korea, not just Japan, in the future all nuclear fuel cycle facilities may have to be internationalized eventually. So, instead of seeking its own national right to reprocess, it would be better for South Korea, and even probably for Japan, too, to search for some kind of arrangement for international -- an international arrangement to reprocess spent fuel.

Otherwise, it's very difficult to get approval from the United States. So my suggestion is that if there is any way that South Korea can look for an international program which can allow South Korea to conclude the fuel cycle.

And one suggestion is Japan actually has its own reprocessing plant, but its technology comes from France. And also, the advanced fuel cycle technology comes from the United States. And for the advanced fuel cycle technology, we do not have our own reprocessing facility. We reprocess spent fuel in Europe. So that's one possible model that South Korea can follow.

DR. FERGUSON: Yeah. A very complicated issue as Dr. Suzuki was saying. From the U.S. perspective, it's a balancing act, walking a tight wire. The U.S. doesn't want to get into the, you know, political problem of the North-South Korean Agreement not to do enrichment reprocessing on the Korean peninsula. So we have to deal with that issue. And I know a lot of Korean experts and politicians have been saying, well, the North Korea issue, you know, that's political. Here is something different. This is something to do on commercial energy. And I understand that, but still that linkage is still there. So that's a big sticking point.

Two is that South Korea one day established a low level waste facility. The government paid too much money, so that established a bad precedent, to be honest. So,

then, there were worries that in order to cite a high-level waste facility, it's going to cost an astronomical sum of money. And South Korea is a small country, about the size of Virginia. So there's not a whole lot of available pieces of land for high-level waste or spent fuel repository.

So, and we know that by 2016, the spent fuel pools in South Korea are going to be at capacity. So what do we do? As Dr. Suzuki said, one option could be South Korea could send its spent fuel to France, but that's going to cost a lot of money. Japan is paying a lot of money; you asked what the per gram price is for storage of plutonium in France. It's huge. So, you know, that's not necessarily going to save money. And it's also going to kind of kick the can down the road.

Well, one suggestion I've been kind of batting around, and I don't know if this is good or not, but I'll throw it out there -- is that the U.S. could open the door a crack for South Korea to continue doing some research on, say, pyroprocessing with the U.S. collaboration. And that may be enough for the time being for then the South Korean government to tell the people at least we got the U.S. working with us here to a possible long-term solution. And this is truly long-term because really to close that loop you would need fast reactors and there's big question marks whether they're going to work and be cost-effective. But if you do that, maybe you can then begin the process of also establishing a high-level waste facility. Because you're going to need that no matter what because you're going to get fission products coming out, no matter whether you do pyroprocessing, fast reactors, or you just do the traditional storage methods, or even the ones through recycling that happens in France.

So you're still going to need a high level waste facility. So if you can have an agreement saying the U.S. still is going to work with South Korea to find a long term solution, that may provide a pathway forward.

MR. EBINGER: I'm sorry we have run out of time, that we didn't get to all your questions. Hopefully, you may be able to ask them of the next panel. But I want to thank Dr. Ferguson, Dr. Suzuki for excellent presentations. Thank you.

(Applause)

MR. EBINGER: We'll take a 10-minute break and then we'll have the next panel.

(Recess)

SHOICHI ITOH: Okay, let me start. Ladies and gentlemen, my name is Shoichi Itoh. I'm a visiting fellow at Center for Northeast Asian Policy Studies here at the Brookings Institution. I'm delighted to moderate one of today's exciting panels. I'm sure you have already enjoyed the first excellent panel. We are going to have another excitement from now.

Now we turn to the question of disarmament and nonproliferation, which, again, the United States and Japan share tremendous interest in common. President Obama in his famous speech in Prague this past April called for a world without nuclear weapons, even if it was targeted at the distant future. Japan has fully supported this particular idea for many decades. However, translating the idea into reality is always difficult enough all the time.

Today, apart from the mere question of reducing the number of nuclear weapons, we are facing a variety of new challenges, including Iranian and North Korean issues, danger of nuclear terrorism, et cetera, et cetera, et cetera. Just yesterday, at the General Assembly of United Nations, Japan and the United States jointly proposed a disarmament resolution at a first Committee on Disarmament. U.S. supported Japan's proposal for eight years' abstinence this time. However, North Korea and India vetoed, China, France, Israel, Myanmar, Pakistan, Cuba, and Britain abstained from voting. We are facing lots of new challenges.

Now let me invite our distinguished presenters. We have Mr. David Albright. He's president of Institute for Science and International Security here in Washington, D.C. He worked for the IAEA Action Team in the '90s. He also worked as senior staff scientist at the Federation of American Scientists as well as a member of the research staff at Princeton University's Center for Energy and Environmental Studies, and published numerous works on this particular topic.

And Professor Akiyama is from Hitotsubashi University in Tokyo. He has an adjunct post as a research fellow at the Center for the Promotion of Disarmament and Non-Proliferation at the Japan Institute of International Affairs, and is one of the leading experts on today's particular topic in Japan and the world.

Please let me invite Mr. Albright first.

DAVID ALBRIGHT: Thank you very much. It's a pleasure to be here today. It's always challenging to kind of leap from the world of nuclear nonproliferation into the world of nuclear energy.

And just as a little bit of background, ISIS, for the last several years, has really focused primarily on proliferation or on North Korea, Pakistan, India. We haven't done very much work on nuclear energy, per se. In the past, we used to evaluate worldwide inventories of fissile material, either funded by foundations or by our national laboratories. And in that context, we would study essentially every program in the world that was generating plutonium, highly enriched uranium, or, in the latter part of the project, neptunium and americium.

And so in the distant past I certainly looked quite closely at the Japanese nuclear program and many other civil nuclear programs in Europe. And we would try to focus, as I said, on nuclear explosive material. And so some of that will come into this talk today, although I will say that I'm going to slant it toward the proliferation and what nuclear

energy looks like, or particularly -- and I will say nuclear power looks like from the perspective of someone who spends their days dealing with nonproliferation, or I should say, unfortunately, dealing with proliferation. (Laughter)

And let me just start by, you know, how does proliferation occur as we see it at ISIS. And it's largely by acquiring wherewithal overseas. We don't see any indigenous programs anymore. In fact, we'd argue there were very few to begin with; maybe in the United States, but we depended on foreign scientists to a great extent. And if you go from there, you just see various efforts, some quite extensive, some less so, depending on overseas acquisition. And it's happened, in broad terms, in two different ways.

