CLEAN ENERGY SOLUTIONS CENTER
ASSISTING COUNTRIES WITH CLEAN ENERGY POLICY

Risk Assessment of Power Projects

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For more information, see the clean energy policy trainings offered by the Solutions Center.

Webinar Presenter

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Sean Hello, everyone. I'm Sean Esterly with the Clean Energy Solutions Center, and welcome to today's webinar, which is hosted by the Clean Energy Solutions Center in partnership with Enerdata. And today's webinar is focused on the risk assessment of power projects.

Before we begin, I just want to go through some of the audio features that we have for the webinar. You have two options. You may either listen through your computer or over your telephone. If you choose to listen through your computer, please select the mic and speakers option in the audio pane to help eliminate the possibility of feedback and echo. And if you choose to dial in by phone, please go ahead and select the telephone option and a box will display the telephone number and audio PIN that you should use to dial in. And if anyone is having technical difficulties with the webinar, you can ask me for some assistance through the question pane, or call GoToWebinar's help desk at (888) 259-3826.

And we do encourage anyone from the audience to ask questions through that question pane at any point during the webinar. At the end of the webinar we will be addressing those questions in the Q&A session. Also, if you have any difficulties viewing the materials through the webinar portal, we will be posting PDF copies of the presentations as cleanenergysolutions.org/training, and we will also be posting a full recording of the webinar to the Solutions Center training page within a few days of the broadcast. We're also now adding all of the recordings to the Solutions Center YouTube channel where you'll find other informative webinars as well as video interviews with thought leaders on clean energy policy topics.

And one important note of mention before we begin is that the Clean Energy Solutions Center does not endorse or recommend specific products or

services. Information provided in this webinar is featured in the Solutions Center's resource library as one of many best practices resources reviewed and selected by technical experts.

So, if we get—today's agenda is centered around the presentations from our guest panelist, Antonio Della Pelle, who has joined us to discuss risk analysis for power related products. Before we jump into the presentations, I'll provide a quick overview of the Clean Energy Solutions Center. And then, following the panelist presentations we will have the question and answer session, where the panelist will address questions submitted by you, the audience. And at the end of the webinar, following the conclusion of the webinar, you will automatically be prompted to fill out a brief survey as well, and we thank you in advance for taking a moment to respond to that.

So, this is a brief overview of the Solutions Center and the Clean Energy Ministerial. The Solutions Center was launched in 2011 under the Clean Energy Ministerial, and the Clean Energy Ministerial is a high-level global forum to promote policies and programs that advance clean energy technology, to share lessons learned and best practices, and to encourage the transition to a global clean energy economy. There is currently 24 countries, along with the European Commission, that are members, covering about 90 percent of clean energy investment and 75 percent of global greenhouse gas emissions.

And this webinar today is being provided by the Clean Energy Solutions Center, which focuses on helping government policy makers design and adopt policies and programs that support the deployment of clean energy technologies. This is accomplished through support in crafting and implementing policies related to energy access, no-cost expert policy assistance, and peer-to-peer learning, and training tools such as this webinar. The Clean Energy Solutions Center is cosponsored by the governments of Australia, Sweden, and the United States, with in-kind support from the government of Mexico.

And the Solutions Center provides clean energy policy programs and services, including a team of over 60 global experts that can provide remote and in-person technical assistance to governments and government-supported institutions, no-cost virtual webinar trainings on a variety of clean energy topics, partnership building with development agencies and regional and global organizations to deliver support, and also an online library containing over 5000 clean energy policy related publications, tools, videos, and other resources.

The primary audience for the Solutions Center is typically made up of energy policymakers and analysts from governments and technical organizations across all countries, but then we also strive to engage with the private sector, NGOs, and also civil society.

And the Solutions Center is an international initiative which works with more than 35 international partners across its suite of different programs. Several partners are listed above and include research organizations like IRENA and

IEA, programs like SE4ALL, and regionally focused entities such as the ECOWAS Center for Renewable Energy and Energy Efficiency.

And finally, I just want to highlight one of our marquee features under the Solutions Center, and that is the no-cost expert policy assistance known as Ask an Expert. The Ask an Expert service matches policymakers with one of our more than 60 global experts selected as authoritative leaders on specific clean energy finance and policy topics. So, for example, in the area of resource assessment we're very pleased to have Kuda Ndhlukula, consultant in energy infrastructure expert, serving as one of our experts. So, if you have a need for policy assistance in energy management, resource assessments, or any other clean energy sector, we encourage you to use this valuable service. And again, the assistance is provided free of charge. So, if you have a question for our experts, please go ahead and submit it through our simple online form at cleanenergysolutions.org/expert. We also invite and encourage you to spread the word about this service to those in your networks and organizations.

And so, now I'd like to provide a brief introduction for today's distinguished panelist. Today we'll be hearing from Antonio Della Pelle, who is a chemical engineer with 20 years of experience working in the energy industry and has been advising several governments and private companies on projects related to energy markets review, global energy outlook, power generation, and energy policies analysis. And so, now with that I'd like to turn things over to Antonio.

Antonio

Hello, everybody. This is Antonio. And good afternoon to the people based in Asia, good morning to the people in Europe, and good evening, good night to the people based in the US. So, thank you very much for your time. Thank you very much, Sean, for your introduction. And thank you to Clean Energy Solutions Center to give Enerdata the opportunity to share our experience, methodology, and tools with you related to power projects and how to assess risk and how to mitigate that risk. So, we will go today through this presentation in about 45 minutes, and then I will be more than happy to answer your questions.

