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RESTRUCTURING THE ELECTRICITY SECTOR IN JAPAN:

WILL IT ENHANCE ENERGY SECURITY?

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Introduction and Moderator:

CHARLES EBINGER
Senior Fellow and Director, Energy Security Initiative
The Brookings Institution

Speakers:

YOSHIHARU TACHIBANA
Visiting Researcher
The University of Tokyo

JANE NAKANO
Fellow, Energy and National Security Program
CSIS

MIKE CHESSER
Nonresident Senior Fellow, The Brookings Institution
Retired Chairman and Chief Executive Officer,
Great Plains Energy and KCPL

WILLIAM HOGAN
Professor of Global Energy Policy
Harvard University

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P R O C E E D I N G S

MR. EBINGER: I want to welcome you here at Brookings and we're delighted to have you all here examining the subject of restructuring the electricity sector in Japan and will it enhance Japan's energy security?

We are especially thankful to the Embassy of Japan for providing a lot of the research. We've had a number of people go to Japan under this effort, so we're very thankful for the ongoing support from the Japanese government.

We are especially, I think, I would almost use the word "blessed" to have the panel we have here today because we have years of experience represented on the panel, both in the running of the electricity sector itself in Mr. Chesser's case; and in Mr. Tachibana's case, a man who worked for TEPCO for many years, had extensive experience with the British effort to restructure their energy sector -- you have the detailed bio, so I'm just going to summarize quickly -- and now deeply involved in the whole issue of what is going on in Japan; and Jane Nakano from our good fellowship with the Center for Strategic and International Studies. I always have to say that because I was the first director of their program many years ago. Jane is an expert on the region and the nuclear power area; served in the U.S. Government; has extensive experience in almost all the countries in Northeast Asia and their perspectives on restructuring; and also, most recently, has been doing some very exciting work looking at the prospects for shale gas in Asia. And finally, Bill Hogan, who actually, many years ago, was a colleague of mine at Putnam, Hayes & Bartlett. You were tangentially involved with PHB, right?

MR. HOGAN: Yes.

MR. EBINGER: Which was a firm very involved in the restructuring of the U.S. electricity and gas industry; also involved in the UK and many other countries. Dr. Hogan, many people would say, was, in many ways, one of the founders of the whole

restructuring critical issues involved, certainly going back to when the U.S. first embarked on that.

So let me start off with Mr. Tachibana. And we're going to have the format fairly small, short discussions by the various panelists. I will then ask a couple questions just to get it going, but we want to turn to the audience for as much time as possible. Yoshi?

MR. TACHIBANA: Thank you very much. Thank you for the kind invitation to this very famous place and it is a great pleasure to be here. First of all, on behalf of Japanese people, I would like to extend my sincere gratitude to all the help of the American people to the victims of the tsunami in 2011. And as a retired engineer and manager of Tokyo Electric Power Company, which caused the nuclear accident in Fukushima, I would like to ask your continued support to and sympathy with the people of Fukushima. Thank you.

Now, my task is to bring you a rough picture of what is happening in Japan as to the restructuring of the power sector. I will not go through 100 percent of my presentation, through the handout, so the detailed information is in your hands, so please read them afterwards.

First of all, please look at the page -- page what -- page 2, yes. This is what happened four years ago. And as you can see there are many death tolls. And what is shocking to me is there have been premature deaths of more than 3,000 due to the stress caused by the tsunami and also the nuclear accident of which people of Fukushima amount up to 1,600. So this is a number which we should not forget. And there has been an evacuation of people caused by the tsunami and there are roughly 270,000 people still out of their home, of which people of Fukushima amount up to 48,000 people typical. And all the Japanese people are responsible for those people until

they can recover their normal lives.

Before I go into the details of the regulation or restructuring of the power sector in Japan, I would like to draw your attention to the general tendency in Japanese politics, not only politics, but also all the phenomena, societal phenomena in Japan. There is a big pendulum in Japan swinging all the time. And as you know, Japan used to be one of the developing countries. And in the past, China was the most developed country in East Asia, so the new idea always came from foreign countries. In the past, from China, mainly from China, and recently from Europe and America. And we were attracted to the new concept, tried to learn and introduce it, that is one swing to the new idea from the foreign countries.

But gradually, people tend to think, wait a minute, the idea which can be a good idea to that specific country, say China or the U.S. or UK, might not be a good idea to Japan. Japan should have its originality. We are Japanese. We are special. We are unique. So that kind of new idea cannot be applied here in Japan. So the pendulum is always swinging, and I'm not sure whether the pendulum for a moment is this side or this side as to the restructuring of the electricity sector in Japan.

The idea of the restructuring of electricity sector came from UK and America in the late 1980s, so every story started from that time. Now, before going to the brief history of the restructuring, I would like to draw your attention to the unique situation or unique structure of the power sector in Japan. It is divided into two parts.

Japan is a very small country, comparable to California, but it consists of two frequency areas: one is 60 hertz and one is 50 hertz. Very strange. Why? That was because of the swing I mentioned.

The Kansai area was attracted by the technology of Westinghouse, American technology, and the eastern part of Japan, Tokyo Electric Power, was attracted

by German technology. That was the reason why the Japanese small power system is divided into two, and that makes the situation very, very difficult in order to transmit power from 60 hertz to 50 hertz or vice versa. And that actually happened immediately after the earthquake and nuclear accident on March the 11th. There was a bad shortage in the 50 hertz area and the 50 hertz area wanted to import electricity from the 60 hertz area. In vain. Why? There was a very weak connection, back-to-back station. There was a very weak connection. That was the beginning of the starting point of the revival of the discussion on restructuring of the power sector.

Now the brief history. It started in 1995. Very interestingly, when I was in the London office of the Tokyo Electric Power Company, I was observing or witnessed the development in the UK. There was a severe fight between Margaret Thatcher and Lord Marshall regarding the restructuring or unbundling of CEGB, Central Electricity Boards. And I received lots of visitors from METI, all the economists, all the researchers, and they made a very good report, a report back to Japan. And this is always the case that the new concept or new idea is introduced to Japan with a time lag. And in the case of the restructuring electricity, the time lag was roughly eight years. So we have ample time to be prepared for the coming deregulation or restructuring of the power sector.

So the first wave came in 1995, followed by the second reform in 1999; third wave, 2003. And all of a sudden, there was an earthquake, relatively small, but still affected one of the nuclear power plants of Tokyo Electric Power Company. There was a bad shortage of electricity. And then the competition among power companies stopped because of the shortage of electricity. The competition between power companies and gas companies started immediately after the introduction of the deregulation of the energy sector in Japan. And that competition continued, but the competition among power companies stopped because of the shortage of electricity caused by the

earthquake in 2007. So the first reform was a very, very moderate one.