Through legitimate nuclear cooperation. I mean, a classic example would be India's CIRUS reactor that was acquired from Canada and then became the source of plutonium for their first nuclear explosive.

We also see it through illicit methods, which seems to be the primary method today and has been a for a couple decades. A good example is AQ Kahn in Pakistan. But also if you look at the Iraqi program, heavily dependent on overseas procurement, illicit in many cases, but often secret. We see Iran continuing that tradition today, very dependent on acquiring things overseas for its gas centrifuge program and we believe, also, for its Arak heavy water reactor.

Also, we see battlegrounds. And for us, as I mentioned, the key battlegrounds are really Iran and North Korea. And I think the outcome of those situations will have a big impact on proliferation in the future, whether we're going to enter kind of a more golden era, where maybe we'll even have fewer nuclear weapon states, or we're going to see a real stress over the possibilities of additional states seeking nuclear weapons, particularly in the Middle East. And it's -- if you follow the news, which I know you all do, it's very hard to predict how Iran's going to end up at this point or North Korea.

And from my point of view, one very positive development is President Obama has brought back nuclear disarmament in a big way. And so I don't see Iran or North Korea making decisions, despite North Korean statements, making decisions on whether there's a trend toward -- an active trend toward nuclear disarmament. It certainly helps, I think, the effort to stop the spread of nuclear weapons around the world and it's long overdue that it became a central issue again.

One thing I'd like to point out, again, this is an ISIS perspective, but I think it's shared, that the spread of -- and it's very specific -- the spread of turnkey modern nuclear power plants has had little stimulating effect on proliferation and for some, not in this room maybe, an irony. But we found that if it's used wisely, that the provision of turnkey light water reactors can actually discourage proliferation -- and I point to North Korea and Iran as two examples -- and that these reactors become alternatives to, in essence, something far worse, if you want to say every reactor's a proliferation risk. And they also, by their provision, integrate these countries, these very nationalistic programs, into an international

community, and they get a set of incentives not to proliferate. And also, I think you can safeguard these reactors much more effectively than you can the alternatives.

Now, key to these arrangements in North Korea and Iran has been an insistence on permanent or temporary suspicion of reprocessing and enrichment. I mean, let me -- Bushehr is an exception, obviously. And associated with these arrangements is, one, spent fuel take-back schemes; and also assurances of fresh fuel. And Iran, I think, will -- in its current policies in this very hard to define regime probably will never accept fuel assurances of any type. And I think we're seeing this played out with this very generous, kind of clever offer to provide or to take Iran's kind of zero economic value low-enriched uranium, enrich it further and provide fuel for their research reactor, fuel they haven't been able to get since the early '90s. And yet they're raising inside Iran on all kinds of opposition to that deal, including that if we give them the low-enriched uranium, we'll never get the fuel back, which is highly unlikely unless there's a war. Although, you know, that's happened before. But nonetheless, if Iran is willing to risk almost nothing, it can get fuel for its research reactor.

Now, the real catch in proliferation is how do you generalize these approaches? I mean, I think in proliferation cases can be worked on pretty effectively. I mean, you don't always win, but you can develop a strategy. But the real problem comes up when you try to generalize it, and I'm going to start that process, maybe leave it to my colleague to expand upon, and then we can discuss this. And it also becomes a lot more controversial.

Let me start with the Middle East, where we do do quite a bit of work, and we look at who could proliferate and what are the chances, how would they do it. And I think nuclear power plants being inserted in there right now are a symbol of a country establishing a nuclear weapons capability. I mean, I think it's irrational, but then many things in the Middle East are irrational. (Laughter) And so what do you add to that if you're going to provide nuclear power plants, what do you add? And I think it's fairly obvious.

One is you look for a commitment by that country that's going to receive the power plant that they'll have no domestic reprocessing or enrichment. UAE has been willing to go down that path; Turkey hasn't so far; Egypt hasn't. So it's a tough one, but, nonetheless, I think it's important to insist upon that if reactors are going to be provided.

Another is that the additional protocol has to be accepted. And I would argue -- well, I come back to that, but the country has to accept the additional protocol. Proliferation, unfortunately, does take place. And how do they do it? They don't sign the additional protocol. Look at Syria, look at Libya, look at Iran. I mean, it's a no-brainer that if you stay with traditional safeguards, you can safely build on declared sites. You may get caught eventually -- Syria suffered quite a consequence -- but there's a lot of this just-in-nick-of-time if you don't have robust inspections in these countries to provide transparency.

Another aspect of supply should be the return of the spent fuel, fuel assurances, and also just an NSG commitment not to supply enrichment or technology into the region. And so here's, from our point of view at ISIS, an attempt to try to generalize this. It's certainly deeply opposed by many in the Middle East, not least among Turkey, Egypt, Syria, I could go down the list. But we see it as the kind of conditions that we should be striving for.

And that's why I think, also, UAE was so important, even though I don't think anyone worries about UAE proliferating. But if you couldn't get it there, you had no chance of getting it anywhere else. And so that was the first test of this kind of approach.

More general terms, and this gets back to my days at Princeton, I think, we used to be called the Anti-Plutonium Mafia by some in the '80s when this controversy was a lot more spun up. (Laughter) But I think that as a matter of policy, countries with reprocessing and enrichment should discourage additional reprocessing and enrichment. And again, that obviously applies -- but it's an important position to take and it's an important policy to have. And I'm happy to discuss it later. I don't want to dwell too much on it now. But in proliferation you do need -- or in fighting proliferation you need to have that in your back pocket. It's extremely important.

And I could conceive of a situation with Taiwan. Taiwan moves to reprocess, that could make China very nervous based on what Taiwan has done in the past. And so, so long as we live in a world where there are tensions that can spill over into military conflicts, I think we have to have a policy like that at the government level.