The plan for today is we will have a brief introduction about Enerdata for those of you that don't know Enerdata. Then, we will create a big picture—so, to see what is the primary energy demand and electricity forecast globally, with some focus on Asia. So, today the case studies will be very much focused on Asia, so we will have also—drill it down to Asia cases. Then, we will talk about LCOEs, or the different—an indicator where you can assess the different costs of technologies of being able to generate electricity. So, electricity can be generated in many ways and we want to see how the different technologies compete against each other from an economic point of view.

Then, we will talk about renewables and feed-in tariffs. A feed-in tariff is one of the mechanisms to support renewables, so we will talk about feed-in tariffs and renewables. And then, we move to specific case studies. So, we picked three countries: Japan, Indonesia, and Malaysia. But these countries are quite

different from each other—but sometimes quite similar. So, we will see related to the power business what's happening in these countries, what are the opportunities, what are the risks they determined there.

Then, we will introduce Enerdata Energy Risk Index; it's a _____ tool and methodology to assess and benchmark different countries. So then, we will do a real case study again with Japan, Indonesia, and Malaysia to see how you can assess or how you can really identify the risk of potential power-related projects in these countries. And then, we will have the conclusions, and then we will move to the Q&A session.

Okay. Enerdata. Enerdata is a French company. So, we are an independent company and the office is in Grenoble—so, it is near Paris, about two and a half hours south of Paris. And then, we have another major operating office in Asia, in Singapore, and I am the Managing Director of the Singapore office. Enerdata has been in business for the last—well, now 26 years. It was 1981 when we were born. And we have three major business lines. One is information services—so, we do have databases. We do provide reports. Just to let you know, we do have the biggest database available commercially, that is called Global Energy Data, where we cover 186 countries and we have more than three billion data in this database.

Another business line is about modelling. So, we do our own models. So, one model is POLES. POLES stands for Prospective Outlook on Long-term Energy Systems. We will talk more about POLES later. When we talk about the forecasts, we will share with you the output of that model. We also have another model called MedPro that is a bottom-up approach. POLES is more of a top-down approach.

Finally, we do consulting. So, we help companies, we help governments with business strategy, business study, market study, energy consults, et cetera, et cetera. So, this is Enerdata.

Here you will find a few logos of companies that we work for. And what you can see, we work for a big variety of industries because we are energy experts. Energy is directly related by everybody. So, oil and gas companies deal with energies, equipment manufacturers deal with energies, government, banks. So, that's why we do work with very different types of industries and services.

Okay. About myself—Sean did a great introduction about me. The only things I want to say is I've been living in Asia since 2003. So, I lived in Japan for one year and a half, then China for one year and a half, and then moved to Singapore. So, I am half-Asian and half-Italian.

Okay. Let's talk about primary energy and electricity forecasts. So, we use POLES. So, our POLES model covers 66 countries and regions. It covers all the fuels. And you can see from the picture here, as inputs we put the source system in for the specific energy—so, we are oil and gas, coal, biomass, and also uranium, which we have for nuclear. Then we have macroeconomic assumptions—so, we need to do GDP assumptions and exchange rate

assumptions. Climate and energy policies—so, how the policies will affect the _____, and these are the inputs. And then, technology. Technology costs for power generation, for the production of oil, the production of gas. So, all those kind of technologies are there, and there are also new technologies.

So then, we ran the model—so, the model has the supply module, the primary demand, the transformation, the final demand. And then, afterwards we get the international prices. So, international prices is a balanced output. So, the model based on the production cost, based on the resources, based on these things—we calculate the different balances, and then based on those balances there is a price for the oil, for the gas, for electricity. So, this is the model that we use: POLES. And the next few slides that we go through, you will see there is a reference to three scenarios that we have run in POLES.

So, these three scenarios are called Ener-Blue, Ener-Green, and Ener-Brown. To make it simple, I will say Ener-Blue, you can recall as it—the NDC scenario. So, as you know, in Paris in 2015 there was an agreement by many countries being that they will commit to reduce emissions. So, we ran the scenarios where we say all of those countries will achieve their commitments by 2030. Then, when we ran those scenarios what we are seeing is that the temperature decreases in this model 3°C. We do know that there are some scientists to say that if the Earth's temperature was above 2°C, we will be in a big problem, so what we do is we have another scenario called Ener-Green where we target to have a temperature up to 1.5°C. So, this is called Ener-Green. And Ener-Brown, I will say, is the sort of scenario of business as usual—not much emphasis on climate change. And that is what we call Ener-Brown. So, when we look at different pictures, you will see blue, green, and brown. And then, in many other slides we just pick the base scenario that is the Ener-Blue scenario.

Okay, on this slide that is just a summary I would like to bring your attention to two or three key points. First is the primary consumption. So, what we can see is for Ener-Blue and Ener-Brown we have the energy demand growing. And it's only the Ener-Green scenario where the energy demand may peak at around 2027, 2028. And this is quite important, because we—peaking of any total primary consumption is still a new concept for us. We talk about the peak—oil peak and other things, but total energy demand peaking is a bit different concept. And what we see is with Ener-Green, because the appeal of the customer changed and the appeal of the user changed because we are more keen on renewables and more on saving energy—so, what we can see is that we can achieve a peak on primary conception.

Now, if we move over to share of fossil fuels, what we see is Ener-Brown and Ener-Blue, we still have fossil fuels account for more than 70 percent—so, it's a big percent. And the Ener-Green is the only one that—where we can see a reduction down to 50 percent for fossil fuel. Okay? Let's go to another slide.