Then March 11th, the earthquake and nuclear accident, that changed all the things, and the government of Japan decided to reconstruct the power sector in Japan. It was determined to do so. And generally speaking, the power companies are relatively resistive to the introduction of new ideas, saying that the Japanese power system is unique, it is reliable. Why do we have to change? But because of the nuclear accident, power companies had no voice to the general public in Japan.

And finally, in November last year, the Electricity Reform Act, Phase One, passed in the Diet. So the new restructuring started.

Could you see the chart entitled, "Retail Sector Liberalization Timeline?" The electricity market in Japan expanded gradually from 2000. And now nearly 60 percent of the electricity market has been liberalized and the current plan is to make it 100 percent, and, also, it includes unbundling of transmission and distribution companies from generating companies and retail companies.

For the sake of time, I will stop here, but could you see the last page of my handouts? This is the starting point of the discussion. This is the new concept. It was the new concept to the Japanese. So the pendulum swung to this and we will see how the pendulum will swing from now. Thank you.

MR. EBINGER: Thank you, Yoshi. Jane?

MS. NAKANO: Sure. First off, thank you so much for having me, Charlie and Alisa. A pleasure to be here. And my job today is to outline the key stakeholders and what their main concerns and interests may be as they are driving the current sort of national discourse on the future of Japanese energy policy.

But just to, you know, quickly review, Japan is an energy-poor country that's highly dependent on fossil fuel energy imports. And since the early 1970s, around

the time of the Arab oil embargo, Japan had a concerted effort to shift its energy reliance on Middle Eastern crude -- I mean, away from that and put more focus on nuclear, renewable to some extent, but then also energy efficiency. So consequently, Japan has become, or had become prior to Fukushima, become a major nuclear energy country where the nuclear accounted for about a third of the power supply. And prior to Fukushima, Japan had a vision of having 50 percent of its power source from nuclear.

Obviously, the great East Japan earthquake and tsunamis and then followed by the power plant accident very much sort of has shaken the core of the Japanese energy policy. And today, all nuclear power plants, civilian nuclear power plants in Japan are offline, and so there is sort of three -- so that's sort of the background in a very sort of broad manner. And I'd like to talk about what sort of concerns are there.

Obviously, the public is the largest stakeholder in this whole issue and discourse. The public, there is a sizable group of Japanese public that are very much opposed to the restarting of the 48 nuclear power plants that have come offline since Fukushima, and they're very much concerned. They've lost the trust in the nuclear regulatory system in Japan and also the safety of the nuclear power generation.

But in July of 2012, the new regulatory body was established. And a year later, the Japanese new regulator issued new safety standards. So as of today, 17 power plants, nuclear power plants, are now up for the new regulator's evaluation as to whether they meet new standards, safety standards, and so that sort of a situation. But it depends on, obviously, which poll numbers you follow, but about 60 to 70 percent of Japanese public polled, to my knowledge, are very still concerned. They certainly want to make sure that the plants that would come back online are meeting very stringent safety standards. The one sort of seemingly sort of minor issue here, which is pretty important, I think, is that even if these power plants meet the new safety standards, they

still have to gain the local government consent to restart. So it's one thing for these power plants to be sort of certified that they are meeting new standards, but there's definitely one additional important step before they can come back online and start supplying electricity to the Japanese society.

And, of course, the Japanese government is another sort of a group of stakeholders or, you know, they do have their concerns. And one is, of course, how to restore the public trust in the government's ability to manage crisis, the way the scale and impact of Fukushima has had, but then also to make sure that the new regulatory body is off to a good start. But the other one is they're certainly worried about the high toll, economic toll, on the Japanese economy that the current situation has caused.

The fossil fuel usage in Japan has come back up quite high, pretty much to the 1970s level in that I think the oil, gas, and even coal are back in use to generate electricity. And natural gas demand went up by 30 percent in Fiscal Year 2012 compared to pre-Fukushima Fiscal Year 2010. And that has meant about -- I don't want to get the numbers wrong, so I'm just looking at them to make sure, but $67.7 billion U.S. was spent to procure LNG alone; just LNG, not even, you know, oil or coal. And that's about double the 2010 level and that has led to a huge trade deficit for the Fiscal Year 2012, and it was in the order of, like, close to $80 billion. That's about 170 percent higher than the Fiscal Year 2011. And for the 2013 fiscal year, which is about to end in a couple weeks, the estimate is looking quite bad. I think the estimate deficit is $115 billion deficit, 40 percent higher than last year.

And so there's definitely a high economic toll. And also, the Japanese government has to know figure out what to do with the new -- to do with energy planning. Prior to Fukushima, as I've mentioned, they wanted to see a greater share for nuclear energy, but that plan is certainly dashed. So they're now -- they've recently come out

with a draft basic energy plan that does still have focus on nuclear to the extent that it is an important base load for the Japanese economy, but it also indicates that, you know, the reliance on the nuclear power generation will probably be reduced compared to pre-Fukushima state. And also, renewable will be another key -- will be one of the focal resources for Japan to pursue.

So now the Japanese government is calling for the restart of the nuclear power plants. And certainly, as for the renewable side, you know, they're also looking at this future deregulation in the power sector to be able to help introduce renewable in the country's energy mix.

And then last but not least, of course, business is concerned with the high price of electricity. They're very much concerned about the Japanese economy's competitiveness against its economic rivals. But then they're also concerned down the road how the Japanese society may be able to see the stable supply of power as the competition may unfold.

And so in sum, I think there are a couple things for me that I look forward to sort of keeping a close eye on. One is, you know, sort of short term, how much nuclear may come back. I would be surprised to see all 48 of them coming back, but, you know, what's the scope of nuclear coming back? Because it will have a huge impact on Japanese demand for natural gas as well as crude. Although, you know, Japan has been shifting away from burning crude for power generation.

The second and the third questions that I will be following closely are, in this context, are more mid- to long-term questions. One is how this deregulated competition affects the efficacy of this whole notion of coming up with the best energy mix. Prime Minister Abe has talked about it a couple of times and right now the Japanese government has not really issued a new mix, like, you know, 50 percent from

nuclear or X-percent from what have you. But down the road, as you see more competition, that may sort of make this whole idea of having an energy mix by the government level, it will probably challenge. I mean, there will be -- it might affect the efficacy of that approach.