A related point then is what to do with spent fuel? And others have talked about that and can talk about it better than I. In a way, I can just complain. I mean, for these kinds of things to work there's got to be a place to move the spent fuel. And each time it's come up, it's been unbelievably laborious to find a place to move -- and I'm thinking now of research reactor fuel. Taking out the Russian-supplied irradiated spent fuel out of Iraq, I mean, it had to become public and suddenly Britain couldn't do it or France, and it's a small amount of research reactor fuel. And Russia took it, but you have this fundamental problem of how to take the spent fuel out of these countries where you don't want them to develop, and I'll use an old term from some of our opponents, a plutonium mine -- or let's not even say it's a mine; let me just say a plutonium supply on the surface in spent fuel that becomes easier and easier to reprocess as time goes on.

Another issue is IAEA safeguards. And I mentioned that if you don't accept the additional protocol, it's proven that you can build on declared facilities and you have -- and then we have to turn to the intelligence agencies' luck of having a defector come out to find these places. And so I think it's long overdue that the additional protocol should be a condition of supply. And the NSG should adopt that and certainly countries should adopt that as a policy. Now, obviously, Russia and China are the big problems, and that argues for work at the NSG. But it's absolutely necessary.

And, for example, Syria, by not coming clean, certainly sends a signal that it hasn't stopped. It's just biding its time. And we know very little about how it got that reactor. I mean, it used its own smuggling networks, had North Korean help, and it's hard to track down how they got the components. I mean, it's not a sophisticated reactor, by any means, but where did the graphite come from. It's over 500 tons. Was it flown from North Korea? Would it come by boat? Did it come from China? I mean, you probably noticed, there's no distinction between nuclear grade and regular graphite anymore because of the way it's produced. So it's a dual-use commodity that's easier to obtain. And so it may -- and Syria hasn't admitted the IAEA to look at at least three to four or five sites, one of which had an indicator of possible fuel fabrication or fuel. I mean, uranium was discovered at the reactor site that looks like it had a metal origin, but not a metal origin from an anti-Israeli tank or armor-piercing. It looks like potentially a fuel element.

So again, Syria doesn't accept the additional protocol. There's really no pressure on it to accept it. The IAEA didn't even demand a special inspection. And I think that there has to be a much more -- a much deeper commitment to having robust, intrusive inspections if countries that are in regions of tension are going to pursue nuclear energy more.

The last thing I'll mention is, you know, where is nuclear power heading? And in that I look to you all. I think at ISIS we don't really participate in the debate of, you know, will renaissance happen? Will it not? Others in our community do, like Charles. But I think what we see is that we'd like to see a day when there is such a thing a proliferation-proof fuel cycle, and so we support research toward that direction.

And we also support the U.S. actively participating in the international efforts to try to make that happen. We won't go as far as saying we should reprocess here. We would be opposed to that; wouldn't see the purpose, to be honest. And it would undercut the idea of being against reprocessing spreading further.

And again, I say that carefully. I'm not against it and we're not at ISIS against it spreading further in Britain, France, China, Japan. I mean, we're not going to -- we're not trying to fight that battle. But -- and we'll make exceptions, too. Enrichment in Brazil, we deeply opposed it in the '80s and worked to try to get it safeguarded and stopped, but essentially lost the battle in the Brazilian and Congress. The Navy was just too powerful. But since then, haven't really taken a position in Brazilian enrichment. And ironically, some of the people I worked with in the Brazilian Physics Society who were deeply opposed to Brazilian enrichment, one of whom is heading the Atomic Energy Commission now and is deeply supportive of Brazilian enrichment, so. (Laughter)

But in any case, I think it's important for the U.S. to participate in this because I don't -- again, this is from our work a couple years ago, and someone can correct me, we still see that there is a debate, probably economic more than anything, over if you're going to develop an advanced fuel cycle, do you separate out the actinides separately, you know? Is it plutonium first, then neptunium, then americium, or is it all together and it's highly radioactive and so that you have a cycle where that you're not separating nuclear

explosive materials? And we would not want to end up with just more nuclear explosive material with neptunium in fairly large quantities added to the separated inventories and sort of the same old proliferation problem.

And let me just be a little bit flippant here, but it's -- and I'm simplifying, but you end up with a dangerous technology saddled with hard-to-implement institutional and political fixes, which I see as somewhat the dilemma facing the nonproliferation community as we strive to stop the spread of nuclear weapons.

So thank you very much. (Applause)

NOBUMASA AKIYAMA: Thank you very much. My name is Nobu Akiyama. I'm teaching at Hitotsubashi University and also working as a research associate of the Japan Institute of International Affairs.

Speaking in front of you is a big challenge in threefold for me. First of all, I see actually my academic advisor in front of me and I'm feeling like I'm being examined. (Laughter) And that's the first thing.

And second is I'm the last speaker of the panel and it seems like, you know, all the things that I was going to speak has already been spoken by others. So I'm wondering what I should talk.

And thirdly, the biggest challenge is that I put this title, "Avoiding the Failure of Atoms for Peace," that is I think there could be a challenge to the policies of the United States. And I am hoping -- this is rather provocative, the title, but I hope that this isn't really -- I hope you don't feel bad about it.

So the first slide, I think this data was already shown by the other people, so I skip. But the last line, "Since 2005, more than 25 countries expressed interest in nuclear power." And this is a really important phenomena. And my talk, following talk, will be mostly focused on how this new phenomena will be affecting the proliferation and nonproliferation trends from the institutional and political viewpoints.

By training I'm sort of a political scientist and not a natural scientist. So I'm more or less interested in how the institutions, policy institutions, work or not work and, at the same time, how the regional dynamics of the countries -- where the countries of concern are located are a great interest of mine. So my presentation will focus on two things: institutions and politics.

So let me show you some sort of the characteristics of two regions: Northeast Asia and the Middle East. Here, I sort of make a list of the countries in Northeast Asia with some characteristics of these countries' nuclear programs. So, of course, North Korea keeps on playing a dangerous nuclear game. And then China, this is a nuclear giant emerging. And from a security perspective, of course, between U.S.-Japan Alliance and China's sort of problem of how to reconcile kind of a more stable relationship of nuclear

deterrent or a seemingly stable strategic relationship. But at the same time, as far as their nuclear industries and the fissile materials capabilities are concerned, we've got the problems. We don't know how much does China have, the fissile materials and other things, and that is a sort of concern for us.