So, this other slide is interesting. It's really talking again about the peak concept that we have with Ener-Green. So, if I focus on Ener-Green, you can see the primary energy demand is going to peak around 2020, 2030. So, this is very important. The other two scenarios, we have a continuation of growth

of primary energy demand. And then, you can see the breakdown. So, you can see oil still plays a part of it. So, oil mainly is used in transportation and petrochemical industries. Then, what you can see is the growth of gas—so, you notice that gas is growing. Coal. Coal is interesting because we use a lot of coal today, and Blue we have a reduction but still we have a lot of coal, and in Brown, coal is still growing .And then, we have nuclear that is growing in all three scenarios. And then renewables. Renewables is growing in all scenarios. So, there is a common denominator that in all scenarios we have renewables growing, nuclear growing. Coal, depending on which scenario, is growing or is declining. But gas is also growing through all three scenarios.

Where this is growth coming from? Asia plays a big portion. So, you can see here is where we were in 2013, and this is where we will end up in 2040 based on Ener-Blue, and Asia plays a key portion. Asia—really China, India. Then we have Africa. So, that's why the next slide we really only focus on Asia, because most of the growth is coming from Asia.

Okay. Let's talk about Asia now. So, now we move to Ener-Blue. So, this is Ener-Blue. So, just one scenario. And what we can see is the oil demand declining, gas demand is growing. You can see coal consumption all along is still big. Then we have the growth of nuclear, and then there is also a growth on renewables in the environments. The orange dotted line, this is the fossil fuels' inputs in power. So, what we can see in Asia, we see it peaking around 2015—so, we peaked it and now—that it was at 84 percent—and by 2040 we will go down to 66 percent in the Ener-Blue scenario. So, Ener-Green, we have seen we can go below 50. But you can see also Asia is moving away from fossil fuel, but still, two-thirds of the fuel use and power generation will be fossil fuel.

A bit more data, a bit more details about Asia. So, here you have pictures for the major countries: China, Korea, Japan. So, on the left-hand side is primary demand. On the right-hand side now we talk about power. So, what I would like to focus on on this slide is about the power side. So, we can see some common denominators. So, in China we have coal growing. In Korea, coal decreases slightly but is still important. In Japan, coal will decrease. But then, we see in the rest of Southeast Asia coal decreasing a lot. And also in India, coal increasing a lot. So, what we can see overall: In Asia, coal is still a dominant fuel.

The other news are regarding renewable. So, you can see China it was growing. Korea, everywhere, renewables are growing. So, this is really a common denominator, and that's why later we will talk a bit more about renewables, because you can see there is a big growth of renewables in Asia.

And finally, if we talk about the gas and nuclear, you can see gas growing also everywhere—so, this is very important. So, gas is still a fossil fuel but it's much cleaner than coal. And nuclear—nuclear, China, India, very big difference. Japan, it's a question mark, and we'll talk about it later in the case study. Southeast Asia, it's more nuclear. And then, we have Korea, that nuclear is a big determinant. So, you can see now a common denominator: Coal is important in Asia, nuclear, and also gas.

Now, if I'm in—part of a power business, I can be a power generator, I can be an equipment supplier, or I can be a service provider. What I know is that if you talk about power in Asia, you talk about coal, you talk about gas, nuclear, and renewables. So, there are a lot of competitive technologies for Asia. And not only Asia, yeah.

Okay. Somebody—I think in this slide we talked about a lot, so just these bullet points. You can see renewables is growing very well. Demand is growing everywhere with the exception of Ener-Green; that will be peaking in 2028. But if we talk about Ener-Blue, demand is growing and electricity is growing everywhere.

Okay. So, let's move on to comparing the different technologies that we have available today to produce electricity. So, we introduced an indicator: LCOE. So, most all of you—I'm not sure all of you knows it. We just put here a slide for reminding us the definition. So, LCOE is the levelized cost of electricity, and this is the total life cycle cost divided by total lifetime energy production. So, in a few words, what is LCOE? It's the minimum prices at which the electricity must be sold for a project to become break-even. So, this is an indicator where we can now compare nuclear, renewables, and other technologies.

So, we have taken as a reference this study concluded a few months ago by Lazard. And this is the US market. So, the key point that I want to address is this is a good example across the numbers for the USA, but the trends are global. So, what we are talking about here about the competition of wind- and solar-based scores is almost everywhere in the world. So, the numbers can change slightly, but the cost stays the same.

Now, if—how to read this graph. So, on the left here you have—sorry, here you have the different technologies, and here we have the range of prices. So, why you have a range? So, when you build a plant or a new project, the cost—imagine you want to build a 1000 gigawatt—1000 megawatt coal power plant in Africa, one in Asia. Same technology, same equipment provider. The cost would be different because there is a labor cost, there is a financing cost. So, you may have a different equity debt ratio, so that will affect your final cost. We talked about the labor rate. The exchange rate. So, a lot of these factors are included, and then what you end up with is a range.

Now, in the USA the range will be maybe labor, permitting, things like that. So, there will be also financing and things like that. But what is important is if you look at the red dotted line—what we did there is it's the minimum point of coal power projects. So, in the USA there was a project, one or more projects that cost $60 per megawatt-hours—coal. So, any technology that is on the right-hand side of this line, it means it is more expensive than coal. So, if I take a—I don't know, geothermal in the USA, it is more expensive than coal. But you can see there are three circled ones. These three, they can be cheaper. Two are solar PV—so, crystalline and thin film—and one is wind. So, this is an important one, because many of us—if you remember, the year was five, ten years ago—the big drivers for renewables was really energy policies. It was governments to support the industry with FIT or green _____.

But nowadays, we are coming to a different concept. Nowadays the concept is that solar and wind are competitive. You can go ahead with a project of solar and wind just based on the current investment, just on the economics. You don't need really any more support from government to do that. That is a big change.

So, let's see what's happening. So, again, this is the USA, but the cost of wind and solar has been decreasing all around the world. So, if we look at these two graphs, we can see the wind LCOE has decreased by 66 percent from the period of 2009 to 2016. So, the last 7 years, 66 percent reduction. Solar: 85. So, these are big numbers, so it's a big reduction. And what we experience, we see even more and more reduction.