And then, of course, you know, the question is, will the deregulation affect the stability of power supply? And can the stability be ensured? And so those are some of the questions I'll be closely following. Thanks so much.

MR. EBINGER: Thank you, Jane. Bill?

MR. HOGAN: Well, thank you, also, for inviting me. I'm obliged to say before I start that I don't speak on behalf of the Harvard Electricity Policy Group. That's part of my deal with them to always remind everyone these are my own opinions. And I am happy to have this opportunity.

I have, in the past, had the privilege and the pleasure to work closely with groups from METI and from various industrial and academic groups in Japan, and have been there many times and have many very good friends there. So there's even a little nostalgia in thinking about these problems.

I was asked to address today the question of regulatory issues that should be addressed for Japan to successfully unbundle and deregulate its electric power sector in the next few years. And I'm going to make a few preliminary remarks and then we can get into it more in the discussion.

And I'd like to address three topics. The first one has already been discussed and mentioned at length, which is the aftermath of Fukushima and the horrible tragedy of the tsunami and the implications that has for nuclear. And that is an important question. It raises many challenging policy issues and choices for the Japanese, but I'm going to argue that it has relatively little to do with the topic of electricity restructuring, and

I'm not going to say very much about it. So I think it's important, but I'm not going to say much about it.

The second is in my own conversations in Japan and undercurrent of reading what's been happening there, there is this undercurrent of disaffection, with all due respect, disaffection with the existing utility monopolies. So there's a little bit of -- TEPCO is the poster child for this, but the various companies in the various areas that the popular view or the government's view or something is that they have had too much power, too much autonomy, they were too opaque, no transparency in that process, and we would like to fix that problem, and that's what we're really about here. And that may be true and it may be a problem and you may want to deal with it, but it is a little bit looking backwards at what has happened historically with the country. And while electricity restructuring may have impacts on that issue of the role of these monopoly utilities, and very big impacts, I don't think electricity restructuring should be thought of as addressing that problem. It should be thought of as doing something more constructive and forward-looking, and the collateral effects on the role of these monopolies will be there, but that's not the principle purpose. So I'm not going to talk much about that.

So now let me talk about the third topic, which is the electricity restructuring. And there if the goal, which I think is the articulated goal, is to promote competition and to promote the use of competition, innovation, entry by new companies, diversification of the fiscal and financial structure, creating choice, diversity, all of the other kinds of things that we appeal to in thinking about the advantages of markets, if that's what we're trying to accomplish there are very important things that have to be done. And I'm going to argue that Japan has attacked the problem backwards. So they've done the unessential things first and they've deferred the essential things to later, and I'm going to try to explain what that is right now.

So if you want to have that kind of market and so on, the critical thing, when you analyze it, is to have open access and nondiscriminatory rules and protocols for using the transmission grid. That's a thing that's complicated. That's a thing that is central to electricity that's different in other sectors. And obviously, if you're going to have generators interacting with customers and traders and marketers, they all have to somehow interact through the transmission grid because the power's produced over there and consumed over here. And that's a fundamental problem that has to be addressed and solved.

And we want to have open access, so that anybody can enter; meet, you know, certain financial requirements, but you can have a lot of new companies and innovative ideas. And we want to have nondiscrimination in the treatment of those so that we're not constantly tilting the playing field or preventing people from doing things. Because basically, if you don't have confidence in access and you don't have confidence in nondiscrimination, you're not going to invest your money is what it boils down to. So you have to have those kinds of rules.

And one of the things that we have learned through painful experimentation in the United States and elsewhere is that if you really are serious about open access and nondiscrimination, then there's only one way to do it. And the way to do it is the way that has evolved in the organized markets now in the United States. We've experimented with lots of different things, but we now have seven of these organized markets in the United States. And at their core, they all use the same market design, and that market design is not an accident. They evolved towards it or started it, but it's something that you actually have to have.

And the key elements of that are to focus on the wholesale sector first, not the retail, so that's critical. That's not what's being done in Japan.

The second is to take and unbundle the generation from the transmission and the distribution side of the business.

The third is to take that transmission and take out of it the system operations for real-time, which is the critical element that has to be designed properly for these systems to work. And to have that system operate, coordinating over a very large area, conceivably Japan, but certainly over more than just one utility.

And running a real-time spot market that is based on the principles of bid-based security constraint, economic dispatch with locational prices, and financial transmission rights. That's the name of the model that I just recited, and I'm happy to go into the details, but it works. And there's both theoretical and practical reasons to believe that it's the only thing that works if you want to actually meet these goals of open access and nondiscrimination.

Retail competition, retail access opening up to all these other kinds of things can come later. It needs that wholesale market in order to work. Just declaring that people have retail competition doesn't make it happen, as is evidence in Japan, where we have lots and lots of sectors that are eligible, but nobody's doing it very much because it's too difficult, because they don't have the wholesale market part of the story.

So I feel a little bit like the bad news, but the bad news is doing retail first is a mistake and that was a mistake that others have made and Japan has made. Doing wholesale markets is absolutely essential. And if you don't do that, this is not a serious conversation. And if you want to have open access and nondiscrimination to the wholesale sector, there's only one way to do it and we know what works.

That's what Japan should do if they want to do it. If they're not going to do that, then what they're going to do is replace one monopoly central planner with another. And if they're going to have the government do it, then they should recognize

that that's what they're going to do. They're not going to have market solutions. But if they want market solutions, we know what to do. Thank you.

MR. EBINGER: Thank you, Bill, your usual noncontroversial self. (Laughter)

MR. HOGAN: Right.

MR. EBINGER: Mike?

MR. CHESSER: Thank you, Charlie. Charlie's given me somewhat of a daunting task. My job is to review the last 25 years of deregulation in the United States and talk about lessons learned for Japan in 10 minutes, so that'll be a bit of a challenge. (Laughter) I think I'll just hit some of the highlights and, again, we can get into any questions during the Q&A session.

I think it's fair to say that over the last 25 years, competition has hit all aspects of the electric utility industry. And some of that competition has resulted in significant benefits for customers. I also think some of it has resulted in fewer benefits for customers. So it hasn't been 100 percent one way or the other. But clearly, there are valuable lessons for Japan to learn from us and I'll try to highlight a few of those.