Of course, Japan, we have some troubles actually, to be frank, in the fuel cycle programs. And then, from the outsider's viewpoint, probably the largest fuel cycle programs in the non-nuclear weapon states and the largest stockpile of (inaudible) plutonium could be perceived as a kind of concern in security matters. And South Korea, you know, in the previous session we had a question about the renewal of the Korea-U.S. bilateral nuclear cooperation agreement, and in that process there is an issue of whether or not the power processing will be accepted or not. And in my observation it is really difficult for South Korea to pursue this technology. I think it's not likely that the U.S. government will give consent on that.

But still, with this there is the rising politics over so-called nuclear sovereignty. And that is somewhat similar to the phenomena of kind of the politics of inalienable right of Article IV of the NPT.

And Taiwan, it also has trouble in storage of spent fuel. And I think some of you may remember that there was an incident that Taiwan was almost shipping the spent fuel to North Korea, and it's triggered serious concerns on us whether or not -- what really should deal with the -- how we should deal with the spent fuel in the region.

So then the question is, is the multilateral arrangement a solution to deal with such problems? And I see some sort of possibilities and I will try to touch upon this later.

And in the Middle East, of course the Middle East is driven to the nuclear renaissance. And since 2006, more than a dozen of countries in the Middle East expressed an interest in nuclear programs. But the problem is there is a poor record of adherence to safety, security, and safeguards rules. So this is the sort of diagram which I actually cited from Sharon Squassoni's presentation. And then please look at the column of safeguards. This is the status of additional protocol, and many of the countries in the Middle East have not signed and ratified additional protocol. And I think this is a serious concern. And in the previous session we had discussed the importance of additional protocol. And without the presence of such a kind of a stringent rule, it would be the potential serious sort of cause of troubles.

Then, what are the driving factors for the nuclear renaissance? Of course, the countries in the region claim the economic and environmental factors such as increasing energy demand or saving some fossil fuels for the future economic growth or responding to climate change or they need pure water. So desalination is one of the important cause of the nuclear renaissance. But in many peoples' view, it is kind of a response to the nuclear Iran. So this is the programs in the Middle East, sort of the programs, to hedge the Iran -- the rising nuclear Iran. In, first of all, in responding to the military threats and, also, there are concerns of the regional rivalries if -- in order to avoid Iran behaving as the hegemon in the

region. And also, we have a factor of technological and political prestige related to the nuclear fuel cycle.

So then what are -- so what types of proliferation concerns exist in the civil use? They're, of course, divergent and I need to correct this, not CANDU but it is CIRUS reactors in India, and concealing the military activities, in particular procurement of the materials and the technologies behind the sort of legitimate reasons of civil use. That is another concern.

And third is the withdrawal. So I really would like to stress that third point because that actually is the outcome of sort of the programs' deficiencies of existing nonproliferation regime. So that's points I would like to touch upon, some institutional deficiencies.

So IAEA safeguard system is not perfect. Actually, far from perfect I would say. First of all, additional protocol is not the sort of obligatory rule, so if you want to sign, you can sign. But if you don't want, you're not really forced to sign and ratify. And I think so far we've got -- probably are approximately 90 countries that ratified, but it's less than half of the countries in this world. And we need more efforts to sort of encourage other countries to ratify and implement additional protocol. Because as we have discussed earlier, additional protocol is a very effective way to have more intrusive access to -- not only to the other nuclear sites, but as well as some suspicious places or sites. So I think this is important, but we haven't yet reached the point that we have high confidence on the effectiveness of our additional protocol yet.

And the second concern is we have no way of assessing the intentions and the rationalities of nuclear activities. In an extreme case, for example, we got a nuclear reactors here and we don't have an energy grid plugged into the nuclear plant. But still, we have to say as long as it's under safeguards, it's legitimate activities. But, you know, in many cases, such as in Iran, we don't see any rationalities. In the case of Iran, they have developed enrichment facilities first and they don't have -- they didn't have the fuel fabrication facilities.

Then from the viewpoint of energy security, in my view, because the plutonium market is so stable, if I were in the position of Iran, I would develop the fuel fabrication program -- facility first in order to secure the fuel supply, but because you cannot use uranium as it is. So I -- but we see them so suspicious, but as far as the safeguard system is concerned, we are not really able to conclude that they have a clear intention of divergent programs into nuclear purposes.

Then, the second is vulnerable infrastructure and security in the personnel management in many countries. You know, the most serious concern is, of course, in Pakistan. But at the same time, in Japan, we had a case that Iranian students studied in the university on the nuclear technologies, in particular some technology related to the reprocessing. And so we need to have kind of the control on the (inaudible) export.

Then thirdly, as the nature of technology, you know, any cutting-edge technology becomes obsolete or so widespread we are not really able to control the flow of knowledge. And also, the economic incentives sometimes overrides the regulations and rules of export controls. As Dr. Suzuki mentioned earlier, even among the Japanese companies they're really not so proudly -- the record is not so proud, you know, good enough. And some small- and medium-sized trading companies are shipping sensitive materials to the countries which is sort of points for leading into the market of North Korea. And that is, I think, somewhat we may have to really seriously think about.

And, of course, we have a political and security environment as we have seen in the case of the Middle East. Many countries could be driven to the nuclear program by some security and political concerns.

Furthermore, related to the nuclear renaissance, we have additional concerns. When the competition for the market will be intensified, what happens? You may compete for the price, but, of course, price is not only the factor. To what extent are you going to introduce stringent rules on safety, security, and safeguards?

And actually, last month, I visited Vienna and spoke with some people in IAEA. And I heard about the request from one company or country regarding setting up the stringent safety/security rules for exporting the nuclear reactors because some designs of reactors actually have cut safety measures and that provides some price -- competitiveness in price. But, at the same time, if you are not going to introduce the stringent rules in these three S's, then that could be another criteria for competition.

For example, if Japan told the other countries unless you're going to introduce the additional protocol, we're unable to ship the materials from Japan, then if the other country comes, like, for example, okay, but we don't care about this, you know, additional protocol as long as we can do business with you, you know, we're happy to export, then it's obvious which partner you will choose. And that is actually happening, I think, in my view. So that is one thing we have to really remember.

And the second is the rising nuclear sovereignty question. Of course, aspiration for nuclear technology as a symbol of industrialized advanced country, that is the case. And also through -- actually unfortunate discussion on the fuel cycle controls or militarization, there is kind of intensified politicization of the issue of inalienable rights. And that could be one of the major issues which could lead into the failure of NPT review conference next year.