On this slide we just brought back some highlights of recent projects. So, in this one it's in India. So, we talk about solar at 5.30 cents per kilowatt-hour. This other project, 4.5. And then, we have Turkey, 6.9 cents, 7 cents. So, you can see now we are talking very, very low numbers. This is happening also with wind; it's happening with lots of other renewables. So, it is very big news in our, say, sector of power generation, where renewables start to be competitive based on economics. But this is sort of a new concept. Five years ago, you would demonstrate this: You would never be able to give this kind of statement. Now, we can.

Okay. Interesting. So, we have seen LCOE trends. So, we talked about renewables. So, let's say a bit more about the renewables and let's talk about feed-in tariffs. So, as you know, a feed-in tariff is one of the mechanisms to support the renewables. So, we will look at these as well.

Okay. Another snapshot. If we look at the 2015 year, the renewable capacity globally was at 31 percent. So, 31 percent of the capacity or power generation stored was renewables. Then, if we go down by regions, we can see for example in South America 64.5 percent was renewables. Yeah, when we talk about the US in this presentation we include also hydropower. And sometimes some people will take out the hydropower from the US, but here when we talk about the US, hydropower, solar, wind, geothermal, biomass is in the US. So…

Okay. So, you can have a good feeling of renewables. So, everywhere, renewables is getting a good share of the capacity available.

Now, if we look at the future, these numbers are quite exciting for us, because it really shows for the next 20 years there is a lot of business for people involved in the power generation. You can be, like I said before, equipment, power generation, and things like that. But things are going to change quite a lot. So, for example, if you take the USA in solar, you talk about the 21 gigawatt in 2015 going to 233—so, 10 times more. South America, from 2 to 71. Africa: 4 to 15. China: 51 to 512. And the same is for wind; the same is for hydro. And nuclear, it's a bit different because… Okay, let's talk first about the renewables, yeah. So, for renewables, what we can see is there is a big growth. So, there is a big growth in solar, wind, and geothermal in all the regions. Nuclear also, there is a big growth. So, nuclear is clean energy. You

can see Europe would be reducing—so, come countries start to remove nuclear. The USA would be stable. But in Asia, nuclear is growing, especially in China and India. So, in the future, really, Asia will have the biggest amount of nuclear stored. So, in addition to what we have in Japan, what we have in Japan, what we have in South Korea, Taiwan, China—really, Asia, you start to be really in the nuclear era, the nuclear technology.

Okay. Renewables. What the government targets are and where we are. So, here you can see for—you will have these few countries repeated a few times during this presentation. So, we did say Malaysia, Indonesia, and Japan, we will have defined case studies for them. But we also thought when we put the references we should also put China, India, and Korea, because these are big players in Asia about the power generation, power market.

So, what we can see here is the total stored capacity of renewables in 2015. So, you can see China is at another level—so, it's—well, it's a big country. Now, you can see the growth, the annual growth from 2010 to 2015. So, what you can see that is we all talk about eight-plus percent. So, it's a big annual growth in every country, including Japan. Japan, well, is decreasing consumption, the population is declining, the population is aging, but we still have more renewables coming. And that has been also supported unfortunately by the Fukushima tsunami that cost many lives, but it made Japan change a bit the way to think, or how to produce electricity.

And this is—you can see the share of production of electricity in those countries. So, you can Korea is only 2 percent and China is 25 percent; so, we go up from 2 to 25. But what is important is all these countries have clear targets for renewables, and that supports power people who want to do business in this area. So, there are clear targets even by countries.

In addition to that, we know that these countries, together with many other countries in the world, have given commitments to reduce emissions. So, again, this is important, because when you do a business plan or you want to invest somewhere, or you want to put a plant, a project, a plant in any country, you need to be fully aware of the energy policies. You need to be fully aware of what the government is supporting more and what the government is supporting less, which technology is the favorite against others. So, this is very important for you to know.

Okay. We talked about renewables. So, we have—you know, you can divide renewables into two different categories: proven technologies and emerging technologies. So, today, we really focus on proven technology—so, it's solar power, wind power, biomass power. You can add hydro and geothermal. And emerging technologies, there are several emerging technologies such as hydrogen and ocean energy, but we will not discuss them today.

But what we know is that of the renewables, if we move to the FIT slide, in Asia most of the countries have a feed-in tariff system, and all the countries have renewable targets. For Singapore, we do have a target, so we do say 600 megawatts of solar. It's the only renewable that really Singapore has in addition to _____ or biomass. That's why there is not a hard target of

renewables. But what is important is there is a target for renewables for all countries and a feed-in tariff on most of the countries in Asia.

Now, when we talk about FIT, here we talk about the very complex situation and the really dynamic system. So, we put two examples: One is a China wind FIT and one is Indonesia biomass. What these two things have in common is first regions. So, FIT is not the same for the whole country. So, in China, big country, so you have different regions, different FITs. So now, imagine you are a wind turbine provider. You need to know that some regions are providing more or better FITs than others—so, that can also give you some criteria for where I should go first and second.

The other key point is these FITs are changing with time, and the trend is, as you can see, lowering. Yeah? Because the government says, "Okay, now the technology is more—it's cheaper, it's more economical to do, so you need less support from us." So, you need to know, "Okay, what happens if I do a project today? What would it be for my next 15, 20 years if I take contributions from these governments?"

For Indonesia it's a similar story. So, here is biomass. You can see there is definition of different biomass; each one has a different feed-in tariff. Then there is the region: Each one has a different… So, it is a very complex system that you need to assess when to do a project to make sure that you have the best plan to get the best project to the best investor.