I look at these 25 years as a series of six what I would call transformative events. Now some of these obviously overlap and some have occurred more intensely in some parts of the United States than they have others. But the first one, and the one that Bill was referring to and I fully agree, was, you know, we started off with independent power generators and we didn't actually have a wholesale market to begin with. We had independent power generators selling directly to utilities and the utilities being required to buy the power at a premium, which created some significant problems with the home customers from those utilities, but we did evolve into the seven markets, and I think it has been very successful.

You know, these independent power producers had processes driven by the profit motive to reduce costs, to improve efficiency. And I think overall it's something that's been very successful, and selling into that wholesale market has been the key there.

The next event is what I would call retail competition. We started in the industrial and commercial area, and that actually yielded some significant benefits, primarily because commercial customers under traditional utility regulation in most states were footing more than their fair share of the costs. Residential customers had very strong customer advocates with the regulatory commissions and the industrial customers had very strong advocates, but the commercial customers didn't. And so when, you know, it was made available to them to work with someone who'd buy power, have it shipped over the transmission grid and into their building or into their plant, there was a significant value there that was being created because they weren't having to shoulder all the costs that they had before. So I think that was a positive.

Then I am a little less positive about the retail -- the residential retail competitive market. There the value gap wasn't as great, number one. Number two, it's very complex when you start getting into telling an individual customer, you know, you could buy your power for so much here and then it'll ratchet up over time and it was confusing. And most residential customers, the electricity is not as big a percent of their total living expense as you might think. So all in all, it was a lot of work, a lot of energy. I'm not sure near the benefit was created as was created for the commercial and industrial customer.

The third event began to happen in the early part of this century, but now is ratcheting up and will continue for the next 10 years, is the closing of some of the older coal plants because of environmental -- the cost of environmental regulation, because of

the low cost of natural gas now with, you know, fracking that's taking place. A lot of the older coal plants are shutting down and they're going to create not quite the deficit that has happened with the nuclear plants in Japan, but there will be a deficit that has to be filled. And, you know, they're looking at obviously natural gas-fired generation to fill that; looking at renewables. And they're also looking at what is my favorite source for filling that gap and that's energy efficiency. And I think that's one that is underappreciated.

And that takes me to the fourth event, which is this renewed push for energy efficiency. And energy efficiency is being driven by technology, to a large extent. You know, lighting technology has improved by leaps and bounds. Compressors have improved by leaps and bounds. So it's possible today to go into a commercial building, such as this building, and reduce the load consumption by 30 percent and to do it at an all-in cost that's lower than any power plant that you could build. And in the United States, and I'm not sure about Japan, although I looked around when I was over there, there still looks to me like a lot of potential to improve the efficiency in Japanese buildings. There's significant potential in the United States. There's a lot of buildings built back in the '80s and '90s with older technology where you could get that kind of 20 percent improvement.

Now, that requires a different regulatory bargain and it requires utilities to be able to go into the capital market to raise capital, and use that capital to pay customers incentives at a rate of what you would call avoided generation cost. But if they're able to do that, building owners can get somewhere between a three- and four-year payback, which is very attractive to them.

So all in all, the energy efficiency -- and there are lots of new players in this. There's competition there as well. And it's going to be important for utilities to welcome and collaborate with those new players. But I think you will see, it will be a

significant impact that plays out in this country over the next 10 years.

The next event I would talk about is large-scale renewables, primarily wind and primarily in the Midwest at this point. And there is some immediate attraction to that. It's obviously environmentally very attractive, and the cost of wind turbines is coming down all the time. But you also have to look at what I call the "all-in cost," which I don't think often is focused on. So not only do you have the foundational cost, but you have the cost of tax incentives that are being paid, that are being offered by the federal government. You have the cost of running transmission from where the wind is generating power to the load centers, which is not de minimis. And you also have the impact on the grid, an issue of grid stability. There are areas in the Midwest where nuclear power plants were being backed off at night because of the wind coming into the grid, which is not in the best operating interest of a nuclear power plant. So there, you know, the all-in cost of large-scale renewables, I think, makes them still a challenge to justify on an economic basis.

And now more recently, the last event I'll talk about is distributed generation: solar on rooftops. There you have a lot of the same issues. Photovoltaic panels are coming down, but you still have to install them, you still have to maintain them. State incentives are critical to their business model right now, so that raises the cost. And also, they have to lean heavily on the grid, although in most states they're not paying any of the cost of that grid that they're leaning on. And there's another problem with distributed photovoltaics is cross-subsidization. So the people that can't afford to pay to have one installed in their house are subsidizing the ones that can, particularly the low-income folks, a mother that's trying to put food on the table.

And then, of course, on the horizon, the next event will be the smart grid. We don't have the time to talk about that, but there will be a lot of costs as well as

potential benefits associated with that.

So bottom line lessons for Japan, from my perspective -- again, this is strictly my perspective -- I think the first thing I would do would be to try to maximize energy efficiency to fill that nuclear gap, to go after every building that has the potential to have its energy consumption reduced by 20 to 30 percent. It may get attractive for companies to raise capital to invest in doing that. I think that's the lowest cost, most environmentally effective, and you also put plumbers and electricians to work, you know, so you help your local job economy.

The second thing I would look at is to maximize the competitive benefits from the power generation wholesale market. I think that would make a lot of sense. And probably retail competition for commercial and industrial customers you would find would add value to the customers.

The ones I would be more cautious about would be the retail residential competition because I think there is a lot of energy around that with fairly limited benefit. And I would go cautiously on both the large-scale and distributed renewables.

The thing to keep in mind, and I've always believed this, in the long run the most important player in this whole scenario is the customer. And if you take actions that unnecessarily drive the customer's costs up, you're going to -- there will be backlash. There will be political backlash. There will be a lag to the economy. And I don't think that is wise decision-making in the long term. Thank you.

MR. EBINGER: Thank you very much. Commendable.

MR. CHESSER: Right.

MR. EBINGER: You ought to write a textbook. (Laughter)

MR. CHESSER: Right.

MR. EBINGER: Well, I think we've had some very interesting

presentations. I'm going to throw out a couple questions and then we want to move to the floor as rapidly as possible.

Bill, and then other can weigh in, on your observations about the impact of Fukushima and what's happening to nuclear, you kind of intimated, not to put words in your mouth, but that that really isn't the cornerstone of the debate on restructuring. But I was wondering, how does Japan, if they bring on a number of nuclear reactors as part -- and at the same time are restructuring, how do you envisage they could bring on those reactors and have them be competitive in a wholesale market that you rightly say Japan needs to create if they want to be serious about this? Do they operate as IPPs? Do they get merged into mixed generation companies? Do you have any thoughts on that?