So then how have we been responding to the proliferation concerns so far? Mostly I'd like to touch upon the three sort of institutional measures.

One is bilateral control through like 1-2-3 agreements. That is maybe, in my view, a supplement to the other safeguards of IAEA. And that is seen -- I see this as kind of an Atoms for Peace version Middle East, Atoms for Peace version – I don't know, something.

Then, of course, we -- I mean, they are attempting to strengthen the industry guidelines, but so far it hasn't been successful.

Then another important policy option is multilateralizing the fuel cycle control and providing assurance and supplies. And seeing this accepted energy guidelines, it's like, you know, kind of back to the future phenomena. We have seen these attempts in the past and we see some consequences.

But anyway, this is sort of my concept in my mind how we are dealing with the security -- proliferation threats. The institutional approaches and the technological approaches, introducing the proliferation resistant technologies and proliferation safeguard technologies should be updated. But at the same time, we need to fill the gap, so that's incentive approaches. That's political and economic incentives. And the multilateral controls and the bilateral agreements fall in the category somewhere in between incentive and institutional. Then we need to integrate three of these approaches into one in order to respond to the various proliferation concerns.

Then I want to touch upon what we have learned from the past, in particular the Atoms for Peace. Of course, the first point is related to the multilateral fuel cycle approach. And then the biggest issue was -- during the '70s and '80s, did actually result, unfortunately, in retaliation of the inalienable rights. So that means, you know, in the end, after the lengthy discussion on that, we had to acknowledge the rights to develop the indigenous or national fuel cycle programs. And actually Japan was one of the beneficiaries of that, but still, from the viewpoint of proliferation, this could be a concern.

Then what about the Atoms for Peace? In my judgment, Atoms for Peace is Atoms for Alliance or the managing relationship with countries. So because Japan is the closest ally to the United States, I think United States gives a special status to us. You know, we host the only single sort of marine base abroad, station abroad and, also, we've got sort of a huge scale of U.S. troops in Japan. And our sort of relationship, security relationship, is so tight. So I think that's one of sort of the reasons behind the fact that we are granted special status. But depending on the relationship with the United States, I think that the level of freedom on activities are different. So even in Northeast Asia, Korea was not granted status of developing its own fuel cycle. That is a huge difference, probably the difference between the relationships, bilateral relationships.

But what happened to the Atoms for Peace, by the way? We have to -- definitely need to look at it. You know, after the Atoms for Peace, the United States has changed into -- they're more focused on the bilateral relationship, bilateral cooperation. Of course, Atoms for Peace is designed to create multilateral, you know, control, but it failed. Then the U.S. had concluded more than 50 bilateral agreements in the 2 years, '55 and '56.

Then what was the result? Then there could be a possibility of proliferation between third parties. U.S. could control the activities with the U.S. origin materials and

technologies, but then the United States cannot control the third party transactions. That is sort of an institutional deficit or deficiencies of this bilateral control.

Then, of course, we have, you know, these bilateral arrangements spread the seeds of proliferation by transferring the technologies, that's more important elements. Then with this we see the pros and the cons of American 1-2-3 agreements. And pros, of course, we can get the political commitment by recipient countries for they're refraining from pursuing a national fuel cycle in exchange for assurance of supply.

But problems are -- first of all, there is no legal requirements of ratification additional protocol. As I mentioned, additional protocol is an important measure for the more intrusive inspections and possibly supplemented by more stringent United Nations Security Council resolution or something. But the existence of an additional protocol arrangement is quite important.

Then this 1-2-3 agreement does not apply to the transaction of these recipient countries with third parties. Then even if the United States could withdraw their cooperation, its cooperation, I mean, U.S. cooperation with that country, then if a third party could fill in that gap, there will be no way that we can really stop it. So that's what we have to really think about.

And also the question is the universal applicability of a 1-2-3 agreement. Probably India is okay; UAE is okay. But what about Egypt? What about other countries which are not really willing to ratify additional protocol and with some sort of past record of suspected nuclear development?

Now, what about multilateral approaches? Of course, it could at least provide one of the criteria of proof of non-interest in military divergence. Their participating into the multilateral approach itself provides a sign that this country is not interested in the military activities. And then we are able to strengthen the cooperation among like-minded countries, which could lead into the strengthening of international nonproliferation norms.

But once again, the problems are -- first of all, it remains as a voluntary arrangement because of very strong resistance by the countries related to the inalienable right of NPT. Then it is sort of the things that if you -- that if that is the case, then determined proliferators would not join because of this Article IV. Then probably we cannot punish the countries not joining the arrangement. It's so difficult because as long as it remains a voluntary arrangement.

Then the second problem is that without a take-back arrangement for the spent fuel, maybe it cannot be enough attractive offer for countries with small-sized nuclear programs. Then, can the United States really take back the program -- fuel which is provided by the United States? The answer so far is no. Then how can you make sure that, you know, you've got really safe -- you've got really attractive fuel management?

So the challenge is ahead for us, the Alliance, U.S.-Japan Alliance. I would say that we need a ground rule. We have to pursue sort of universal rules and regulations in the area of those three S's. And that is not only in the purpose of the nonproliferation, but also it could provide the venue for setting a level playing field for American and Japanese nuclear industries.

As I mentioned earlier, United States and Japan probably are the countries with more stringent rules for introduction of nonproliferation areas. So with this, countries may choose whether or not they're going to cooperate with the Japanese industries or not. And then if you have more attractive offers without stringent introduction of the nonproliferation rules, and if the price is the same, which are you going to choose? So for the purpose of the industries of our countries, we have to pursue this universalization of the rules of the three S's.

Then, secondly, we also need to consider about the intentions of the countries trying to introduce their nuclear programs. So we have to try to introduce some rules for increasing the transparencies and accountabilities in nuclear programs in industry. And for that purpose, even though I was not so optimistic about the multilateral fuel cycle control, it could play some role. And further, China is ahead.

Of course, the motivations behind the nuclear programs are mostly deriving from the security concerns in some countries, in some regions. So that's the kind of root cause of proliferation that we have to address that. And these security challenges must be dealt with in a coordinated manner between the United States and Japan.