Okay. So, now we start to bring in some complexity of projects. We talked about FIT, feed-in tariff systems that are very dynamic and moving. We talked about renewable studies for government, emissions reduction targets for governments. So, all of those things you need to put together for your strategy. So, what we have done is we looked at Japan, Indonesia, and Malaysia. So, what we want to do is here to show, "Okay, if I want to be doing something power-related in these countries, what do I need to look at? What—where are the risks? What should I know about it?"

Let's start with Japan. So, Japan—this graph can look busy; it is busy. But the key point is here. So, the blue line is the nuclear power generation. So, Japan, as you know, has been a nuclear country for many years. And 2011, after Fukushima—so, here is 2011—after the Fukushima tsunami, they stopped doing the nuclear. So, that has been a big blow to the Japanese economy, because first they spent a lot, a billion dollars to build those nuclear plants that today are returning zero investment. So, all that money invested isn't making money. And they had to replace, so what they needed to replace with was fossil fuels—so, mainly gas and coal. So, there you can see now in this case Japan had the necessity to replace all the nuclear power that had disappeared with the cheapest fuel. So, they went for coal. So, emissions was really not the bit—you know, it was not more important. What you have to make sure is the country is still providing electricity to the—to its population.

After Fukushima, Japan has not said "No" to nuclear. However, the people—you know, the population is not that keen to have nuclear again, even if for the last 20 to 30, 40 years they had nuclear. Now, they have changed—some

of them have changed mind. Also, a lot of new safety regulations have been implemented. So, it means for existing nuclear plants to restart, they need to have a lot more safety systems. So, it costs more money, so it's taking longer. So, today we only have a few reactors back up online. We talk about more in this slide.

Now, we talk about Japan's electricity targets. So, if I go to nuclear—so, the government at the moment has an energy policy, an electricity policy where they say about 20 to 22 percent of power generation will be—by 2030—will be generated using nuclear. Today, you can see we are only at one percent, and the public feeling is really not supporting much nuclear. So, this is something that if you want to do business in Japan, you need to understand the risk and you need to watch it. Because if nuclear does not come on stream as much as the government wishes, but let's say only 5 percent comes—so, we have a gap of 15 percent. So, that 15 percent could be coming from coal, gas, or renewables. So, it's something that is very important for the future of this country, the future of the electricity needs of this country.

Okay. What's going on in Japan that is good to share with you? Right. So, I'm sure you've been following about the news related to the Toshiba bankruptcy. So, that is not good news. So, Toshiba is a big—they have a big nuclear business in Japan, and a few years ago they bought Westinghouse in the USA. So, as part of the bankruptcy they will need to sell Westinghouse. Now, the Japanese government is really telling the US not to sell to the Chinese—so, because there is some concern that China—they have witnessed that the Chinese have plenty of cash, so they could buy Westinghouse, and they could buy the American technology for nuclear. So, because already China has their own technology, they could become even stronger on the nuclear business. So, this is about nuclear.

Another thing for us to remember is that Japan tried to move on the fast-breeder of nuclear reactors—so the new generation. They spent a lot of money. It's not working now, with the new safety—security/safety procedure requirements. There are $6 billion just to open this one plant, so you can see it's big money. With $6 billion you can invest in more LNG plants or gas plants or _____. So, really, the Japanese government is in a situation at the moment to say, "Okay, what do we need to with nuclear? We have current assets. How can we make money with our current assets? We have our own population; we need to make sure they are happy." So, they need really to do a tradeoff between their economic drivers versus political drivers.

The other one is—so, Japan's government really is saying, "Okay, we want anyway energy security. That is important for the country." So, Japan has not really energy—they import 100 percent of everything. They have a little coal, but very, very little. So, first, what—their policy is, "Okay, first let's go to invest in upstream projects." So, if you go to Australia, you will find a lot of Japanese countries that invested in many energy upstream projects. Now they are doing this in Southeast Asia—many, many countries. Also, the USA.

Then, they want to move more about LNG. So, LNG—they want to avoid the crude oil price volatility by moving to LNG where they invest in the full

value chain. So, they are investors in the upstream, they are investors on the dispatching of energy, and then they are investors on the use of the energy. So, because they are involved in all of the sectors of the value chain, so they feel they can share the risk against trends, the risks of LNG.

So, then we have "exporting Japan's energy-saving technologies." That is what really—Japan says, "Okay, we are strong in technology. Let's go out with other countries and we'll export our technologies." So, that is really how a country can make modern energy that is a bit different. You know, I may use LNG that is more expensive, but I can sell my technology to countries that in the future will use LNG and end up with a low GDP overall. So, this is a good way to approach the energy, say, industry.

And finally, this is a matter of LNG where we were talking about, where the Japanese invested upstream, and this is—it's—downstream, it's really producing LNG, and this is in Malaysia.

So, how you can see now—okay, Japan there is a big discussion about the future of nuclear. There is also another discussion about the deregulation of the electricity market. So, today the electricity market in Japan is regulated. They've tried already for many years to have some sort of deregulations, but today it's still not working. But there are opportunities also there to be bought when the Japan electricity market becomes fully open.

Okay. Let's talk about Indonesia. Indonesia is different from Japan. Indonesia has its own coal. They have coal. And they have some more. So, because they have their own coal and gas—so, you will see on the power generation the amount of coal percent is quite high, because they use their own coal and it's quite cheap. And then, they use a lot of gas. So, they're starting now to replace some of the oil with the gas and the coal, and then you can see hydropower and geothermal—so, it's very strong in geothermal as well, Indonesia.