MR. HOGAN: Well, I don't have a good answer to this worked out, but let me try to go through the components of it. The nuclear plants are probably uneconomic if you incorporate the costs that haven't been collected already, the unamortized costs of those plants. So that's an overhang. When we went through our own restructuring we called this "the stranded asset problem." And basically, the way we addressed that problem was by deciding who was going to pay the stranded assets. And there was a deal cut in every state that was slightly different, but basically, it was kind of -- most of it was paid, I would say, by the loads and then some of it was absorbed by the shareholders of the company and it became a wires charge on the distribution wires in effect that you had to pay. It was your transition charge; know that you had to go away.

And then the plants were turned over. In some cases, they were sold to operators who were going to operate them going forward and took them as economic. Sometimes they were retained by the utilities, like Exelon. And everybody thought at the time they were dogs and they were going to hate to have them, and then gas prices went up and then, all of a sudden, they were making a lot of money and then people were

jealous that they had these nuclear plants. That's reversed because gas prices have gone down. You know, it's gone up and down, but they're taking the risks on the marketplace.

So you could have the existing utilities, you could sell them to new players. You had companies that went around and -- Entergy bought a lot of plants outside of their territory and operates them in New England and places like that. So there was a very much competitive market for taking it over.

I think with the case of nuclear, because of the safety concerns and all that sort of stuff, you want to be a little cautious about that, so you don't want me running them. You know, you want somebody that regulators have confidence that they're going to do it in a safe way and all of that kind of thing. So that's for the fraction that you want to come back, and I don't know what that fraction is. It's somewhere between 0 and 48, but I don't know the answer.

Then for the others, you have to go through the close-down, the shutdown process and dealing with the spent fuels, and that's going to be a government-regulated process as well. So I think it's a hard problem. I think it's expensive, but I think the basic outlines of how you do this are conceptually pretty straightforward and don't have any impact on the designs of markets or how you do electricity restructuring. You can accommodate it completely within that.

MR. CHESSER: I would just add that having been part of a utility that owned a nuclear plant, it really is eye-opening how complex and demanding it is to own a nuclear plant day-in and day-out. You know, it's a very complex piece of equipment. There's lots of things that can go wrong. There's lots of regulatory requirements. You know, I was amazed that if you wanted to tighten that bolt, you first had to go to your operating manual and bookmark the fact that I'm going to approach that bolt and I'm

going to turn the screw three-quarters of a turn and document the fact that you did it. You know, I mean, it's just a whole different way of operating.

And for that reason, you know, my view is it's a lot different than an independent power producer that owns a combined cycle power plant. And I think these plants probably either ought to be owned by utilities that have been operating them for years or by someone like an Exelon or an Entergy that has a whole fleet of these plants and that is one of their core competencies. So it's a different market construct than you would have for other independent power plants.

MR. EBINGER: Yoshi, and then anybody else can weigh in, we were discussing before the meeting began about the different challenges perhaps Japan faces in restructuring in that you are embarking on restructuring when you already have quite a substantial renewable energy load from wind, solar, and so forth. Is that a fundamentally different problem as you unbundle with a large renewable load as opposed to the experience in the U.S. and the UK when we unbundled and then slowly brought renewables into the system? And I'd be interested, Bill, you might want to comment, does that require -- to do that effectively do we need for sure a wholesale market rather than the way Japan has embarked upon it? And anybody on the panel that wants to weigh in. Yes.

MR. TACHIBANA: I visited Germany, UK, and Ireland last year with another (inaudible). Within Japan, we are very much interested in those countries in terms of a large deployment of renewable energies. And I have found that they are overcoming the difficulties because, in my view, unbundling happened much earlier than the large deployment of renewable energies into the grid. So the central dispatching center, the managers of them have extensive experience in market operation, I mean, electric power market operation. So they know how to get the most economic power

plant in the right time, so they are already accustomed to that unbundled and free market situation. And after that, the expansion of renewable energies, particularly wind energy in the northern part of Germany, came. So it was an additional burden for them. Even then the burden was tremendous.

And they changed their dispatching practice. They named it "redispatching." For those who are not familiar with this terminology, what is the difference between dispatching and redispatching? And it takes hours of lectures to fully understand that, but it may give you a kind of idea of what is happening in Germany. So they had to cope with the large deployment of wind energy by means of changing their practice of dispatching or place an order to the generating stations.

Now, what the Japanese government is trying to do is to make it happen at the same time. On the horizon of 2020 or so, all the power companies will be unbundled and then the renewable energy target, the government has not decided yet the actual number of the future renewable energy penetration rate into the power grid, but suppose it is as large as 20 percent. Then, as was the case in Ireland, in the Irish case -- the target of the EU is 20 percent of renewable by 2020. In the case of Ireland, it is 37 percent by 2020 because Ireland is a windy country. In the case of Japan, Hokkaido is very windy island and it is expected that the majority of the wind power is to be installed, planted in the Hokkaido area. So the similar thing would occur.

And the Irish dispatching people can manage it. They have done a very good job. And I believe that the Hokkaido people can manage it, but the challenge for the Hokkaido people is that two things happen at the same time: unbundling and renewable energy. So there should be some appropriate process or steps to make this really happen with the stability of supply kept safely.

MR. EBINGER: Yeah. Anybody else want to add anything there?

MR. HOGAN: Well, there is a natural experiment that's going on that addresses this question, which we could take advantage of. So in the Western United States, we have the California Independent System Operator, which is one of these regional transmission organizations, and we have PacifiCorp, which is vertically integrated, traditional -- where they haven't done restructuring and they haven't done all of this unbundling and all that. And there's been a large influx of renewables because of the government subsidies coming from states and from the federal government. And the people in the West who are not part of the California ISO are getting overwhelmed by it because it's just operationally so difficult to control, and the model they have where operations doesn't deal with it on the timescales that need to be dealt with. So they have now have filed, after a year and a half of to-ing and fro-ing amongst themselves, a provision -- a tariff filing with the Federal Energy Regulatory Commission which is -- the legal description of what it is, is going to be different to what I'm going to say, but that's because of jurisdictional questions. But what they're doing is expanding the footprint of the California Independent System Operator to cover these new territories and run the real-time balancing market for those things because they can't deal with the renewables under the old model, but they can deal with it quite easily under this dispatch and redispatch story at the Cal ISO.

Now, they're going to call it the energy imbalance market, and they're going to say this is not part of the Cal ISO because then it would become FERC jurisdictional, you know, and all these other -- so there's a lot of paper that's going to be shred in this process, but that's the reality of what's actually happening there.