Then, finally, beyond the Rally Around the Flag or Show the Flag. Now, Show the Flag is sort of the famous phrase, supposedly made by Richard Armitage when the Japanese are reluctant to provide some support in Iraq, I think. But then that means it's sort of some sign that Japan should more work together for -- work on the international peace cooperation and so forth. But that's also maybe kind of a reluctant -- showing the reluctance of the Japanese cooperating in that. But -- so we have to go beyond that kind of attitude. We have to be -- we have to play a leading role in setting these sort of universal criteria for safety, security, and safeguards.

And also, it shouldn't be simply, you know, blinded support on the nuclear fuel cycle. We have to be very sober and rational, and we have to think really about the pros and the cons, and we have to think about how to overcome the problems of the fuel cycle. But for that, I think the United States have to reestablish its leadership role, in particular in a multilateral forum. And the U.S.-Japan global partnership must be redefined and also have a clear strategy how two countries really can cooperate for sort of shared objectives.

And finally, as I mentioned, we have to avoid serious politics over inalienable rights and avoid the divide between nuclear-haves and nuclear-have-nots, which might be created by these new mechanisms. So then, what can Japan play a role? That would be the question that maybe I want to throw to you, what Japan can or what the United States can do for that.

Thank you very much. (Applause)

MR. ITOH: Thank you very much for excellent and provocative presentations. I'd like to bring your attention to the very important event next year, 2010. Next year we're doing a 50th anniversary of the revised U.S.-Japan (inaudible) cooperation in security. And the nuclear issues, including both industrial and security aspects will be one of the priority areas.

Now the floor is open. Who's ready to have weapon-grade questions? (Laughter)

Okay. The gentleman over there.

QUESTION: To Mr. Akiyama, how do you see the new Japanese government –

MR. ITOH: Sorry, would you identify yourself? Thank you.

QUESTION: Hugh Grindstaff and just recently retired from National Geographic. How do you see the U.S. government -- I mean, the new Japanese government dealing with your proposal about -- there's a shift supposedly in U.S.-Japan relations? Maybe it's being reviewed? Thank you.

MR. ITOH: Shall we maybe collect a couple questions? Lady over there.

QUESTION : Thank you. Jenifer Mackby from CSIS. I was wondering about the additional protocol and the linkage, as you know, probably with Article VI? Because there are a number of countries, such as Egypt and others, who will refuse to sign on to the additional protocol unless further progress is made in nuclear disarmament. You probably know the story, especially regarding the Middle East. Thank you.

MR. ITOH: One more.

QUESTION: I'd like to ask Dr. Albright -- Charles Ebinger, Brookings. I'd like to ask Dr. Albright if he thinks the U.S.-India nuclear deal was good for nonproliferation or whether it sent the wrong message.

MR. ITOH: Professor Akiyama, please start.

MR. AKIYAMA: Thank you very much. Regarding the policy of a new government, actually we are not sure yet. I think they are now busy handling the base issue and also the budget formulation. And we haven't really heard about their ideas on what they should deal with the nonproliferation aspect.

And as far as the Foreign Ministry's concerned, I mean, it's not the political level, but bureaucrats' level of concern, that's somewhat related to the question on the additional protocol as a condition for the bilateral arrangement with Japan. I think that's the case. And we have introduced this ground rule that the Japanese government will sign the bilateral nuclear cooperation agreements with countries which have signed and ratified the additional protocol.

So in the case of Japan-UAE agreement, I think the Japanese government is waiting the UAE government to ratify additional protocol. So I think that line will be maintained. And even I see, you know, the more sort of stringent the nonproliferation policy will be introduced, in particular the export controls. And, of course, I think government is trying to make sort of political and diplomatic efforts for introducing that amendment when it is NSG guidelines and so forth. But these are, I think, along the line of the past and I don't see any sort of new elements.

And on the linkage between Article VI and additional protocol, I think this is the typical sort of politicization of the articles of NPTs. To me these are totally different issues. And, of course, they are -- we understand the concerns of Middle Eastern countries related to the Israeli nuclear capabilities and, of course, Iran's to some extent. But then it's rather irrational if they say this will be the reason why they are not really going to sign additional protocol. But, at the same time, we understand the security concerns without proper security guarantees provided to the countries and the region. They may consider some room left for the nuclear options.

Then I remember in July or something, I think, Secretary Clinton mentioned actually the possibility of providing nuclear umbrella to the countries in the Middle East. I think the town meeting in Jakarta or something. And so venue is somewhat strange and that record was not in the home page of the State Department, so I guess this is not yet official policy of the government. But still, we -- you know, the question is, actually this is a hypothetical, but if they are provided this kind of security assurances like that, then are they going to give up their nuclear (inaudible) national sort of nuclear program? Then my guess is probably no, because it's somewhat related to the nuclear prestige.

But I'm sure that that issue will be a major, major problem for the upcoming review conference. And if the review conference were to be to fail, that is one of the important factors.

MR. ALBRIGHT: Yeah, let me revisit a little bit on the additional protocol and linkages to Article VI in the Middle East. I mean, they're profound, unfortunately, and they are political. So I think the strategy to deal with it is twofold. One is to try to break the linkage; that if you want a nuclear power plant, you have to have the additional protocol. Simple as that. And it's a big chore, but I think that's the way forward on that.

The other is to start dealing with the question of a nuclear weapons-free zone in the Middle East, which is at the heart of this concern of Egypt. And I think it's very important for the United States to make this a priority. And what does it mean in the short

term? It means getting the CTBT and the Fissile Material Cutoff Treaty. And I think those are two arms control treaties that Israel would have a very hard time resisting. They would like to see those treaties, particularly the FMCT, come into play much later in the process of seeking a nuclear weapons-free zone, but I think that they can be pressured -- if that's the right word -- to accept it earlier. And I think that's, unfortunately, the necessary way to deal with this question of Egypt.

Oh, and I'm trying to avoid this, I always have a block, U.S.-India. (Laughter) You know, let me be flip. You know, if you're going to make a mistake, do it right. So that's sort of my attitude toward the U.S.-India deal. And so what I would look to India for now is help on Iran, significant help on Iran. I think it may be forthcoming. Help on illicit trade. India has horribly implemented export controls. It's a place of growing interest from European-U.S. high-tech suppliers. It's very easy for countries to set up turntable operations in India right now. Wouldn't it be ironic if Pakistan uses India as a turntable to get, illicitly, equipment for its gas centrifuge program? But right now, India is vulnerable. It's had horrible security over its information, nuclear information. But nonetheless, we can, I think, expect help and I think they'll take help on improving their situation.