So, what we can see in Indonesia are some resources on coal and gas. And coal unfortunately is not the cleanest resource, but when a country is growing, it's very important as you grow that you support your economy, and so if you can produce it cheap, you will support the faster growth of your country. So, this is very important to bear in mind when we talk about these kind of countries.

The other one that is important to recognize about Indonesia is that Indonesia is a country formed by more than 1000 islands. So, if—imagine you were doing an electricity model based on, I don't know, minimizing the cost of power production. You could not come up with a big nuclear power plant to supply all of the energy to Indonesia. This is not possible. When you have many small islands, forget it. There is no way you can have transmissions of a big plant. So, the geography of the country pushes really the way you can do the best power generation. So, if you have a small island, today the small island uses these generators. So, what the Indonesian government is looking at, what they are supporting, is the change of moving away from these power generators to some sort of gas engine or small-scale energy and renewables.

So, this is one thing that the Indonesian government is pushing at the moment. And then, in addition, in the places where there are big islands—so, for example, Sumatera Island, or the Java Islands, where it's Jakarta—to build big power plants that could be gas or could be coal.

Now, if you look at electricity targets, you can see today installed capacity, coal is one half of the total installed capacity in Indonesia, and then a quarter is from gas. So, coal and gas really are the dominant energies in Indonesia. And we see renewables more and more coming up.

If we look at what's happening in the moment—we talked about the islands. This is a good example of a project—so, 22 March, so a few days ago. So, a total of eight gas-fired mobile power plants—so, this is gas-fired engines versus, let's say oil/diesel engines—500 megawatts on different islands. So, this is one way they are going to do it, they are doing it. On a similar subject, you have Wartsila; they're also doing something like this. But here, I just want to show you of this mobile or small, say, combined power plant, we have 3.1 gigawatts. So, it's—it feels _____; this is very big, but you cannot have a 3.1 gigawatt nuclear to replace this, because, I mean, it would be on 400 islands.

The other one is ADB. ADB is the Asian Development Bank. So, usually ADB provides funds—they are famous for providing funds on, say, renewable type projects. But in this case, in Indonesia, they provide some loans for an energy plant, liquefaction plants. So, this is quite intense. So, this is a new way of thinking. This is Asian Development Bank; energy investment is part of their rationale to invest.

And then, it's quite interesting, because in Indonesia the regulations tend to change not too often, but they've changed quite often. And now, there is this new regulation on 10/2017. I think the key point is—so, today, if you produce energy in Indonesia you can sell only to PLN. So, PLN is the government. The PLN would be the people that would buy your electricity, and you would need to do a PPA with that. So, in the past, PLN had the social obligation to sign 30-year PPA contracts. Now, with this deregulation PLN can have a clause where they can sign only for 15 years. So now, you can understand: Because of the reduction of guaranteed revenues for projects like coal plants, this is sort of a negative regulation. Because your coal plant life, they're usually—people think it's 30, 40 years, so you do a return on investment of 30, 40 years, so you want to have a PPA, you would put the full life cycle. However, because they are moving PPA to a shorter time, this can affect the final decision.

Let's go to Malaysia. Malaysia is a similar story. Malaysia also has its own gas. Some oil. Not too much coal, very little coal. But you can see here they started to have more coal power plants. They still have a lot of gas. They started to replace oil. And what we will see later is that they are starting new coal power plants so that they can free up some of the gas to be sold as LNG. So, it looks quite complicated, their business model, what Malaysia has been doing, or what it's doing. But if you think about it, Malaysia for the last 20

years has been an exporter of LNG. So, a lot of GDP of Malaysian countries comes selling LNG: liquid nitrogen gas.

Now, because, you know, their own domestic use of gas is decreasing—so, what they are doing is because they make good money by selling LNG, especially with Japan, so they start to import coal to burn coal to produce electricity so that they have some more gas to sell. So, that is a bit interesting to think, you know, is this business model sustainable in the long term?

If we look at Malaysia in 2012, they have—the only gas imported was a pipeline from Indonesia—so, they were buying gas from Indonesia: 2.3 bcm. In 2015 they imported 4.7, of which almost half is through LNG. So, if you—and before—you will say, "Wait, Antonio. You just said Malaysia sells LNG, and now you are saying Malaysia imports LNG." Yes. You understand correctly. So, because Malaysia has taken on long-term contracts—so, usually LNG contract in the past were 10, 15, 20 years, so they have obligations to sell LNG. So, they cannot—they could say, "Okay, I'll stop selling LNG and _____." So, in that case, what they have done is they have stopped to have a classification—you know, when they import LNG to use as their own internal gas for—and then they keep selling LNG from their liquefaction plant.

Okay. So, this is similar. I know that at the end of this webinar this presentation will be readily available for download, so a lot of these numbers, a lot of this information can be done later on by yourself. Yeah. I think the key point from Malaysia is if you look at what's going on at the moment, I would like to bring your attention to a few things. One is there is a big push on solar. So, Malaysia today on renewables, if we talk about solar and wind, the percent is less than one percent. So, very, very small. So, here the government needs to do something to support more renewables, and they are doing it with solar. So, we can see solar, 460 megawatts, in the next tender.

At the same time, they are building CCGT. So, they are using new gas-fired turbines for power generation, 100 megawatts. At the same time, on the right-hand side here we can see Malakoff starting one gigawatt of coal. So, now we can see here I talk about solar—yes, growing. Gas growing, yes. Coal growing. So, you can see almost any technology is growing in Malaysia.

And then, we're talking about LNG. So, we were talking about the fact that Malaysia has some old contracts to satisfy, but at the same time they are starting new contracts: 15-year LNG import contract with PTT Thailand for $1.2 million a year. So, this is quite intelligent, because what we have seen is the gas, the domestic gas is depleted, so you expect Malaysia will need to do less LNG, but they're still signing long-term contracts with the size.