MR. EBINGER: Jane, you're an excellent student of geopolitics and particularly on Northeast Asia. Japan, of course, has had a long history, since the first oil embargo, of trying to diversify its energy sources, both by source within any one energy

type, but also between energy sources. Do you think that -- not to make you think too far afield since we don't know where this is going to play out, but two recent events would call into question, in my mind, if I wanted to necessarily be so dependent on LNG as opposed to nuclear? And one of those is obviously at least the prospect that once again we may see the Russians using a gas weapon against Ukraine.

But the other one, and perhaps more terrifying potentially, is this squabble that seems to be emerging in the Persian Gulf between the Saudis and the Emirates on the one hand and Qatar and some of the smaller other Gulf States on the other, largely over geopolitics, not energy. But obviously with Qatar being such a dominant player in world gas trade, one shouldn't be inured something could get out of hand. Do you sense, as you look at the restructuring that not only in LNG, but in coal, that the geopolitics -- that the geopolitics of coal might outweigh environmental concerns about coal?

I'm also puzzled that, you know, while a lot of people kind of think coal's going to disappear from the world market because we're doing a good job having it disappear from the U.S. market, we count no less than 10 major coal plants under development, world-class coal plants, that will be hitting the market 2020 and beyond from widely diverse places around the world. It would suggest that coal is not dead. Won't coal potentially be very competitive in the Asian power markets, and particularly minus, obviously, a global agreement on a carbon tax? Where do you think Japan is thinking about this in terms of a fuel mix?

MS. NAKANO: I think, you know, coal is king in Asia. And I think coal will remain to be a dominant source in Asia. Recently, the International Energy Agency has released its outlook and, you know, the growth indication is quite strong and, you know, there is a reason for it. I mean, it's easier to store. Of course, you know, no fuel

comes as sort of a silver bullet. You know, each energy source has its own sort of disadvantage and, of course, strength. But in Asia's case, I think, coal will be part of the mix for many, many decades to come.

And, you know, it's sort of interesting to think of how, you know, to see that our sort of campaign to reduce the reliance on coal, but it's now busy being shipped to Europe, obviously, to help Germany realize its sort of nuclear phase-out goal. And then, of course, you know, it's still being used in Asia.

And, you know, looking at the whole efforts for countries like Japan, but then also Korea, you know, the two countries are very import-dependent. In both countries, you know, currently, there's a bit of uncertainty over nuclear. You know, in Japan's case it's a Fukushima-led issue. In Korea's case, of course, the Fukushima has very much shaped the public opinion, I wouldn't say necessarily "against," but, you know, there is a growing concern over to safety. And, you know, there have been a couple sort of series of scandals, nuclear safety scandals in Korea. And now both governments are starting to look at coal more than ever before.

So, you know, there's something to be said about the coal. I mean, there is a geopolitical value to it. And for Asia, I think it's still very much (inaudible). And, of course, you know, China's a little different, I mean, in that their dependence has always been strong, but when it comes to gas, they can import pipeline gas whereas Japan does not have that option. I think the only potential viable candidate is Russia. But, you know, under the current circumstance, you know, that may be something that the leaders in Tokyo may have to take a second look at.

MR. EBINGER: Thank you. And finally, Mike, and then we'll go to the floor. You did very well, I think, outlining your seven stages. But let me pose this question to you. When we all started on restructuring and unbundling many years ago,

two of the central arguments economists used were that, A, we would make the system much more efficient and, B, we would lower consumer costs.

MR. CHESSER: Right.

MR. EBINGER: As you look forward and we have to begin to replace our aging fleet of many different sources of fuel, obviously leading to probably very large increases in capital costs rather than our existing plants, which are largely amortized. And prices begin to rise to consumers at the same time that we're offering them the smart grid and all these new toys to play with. Do you think that's going to be a political problem that we're saying we're getting more and more efficient, but your costs are going up at the home level?

MR. CHESSER: Well, I think it's going to be a very significant problem. I think you've put your finger on it. You know, I was saying at a previous meeting, not only do we have to replace some of the aging generating plants, but we have aging transmission lines, we have a significant number of aging transformers, in addition to which we have ones that are exposed to terrorism that we're going to have to start investing in security around. So there's nothing but upward cost pressures, which is why I think you have to be very cautious about making an investment in an energy source that might be environmentally desirable, but could drive costs up even further. You have to balance that.

I like to think in terms of the total living environment, just not the physical environment. So, obviously, you have a physical environment you have to be concerned about, but you have to be concerned about the cost of low-income customers and cost to industry, so that they can be competitive. And in looking at all that, particularly, you know, 2020 and beyond, I think we're going to have to be very careful about investing in technologies that aren't economic and cost-effective.

MR. EBINGER: Okay. We'll go to the audience. Please raise your hand and when you're called upon, please state your name and affiliation, and please ask a question, if at all possible. Do we have any questions in the back?

MR. BEEBE: Hi. My name is Adam Beebe with Johns Hopkins University SAIS. Jane, I believe you spoke very articulately to some of the stakeholders' concerns about the current energy situation in Japan and specifically to the high economic toll the current situation has taken. I'm curious if anyone on the panel can provide a little insight into industries' concern in Japan.

If I'm remembering correctly, energy consumed, industry consumes about 40 percent of the energy produced in Japan and about a quarter of the electricity consumed in Japan. So beyond simply having cheap, reliable access to electricity, to energy, are there more nuanced concerns that Japanese industry has, especially the big players -- chemical, petrochemical, iron and steel, auto manufacturers, et cetera -- what is their skin in this game in terms of how the future -- the government looks toward the future of policy for energy? Thank you.

MS. NAKANO: That's a great question. I mean, I haven't really looked into it to that level. But, I mean, generally, there are concerns about, obviously, cheap electricity, competitiveness. But yeah, I mean, any industry, any sector, relies heavily on the cheap energy as feed stocks and they would be concerned about competitiveness. It's still very much manufacturing-based, you know, sort of still. And then export is an important driver of the economic health for Japan. So any sector that relies on manufacturing, you know, that's still a concern. But I probably should defer to the guest from Japan for, you know, the insights.

MR. TACHIBANA: Yes, indeed. There is significant influence over the industry, depending on the industry. For example, on -- what is the English terminology,

(speaking Japanese)? No? Sorry.

MS. NAKANO: I'm sorry.