And then also, I think look to India for help on the growing divide on this issue of the inalienable right of nuclear energy, and hope that India can provide somewhat of a bridge on that issue.

MR. ITOH: Who else has questions? Yes, please.

QUESTION: Charles Ferguson, Council on Foreign Relations. So I'm going to take my colleague Professor Akiyama's last slide and his question about what role can Japan play, and turn it back to him and, specifically, in two areas. One area he really talked about a lot was additional protocol.

So my question is if we're facing the dilemma Professor Akiyama outlined, and I think he's correct, that countries who have a choice of going with a supplier that demands additional protocol and one that does not, they would choose the one that does not because it seems there's a lower price to be paid. So one question in that area is, so, why did Japan sign up the additional protocol? Why have certain countries ratified it and gone through with it and others have not? What have you seen -- what do you think you're gaining by doing that? It may be an obvious answer, but I'd like to hear it stated for the record. So then, what incentives can Japan and others who have actually gone through that process offer to make this universal?

And then the final question on Iran, what role can Japan play there? I mean, right now we have this so-called P5-plus-1 process, and so Germany is a player there. And we want Japan to be a more active player in nonproliferation. And I'm a strong supporter, I said last week in Tokyo, of Japan getting a permanent seat on the U.N. Security Council. So how can Japan then take a more leadership role in this vital area right now in trying to stop

Iran from getting nuclear weapons? And by doing so, then really demonstrate Japan is ready to step up to a permanent seat on the Security Council.

MR. AKIYAMA: Thank you very much. Actually the first question, seemingly easy, but I think really difficult if you're thinking some philosophical way. Because if you have a choice of the market or the partner as a business, you know, it's a rational to choose the easier one. And then even with you have a choice of the easier one, then how come you can choose a difficult one, like -- you know, with sort of additional protocol?

I think, I don't know, as a political scientist if I employ this theory of the sort of constructivism, then that's norm matters. And maybe more simply countries do not want to be regarded as suspect of proliferation. And eventually, it could lead into some sort of obstacle for doing more business with countries with high concerns on the nonproliferation. And it coincides with the size of the market, like Japan or the United States.

And for example, in the case of Kazakhstan and Russia, Japan is trying to establish trilateral cooperation in order to get the uranium from Kazakhstan. And we need the plants -- we need to use the plants in Russia. So we have a bilateral agreement with Kazakhstan, with Russia, in which in the process of the negotiation, I think, we also requested that Kazakhstan to ratify the additional protocol, and Kazakhstan did, I think, because the offer is quite attractive and, also, our technology is probably somewhat attractive to the Russians. So if we have more attractive offers, then we have some incentive for them to ratify additional protocol.

So we may be -- so the assumption is if conditions are the same, then which is the easier one? But if these conditions are more, we can offer more attractive terms in terms of technology and other matters, then we can encourage. And also, the norms matter.

Then, secondly, the -- so that's somewhat related to incentives, right? And then as for Iran, what Japan can play a role in the case of Iran, well, I think my understanding is the role that Japan can play will be limited. But at least we can provide the sort of details of the Japan model. The Iranians always claim that they are following the Japan model. It's non-nuclear weapons states with the full biofuel cycle program. But there are two faults.

One is Japan doesn't have a complete closed fuel cycle. Some elements of the fuel cycle must be relied on the foreign services, and that's one thing. So we are somewhat already internationalized to some extent.

Secondly, the Japan model is not about the fuel cycle, but about the compliance with IAEA safeguards. And, of course, from the experts' viewpoint, we got some questions over the perfection of the application of additional sort of safeguards. But still, we are probably mostly in full compliance with the safeguards, including the application of integrated safeguards. So I would like to tell the Iranians if you claim the Japan model, you have to be -- you have to make application of integrated safeguards to

their programs. Unless they are doing so, they shouldn't have rights to claim the Japan model.

DR. ALBRIGHT: Yeah, let me be a little heavy-handed, I mean, turning your question a little bit. But, I mean, you know, one thing that I would like to see is Japan playing more of a role in imposing sanctions on Iran. And in conjunction -- and not in the Security Council, but in conjunction with the United States and the European Union. I think it can be very useful. I know it's hard.

Another is I think Japan's done a wonderful job of improving its ability to stop illicit trade. I mean, we know Iran operates out of North Asia when it can. I mean, it's used South Korea as turntables. It certainly uses China. Iran likes to hire, better quality equipment for its nuclear program. And so I think Japan's really done a lot on that and also trying to thwart sales to North Korea.

One whimsical thing I would like to see is the Japanese government say that -- and other governments -- that the IAEA cannot do its job without the additional protocol. I mean, if you read the IAEA safeguards report on Iran, they essentially say it every three months. And I think it would be interesting to have it stated by the Japanese government and then by the next director-general that we just can't do our job without the additional protocol. And if that's what the world wants, then fine.

MR. AKIYAMA: One point about the sanction, actually one time I took part in the sort of team of examining the options of economic sanctions vis-à-vis Iran, which is handled by the Foreign Ministry. And then after reviewing various policy tools, actually we have pretty much limited tools for imposing sanctions; also the area of the sanctions. And I think the most effective way is to stop the sort of foreign currency in the transactions and so forth, but that was probably impossible. And trade between Japan and Iran at the time is already low enough not to have a sort of significant impact in decision-making in Iran.

And so, of course, we need to give some negative sanctions. But, at the same time, if the -- you know, at some stage that Iran expressed interest in engaging with this EU 3-plus-3, then we may be able to provide further sort of incentives. And maybe that's -- Japan can play, but as far as negative sanctions are concerned, I think tools is limited.

DR. ALBRIGHT: Can I say one thing? I mean, one thing that's been helpful in Europe is for governments to take a policy to discourage business with Iran. I mean, it has much more play in Germany, which has huge amounts of business. But as a policy, it's helpful.

MR. ITOH: No more questions? Okay. Gentleman here and then lady over there.