Okay. Now, what I want to do here is really to share our experience—as Enerdata and also as Antonio—when you are involved in these feasibility study projects. Like here, we just looked at three countries: Japan, Indonesia, and Malaysia. So, they all have been good opportunities—so, we say, "All right, that's good. We go there, we will make business, we make money." At the same time, each of these, we have a risk.

Then, the other side is, okay, imagine you have a company that you want to be part of this market in Asia. So, you say, "Okay, where should I go first?" Because obviously, Indonesia, Malaysia needs electricity, but Cambodia, Philippines… Japan also maybe because there's no nuclear. So, how do you rank where you should go? You cannot go to every country; you want to be focused. So, what we have done weekly is the Enerdata Energy Risk Index. So, this is really putting together 20 years' experience of doing construction projects, doing feasibility studies, and trying to make a methodology that is transparent almost and it is applicable so that you can quickly do benchmarking between different countries.

Okay. So, feasibility studies—you know, if you do different feasibility studies there are different mind _____, blocks you need to look at. So, one is policy and regulations. We need to know those. Then, you need to do a market assessment. "Do I do business here? Can I make money? Who decides?" Then they say, "Okay, we are talking about electricity. I know this country needs electricity. Which technology? Do I go with nuclear? Do I go with wind?" Then, economic analysis. "Okay, I want to know return on investment." So, you need to have all the cost factors, financial indicators. And then, you need to do a risk assessment because in anything we do in life there is a risk, but all risk can be mitigated. And sometimes, what we will see later in the Energy Risk Index, some countries have higher risk than others, but it does not mean you should not go to that country. It means your risk mitigation for a country with a higher risk may be deeper than in another country. Even if—what I believe is you should always have a very detailed risk mitigation plan. Then, we come with final recommendations.

So, what we're going to do is, okay, a feasibility study—if Enerdata is involved, it can take six to nine months, quite a lot of money, but it—my experience, really, the first two blocks, you can do automatically—really, you can do it even by yourself. So, what we're going to be able to do is clear that index of methodology that you can use, that we can support you or you can do by yourself, but you can do it, a quick screening of where to go and what are the risks, et cetera.

Okay. So, Enerdata's Risk Index, in this benchmarking study that I'll show you later, is based on the 80 countries of Asia, but it can be applied to any country. And the one we have done is Asia—as I said, it could be Africa or other regions—is the—the power markets in Asia is much more opaque compared to Europe and North America. So, if you consider only Asia, in Asia there are only two countries where the electricity market is fully liberalized. Those two countries are Singapore and the Philippines. It means for all the remaining countries their electricity price is regulated by the government. So, they will decide, okay, how to price the electricity. So, that is quite different if you come from a culture of a full liberalized market where you buy electricity for 30 minutes and all these—they can be the seller; you can buy it. Here, you know, you have countries that for five years these prices are always the same. So, it's different when you do business, because now, you know, these countries, a lot of them are subsidizing the _____ facilities to increase the prices. So, if I'm doing a project and I'm going to come to where

there is a lot of subsidies, what happens if in five years' time that country removes its subsidies? What happens to my business? So, all those kind of things, we feel the need to share our experience in providing an index, this ERI index, this methodology. Okay? And this methodology we review constantly.

So, what we have done is we select 25 KPIs in five categories. So, we have commercial, socioeconomic, financial, environmental, and security. These five categories have been selected because what we have seen from our personal experience: Any success or failure of a project, the result will always fall in one of these five categories—or more than one of them. But these five categories, 99 percent of these times, will represent your failure or success of your project.

So, let's look at numbers. Let's go to the benchmarking. So, we start with commercial risk, so the first category. How to read this graph: So, here you have the five KPIs that we have defined. Here are the descriptions. And here you have the 80 countries, 80 countries in Asia. Here, we reported on the countries for this presentation we've been talking about, and also we have Japan, Indonesia, and Malaysia. So, let's focus on the—our three countries.

So, what we see is Indonesia, right at 16. So, Indonesia is this one. It means it's one of the most risky on the commercial side. Now what we do is we break down. What is the risk? Because you can see we have five indicators and all of the indicators are different. So, not all the indicators are the same. So, I can see Indonesia, C2, C3: ten. Okay. I forgot to mention that if it's ten, it's the highest risk; if it's zero, it's the lowest risk. So, ten is the highest risk. So, if I go to C2, private sector participation: "The cumulative percentage market share of the top three private power generation companies." So, in Indonesia the risk is ten. Three are all _____—government or the _____.

So, now what we are seeing is—imagine you are a company called Antonio, Ltd. I want to start a gas-fired plant in Indonesia. I know that my competitor is the government. So, indeed, before I start doing my business in Indonesia, the first people I should be talking to is the government. Yeah? So, this is a sort of risk mitigation. You can assess your risk and you can say, "Okay, _____, that's good there is no business. I just need to talk to certain people."

Now, if I look—so, Japan. Japan, it's 6. So, risk is possible. Let's go to individual, and I have here C5: ten. Very high; the highest. So, if I go to ten, it's "Main Utilities Weighted Profit." So, it's "The ratio of operating profits to revenues of the top three companies." I'm sure most of you know already the answer. There is a lot of these companies that are not making money because they are power plants that are switched off, because they invested a lot of money in nuclear and they cannot use it. So now, they need to use gas or they need to use coal, but it is costing them money, because they still have finances to pay.

So, imagine I want to invest in Japan, or I want to do business in Japan. What I know is that there are big companies there losing money. Usually, when a company loses money they may take extraordinary actions to make sure they

don't lose market share and things like that. So, again—now, this is very important, how you read the ERI index. Because Japan overall, the risk is quite low, but there is this specific indicator that is quite high. So now, again, if I want to go to Japan, maybe what I'll do is I'll try to do a joint venture with TechCo, that is one of biggest that is losing money, or Chiba. So, what you want to make sure is, "Okay, if I go do business, I'll talk to these people that could be the people that make my project a success."