MR. TACHIBANA: Sorry. And for recycling iron, they use electricity to melt that recycled iron. An arc furnace is used and the cost of electricity, I do not have the specific number, but the share of the cost of electricity within their production costs is so large that they are quitting their business in Japan. And it is very sad news, but that recalls the sad news I heard after the oil embargo.

After the oil embargo, almost all the aluminum industry disappeared in Japan. Only one left with its own hydraulic power plant. So only one factory is still competitive in Japan, but others, all shut down, the plants. So a similar thing is happening. Very sad.

And for chemist industry, of course electricity price is a big problem for them. But the bigger problem -- the biggest problem for them is the price of their raw material, which is gas. And because of the event of the shale gas in the United States, the competitiveness of the American chemical industry is very, very advanced compared to Japan, even compared to Europe or other Asia emerging economies. So they are thinking of many things to survive. So they were already under that very burden and additional burden of higher electricity price. What is the English terminology? The last pin on the shoulder of an elephant or something?

SPEAKER: The straw that broke the camel's back?

MR. TACHIBANA: Ah, yes, camel, camel. (Laughter) That could happen, so there are serious implications.

MR. CHESSER: Yeah, you know, this gets to the point I guess I was trying to make when we were talking about coal. Ten years ago, the utility that I was part of, I had just taken over and we were going to build a new coal plant. And the

environmentalists were the Sierra Club; everybody was in the paper with this day-in and day-out about not wanting that plant built. So what we did was we called together all the stakeholders across the community, so we brought in the industrial customers, we brought in the low-income customers, we brought in the environmentalists, we brought in the regulators. And we said let's have a community conversation about what we need in the way of energy here.

And we came out of that with, okay, well, we'll do more energy efficiency and we'll do some renewables, but we also need to build this coal plant to keep rates low. And so I think keeping all the stakeholders' interests on the table and in front of the policymakers is critical.

MR. EBINGER: Yes, here up front.

MS. SKLAREW: Hi. Jennifer Sklarew with George Mason University. I had a quick follow-up question, actually, which is -- and then I had another question. Sorry. They're short.

The follow-up question is --

MR. EBINGER: I don't think that's on.

MS. SKLAREW: Okay, sorry. The follow-up question is whether you've heard about, and also maybe from the American experience, the role of some of these large users in possibly serving as entrants into the market if unbundling actually were to take place and they had access to the grid? Because I was in Japan doing research on broadly this topic last year, and what I had heard was that there is some interest from some of these larger corporations and actually playing a role in the grid if they were able to do that, selling back excess electricity, et cetera.

The other question is an innovation question, which is related because Bill mentioned that Japan is doing things backwards. And it seems like they've already

chose their path, so if it's backwards, it's backwards. The legislation's being passed already. So if that's the case, then where can innovation actually happen if they're doing things backwards? Is it energy efficiency, as Mike mentioned, or is it distributed generation? Or is it actually in renewables because that might actually be a possibility even with a backwards path? Thank you.

MR. EBINGER: Anybody want to take that?

MR. HOGAN: Well, I mean, it's clear that Japan has made a choice. And I think it's a mistake, but they have made a choice. They made the choice a long time ago. The results are there for all to see, which is we have lots of people who are eligible and nobody participating to a first approximation, so it failed. That's the reality.

So if you want to get innovation in that kind of an environment where it's hard to get into the market because the monopoly controls the critical, essential facility, which is the transmission grid, then you have to have some other monopoly, like the government, come along and say we'll just dump money on you. And if you're willing to spend enough money, you could make anything look cheap, and that's probably where we'll go to get that kind of innovation. If they want to get innovation because people are risking their own money and trying new ideas that nobody thought were going to work, then they have to have open access and nondiscrimination and all the other kinds of things because they have to allow entrepreneurs who are going to do something the government didn't think of. You know, if it was as easy as that, the government would just think of it and just do it. But the whole point of innovation is we don't know what to do and lots of people are going to try lots of things because there's a business opportunity. They're not going to get the innovation if they don't open up the market.

MR. CHESSER: I think one potential channel for innovation is the whole area of demand management and energy efficiency. Obviously, you know, they had

significant problems with load curtailments and things like that when, you know, Fukushima went down. And there's a lot you can do. We talk about it in terms of building a virtual power plant. So you have your base load, which is energy efficiency; you have your demand management, which is capacity; and you synchronize that in with the grid. There is -- and that's not the utilities doing that. That's the Honeywells of the world and, you know, some of the -- the GEs of the world, some of the bigger players. So some innovation along those lines would be where I would look first if I was saddled with a competitive wholesale -- a competitive system, you know, or generation system that wasn't working.

MR. TACHIBANA: May I --

MR. EBINGER: Yes, please.

MR. TACHIBANA: -- say something about innovation? The question on innovation is critical for the future of the electric power industry, and your question is very valid. And I'd like to mention three things.

One is that power companies in the past, before the restructuring or before liberalization in 2000, it was a monopoly and all the expenses can be recovered if the government approves it. So all the expensive research and development programs can be funded by power companies, nuclear and high-temperature gas turbines and others, battery as well. And after the liberalization, which started in 2000, then no Japanese power companies is capable of spending that much money. So the support to the innovative idea has been shrinking, but it's a very, very serious situation in Japan. So I'm very much concerned about the coming near future, how the unbundled companies can support research and development activities in the power sector. That is a very big question and big concern. That is one thing.

Another thing is that I have talked about that big project, but as for the

smaller project, I think there is some hope, especially in the field of efficiency improvement. The competition among power companies has not been very, very good in the past, but the competition between power companies and the gas companies has been very, very severe, even before the deregulation of the power sector. And power companies try to develop the technology of a so-called heat pump/water heater technology. That market was dominated by the gas industry, so almost all the consumers which need hot water, be it domestic consumers or the commercial consumers or industrial consumers, use gas or oil for hot water.

Now, the new invention was made, funded by the liberalized power companies, and heat pump/hot water, water heating technology has gained some share of the hot water market. That is one aspect. So those kind of small-scale efficiency-improving technology, innovation, can be continued under the unbundled power companies.

Another example I would like to mention is the floating offshore wind technology. This project started long, long before the Fukushima Daichi nuclear accident, but it happened at the first demonstration plant now has been installed in the offshore of the Fukushima Daichi nuclear power plant. An investment which TEPCO made to kick off that project was not very big. And lots of collaboration between TEPCO, university, and manufacturers have made this project successful. And I hope this kind of collaboration can be continued, can be studied even after the unbundling of the power companies. Thank you.

MR. EBINGER: Yes, sir, on the aisle there.