QUESTION: Pete Sprunger, AAAS. GE and Hitachi are starting or have just started up a laser enrichment facility. I was wondering if you could comment on what that could mean if that technology turns out to be viable. What would that do for proliferation?

QUESTION: Hi. Thank you. Sharon Squassoni from the Carnegie Endowment for International Peace. Dr. Akiyama, I really loved your chart which had the integrated approach, but it got me thinking, especially the fact that Japan has, on a national basis, now adopted the additional protocol as a condition of supply, that we can't let up the pressure on doing this all at three levels: multinational, national, and maybe even industry. But it seems to me that, you know, a few multinational approaches isn't going to work, precisely because of what you described as the increasing politicization of this debate about inalienable rights.

So I would like to ask you and maybe David also, how do we get to complete multinationalization, at least of the sensitive parts of the fuel cycle: enrichment and reprocessing? I have a hunch that we would need to move through a legal route, maybe using the cutoff treaty as a way to level the playing field for all existing and future facilities, but I'd like to hear your views.

DR. ALBRIGHT: Yeah. I think I've been asked to deal with the laser enrichment question. And anytime a technology is proven to be simple to replicate, if you have the classified information, it poses a big risk. I mean, that's really the problem with the gas centrifuge. If you're on your own -- if Iran was on its own, it never would have built one, but it had incredible amounts of assistance. So I would probably apply that same criteria to laser enrichment. If it turns out that it's quite feasible developed and people can get their hand on the classified literature associated with it, it could become a real problem.

But I think my own -- I think our view at ISIS is that we need to study it more, I mean, and it should be done in the U.S. context. I guess Japan could do it, too, but to look at the proliferation implications of this technology, particularly with an eye to what happened with gas centrifuges and a few other technologies that were thought to be too -- basically too advanced to spread unlike reprocessing.

Let me end it there. I've answered your question. You can answer Sharon. I'm curious.

MR. AKIYAMA: Thank you. I thought that Dr. Albright would respond to Sharon's question, so I wasn't really preparing for the answer. (Laughter) But my observation is that unless we make this multilateral arrangement a legal obligation, it's very -- totally impossible to have achieve universalization of participation into this multilateral arrangement. So my thought is that's why we have to have sort of supplementary sort of various layered approaches, including pursuing the universalization of additional protocol and introducing this multilateral fuel cycle approaches and also even these bilateral arrangements is important.

And then we have to have two sort of different approaches: one is sort of punitive, the other one is kind of providing incentives. Which is sort of more effective? I think I would say the punitive one's more effective.

And the question is how can we make it possible? I think that in that respect we have discussed earlier the role that the United Nations Security Council could play is important. So, you know, we don't need -- we are not able to assess the intentions, but at least we can guess the intentions and if they have some suspicious activities. And without the additional protocol ratification, we maybe -- we should try to argue whether, you know, more sort of enforceable intrusive inspections could be possible through the United Nations Security Council resolutions. Of course, this is very difficult.

And, of course, as you correctly pointed out, the politicization over the inalienable right still, once again, comes up to be the issue when we talk about U.N. Security Council resolutions. But I think this is one of the venues that we may try to look into, more sort of feasibilities. Thank you.

MR. ITOH: Thank you very much.

Well, can I take just one brief question. The gentleman over there.

QUESTION: Thanks. How about one and a half? I'm Bruce Lauter, formerly of the Department of Energy, now independent.

First off, and I had to step out briefly, you may have covered it, but with the NPT review conference coming up, what do you see as the emerging objectives of the concerned states and how likely will they be able to achieve those at the conference?

And the next is there was a brief discussion about incentives. And, of course, the Bush Administration was very actively involved in trying to incentivize positive behavior through various fora: your atom generation forum; international forum; R&D efforts; and its flagship program, the Global Nuclear Energy Partnership. Congress and then the administration pretty much gutted and ended the domestic component of GNEP and shifted to long-range R&D, and probably never looked that favorably on the international side, although that's still continuing. I'm just wondering what impact that has had on the U.S. credibility abroad in trying to positively shape, you know, the inevitable expansion of nuclear power along peaceful paths.

MR. ITOH: Would you answer briefly?

DR. ALBRIGHT: Yeah. I must say I was never very favorable toward the domestic part of that, so I'm probably in the category you're talking about. I do support the international. I think it's important that the U.S. play a strong leadership role in trying to shape how the fuel cycle develops in the longer term.

Unfortunately, I think in the shorter to mid-term that we're faced with what we have, and it's, unfortunately, from a proliferation point of view, sort of essentially a risky technology. And that I think is going to suck up or absorb a lot of the attention, and I hope it doesn't distract from the longer term. But I think what you're talking about is ultimately a lot of these shorter term things concerns wipe out the more thoughtful, longer term. But I would hope with the Obama Administration that they would continue trying to shape the future of the fuel cycle, generally supportive of nuclear power reactors growing in number, and that we would find another balance on that issue.

Do you want to deal with the NPT thing?

MR. AKIYAMA: Thank you. On the NPT, you know, my response is -- I'm not sure what my response will directly respond to your question, but the thing is how to deal with the sort of concerned countries, like Iran, or the future potential sort of concerns. I think one of the key issues that we have to deal with during the NPT review conference is whether or not we can reintroduce some rules or a stringent interpretation of Article X. And if we cannot -- if we are able to introduce sort of some interpretation of Article X which makes it more difficult for countries to withdraw, then there would be more incentive for the compliance. And because -- you know, the possibility of being sanctioned under the law -- international law would be increased. And that would be one of the major -- that could -- which could prevent the potential proliferators or concerned states from attempting some sort of suspicious activities.

And on the second point that the United States can play a role, that's also related to the U.S.-Japan cooperation. But another area is although it may not be mainstream, but we can set kind of a de facto standard on the more proliferation-resistant technologies in sort of a nuclear reactor design or safeguards, technologies and so forth. And that kind of an area is -- that kind of issues or items are maybe somewhat important for the international cooperation.

MR. ITOH: Thank you very much. I know you still have many questions, but, unfortunately, time is up. I hope today's event triggered for the next stage of fruitful discussions between Washington and Tokyo, particularly in this field of nuclear questions, both in (inaudible) and security aspects. Both nations bear huge responsibilities for the coming generations.

Thank you very much for your attendance, distinguished guests. Please let me join to thank our excellent panelists.

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