MR. EIFMAN: Thanks, hi. Michael Eifman from GE. And first of all, thanks to Brookings for putting the panel together.

So if I'm reading the phases of the electricity restructuring and reform

correctly, it seems that by 2018, 2020, there's full liberalization of the power sector. I don't know if that includes all the ingredients of Professor Hogan's template. It does not? Okay. So maybe that's the answer to my question.

So let me ask it this way then. Is there something fatal about the sequencing or assuming that by 2020 it has all the ingredients you're talking about, can it be corrected? Is the sequencing itself sort of, you know, an irreversible error or assuming that they eventually get to the right recipe, will it work?

MR. HOGAN: Well, it's completely reversible. They just have to set up the wholesale market, do the unbundling they talked about, and then they could leave -- the retail side will then take care of itself. But the problem is that you have an essential facility in the middle and you don't have access to it. So everything else is just around the edges, a little tiny bit is happening, but not very much.

And we encountered the same problem in this country. I mean, you know, when they passed the Energy Policy Act in 1992, if you ask Phil Sharp, who was the chairman of the committee at the time, you know, he said we had little wholesale competition that was in single digits as a share of the market and that's what they thought they were doing. And whew, you know, it just completed expanded and took over everything because that's what has to happen and that's what does -- it's a natural dynamic once you open that up. But if you don't open that up, you know, you just don't have this opportunity for entry and all the other things that you want.

But it's completely -- they could do it tonight and they'd be fine and they wouldn't have to mess around with the retail side because they've already done that. I mean, I don't even know what the details are or the rules there, so there might be some problems, but more or less it's a problem of focusing on this, taking the system operator out and do it.

And every country you go to and you have this conversation and they just -- you know, they're sucking their breath and they're just -- the existing monopolies are just horrified at this idea, so I'm familiar with it. (Laughter)

MR. EBINGER: Yes?

MR. TACHIBANA: May I add one thing from the viewpoint of an electric power engineer? I have no knowledge about economics, so I do not really understand what you have said. (Laughter) But in my understanding, the economists are mainly talking about transactions and engineers, like me, always talk about transmission. And transaction and transmission sounds like similar, at least similar to Japanese, and that makes the people confused.

And to me, almost all economists take electricity as if they are dealing with the flow of water. Electricity is not water. Water does not have reactive power. Water does not have the concern about frequency stability or trangent stability. Water flows very slowly, but electricity or actually the energy of electricity flows at the speed of light. Very different. And many economists, I'm sorry to mention this (Laughter), but to me, does not care about it. You take it as granted that electricity can be dealt as if it were water. It is wrong. Thank you. (Laughter)

MR. HOGAN: Can I respond? So I agree with everything you said.

MR. TACHIBANA: Thank you.

MR. HOGAN: Everything. (Laughter) And including the part about most economists make this mistake. (Laughter) And it's a serious problem. And if you think electricity is like water, you're going to get yourself in a lot of trouble.

And a lot of engineers make the mistake of ignoring the incentives and all the problems that are associated with markets, and you have to put the two together. That's the whole idea. And there's only one way to do it, and the way to do it is to have

the engineers run the economic dispatch system, security constrained economic dispatch, the way they've been doing it for decades, and the economists come in and price it. That's basically what it boils down to. You don't change the economic dispatch principles. You keep them the same for the very reasons that you say, because electricity is not water.

But then when you do it that way, it turns out the prices come out of that system automatically, and these are the locational marginal prices, and you let the market settle against those locational prices. So what people are doing in the markets are consistent with what the engineers say you have to do for security reasons. That's why it's absolutely critical. This is not a small part of the story. It's the whole story. And you have to put those two pieces together. And if you don't have those two pieces together, you cannot allow people to have access to the market. You cannot allow people to do what they want to do because they will cause the lights to go out. But if you want to give them access and allow them to make these choices, you could do it with security constraint, bid-based security constraint, economic dispatch with locational prices, and financial transmission rights. That's the name of the solution. Okay?

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

MR. HILL: Thank you. Terry Hill with the Passive House Institute. I was here before a couple of weeks ago, and I'm glad to have the opportunity to rephrase my question. I asked about the energy efficiency component. And what I'd hoped to hear today was that Japan was really -- given all the circumstances, Japan was really looking at micro grids and retrofitting existing buildings to take deep energy retrofits -- that's the phrase I missed out last time -- deep energy retrofit advantage of the buildings and getting the net zero quickly. And what impact would that have on the future of the Japanese markets? Thanks.

MR. CHESSER: Well, you know, obviously, I think that's a great thing to pursue, but I'd be interested in your feelings about that.

MR. TACHIBANA: Well, I have two things to respond to your very interesting question. As for the terminology "micro grid," I'm suspicious about it because the concept of micro grid is very, very confused. And people may put everything into the concept of micro grid as if it can solve everything. It's wrong. So you should define what "micro grid" means in your context. So I'm a little bit concerned about the widespread terminology of "micro grid" or "smart grid," so I have decided that I'll be smart enough not to use smart grid. (Laughter)

Now, the second thing about the retrofit of buildings, it is true that energy efficiency of buildings, especially office buildings, in Japan is not necessarily the highest in Japan. There is a good reason. The reason is what is expressed in the English terms lord and tenant problem.

MR. EBINGER: The what?

MR. TACHIBANA: Lord and tenant problem.

MS. NAKANO: Landlord.

MR. TACHIBANA: Landlord, sorry. Thank you very much. Landlord and tenant problem. So the landlord owner of the building is to invest for the efficiency of the building and the tenant has received the fruits of that investment. So the architecture in Japan and maybe in other countries as well, there is very little incentive for the owners to invest for the efficient building. So that is the fundamental problem in Japan.

And WBCSD, the international business association, World Business Council for Sustainable Development, have published I think two publications on this issue. You can download the report from the WBCSD site, and I was part of the project. We analyzed the situation and proposed a solution, but I found it is indeed very, very

difficult to solve that structural problem.

MR. CHESSER: Yeah. We had that same problem in the United States, but we have found ways to address that. You know, there's something known as an energy efficiency lease, where the landlord can share some of the benefits along with the tenants. And, you know, there's enough of a payback there, particularly when you get the utility's avoided cost of generation paid into the equation that there's enough benefits for everybody to go around. But it does require innovation. You just can't do it through the current lease arrangements. So I think there are ways to deal with that.

MR. EBINGER: Well, I'd like to thank all our panelists and ask you to join me in showing our appreciation. (Applause)

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