But the idea—I'll give you an idea of how we made these indicators. So, let's do this one and then you can really—later I'll talk… So, this one, socioeconomic risk—so, if we look at Japan—so, the ranking is a 7; Indonesia 18. Indonesia is the most risky one. And Malaysia average, a little like Japan.

So, let's take again Japan. So, low risk overall, but there is one indicator—SP1—very high. So, this is GDP growth. Well, as you know, Japan GDP is still growing. So, it's a country that has been in deflation for many, many years and the population is decreasing year over year. So, again, now if I want to go there, I own an electricity business, I know that power, the electricity demand long term will not be increasing because the people are reducing. It's already falling a lot in the country. So, I need to really understand what kind of business—because maybe the answer is "Okay, I don't go for population but I'll try to part of the liberalization of the market. Maybe I'll try to be there, the first server provider or software provider on the software that does the transaction of electricity. So, in one, two, five years' time, when Japan is ready to be a fully liberalized market, I can do these things." So, these kind of _____.

And then, we have financial risk: the same. So, Indonesia, you can see it's gone high again. We have F1, F2, F3. Similar to Malaysia. So, let's go to see… okay, exchange rate. If you look at—or if you have been in Malaysia or Indonesia, you may have seen that in the last two or three years the exchange rate—you know, if you have US dollars, or even if you have Euros or Singapore dollars, you can be a lot more Indonesia rupiah and Malaysian ringgits than before. So, those countries, their currency lost a lot, especially because they export, export some oil, like Malaysia, some gas that is linked to oil price. So, oil price went down, so their currency went down, GDP went down.

The other one that is very risky for these two countries, but the same as Japan, is F3: foreign direct investment. So, here I want to see how much of the investment that is in country is money coming from abroad. Because if there is a lot of money coming from abroad—and I assume it's coming from abroad to invest in that company, I feel quite comfortable if I know there are lots of money coming from other countries. So, people feel comfortable. But if there is very little money coming from other countries, then there must be a reason. So then, here you need to have a risk mitigation plan for this. "Okay, why do these countries get little FDI?" And then, if your FDI is a decision factor, then you may go to other countries when you get the _____.

Okay. I will skip a couple. So, really, I want to go to the conclusion because I'm very interested in the QA session, Q&A session.

So, in conclusion: booming market. What we have seen is the market is definitely growing, and the electricity market demand is growing everywhere. So, this is not just Asia. So, yeah, we are talking about the electricity market as a market that is growing around the world.

Now, if you look at global opportunities, not local opportunities, Asia will play an important role. We have seen that. Power markets with both new installations and change of regulations, moving towards deregulated markets. So, what's happening here is that in addition to our necessity of additional power capacity, we are also witnessing the existing price and electricity model system changing. So, there is a double change. So, there is a more capacity and a different way to regulate the markets.

Then, if we talk about renewables specifically, we have seen that all those countries have a specific target of renewables, and all of those countries have made a commitment to the NDC, so renewables most definitely a good support for a future. And in addition, fossil fuel, we have seen that, yeah, it's not going to disappear tomorrow. So, gas is playing a big role, but coal, in Asia we have a lot of it. We have a lot of it. And today, we still have several plants under construction, coal, some of have just started. And those that are just starting, they will not stop in two years' time from yesterday, because you need to recover the money. So, for the next 10 to 15 years, those coal-fired plants will be working.

And finally, a power project presents plenty of risks. But it's not just power plants: It's anything we do in life that is a risk. But in specific case, we have seen here with the case study, each country has its own little peculiarity. Each technology presents a different challenge. So, what you need to do is really identify the risk first and then have a good way to mitigate the risk to issue a profitable business for the long term. And what is important is you need to understand the local market dynamics. So, we have seen for FIT, China, each region is different. So, it's—you cannot treat China as one country; China, you need to treat as 52 countries. And India is the same, and other countries… So, what is important is you need to realize the complexity of the potential business in Asia of power generation or the power business. And then, understand the risk and mitigate the risk.

Okay. With this, this was my last slide, and I'm very happy to take your questions.

Sean

Great. Thank you, Antonio. Give me one second. And just a reminder to the audience, if you do have any questions that you'd like to submit, you can do so by sending them in through the question pane there in the GoToWebinar side panel. One of the first questions that we have to start—let me pull those up—is: "In your ERI index you considered 25 KPIs. Have you considered more? And why haven't—or, why haven't you considered more KPIs?"

Antonio Okay. Thank you. Good question. Right. So, I don't know if any of you listening work at the banks. I think you do something similar: You have 100, 150 KPIs. So, what we decided is—we know that 25 KPIs may appear too little. We could—the methodology can accommodate additional KPIs, so we could do 50 KPIs.

So, the key point is when we have a KPI we need to make sure that we have the same data indicator for all the countries that we are benchmarking. So, certain data, you may not find for all the countries. So, it's meaningless to have a KPI that you can only benchmark certain countries.

And the other one, what we have seen is that on some projects a client asks us, "Okay, I want to replace a KPI." You know, we have some KPI on the gas supply; they want to have a coal supply. So, we can switch KPI. So, really, the number of KPIs is not a fixed number. The methodology can accommodate as many KPIs as we want. But what is important is that you need to have reliable sources for data for these KPIs and for all the countries that you need to benchmark. Because if you don't have reliable source, if you don't have all the data for all of the countries, then it's no point to consider that KPI. And we do review the KPIs on an annual basis, so we will periodically replace some of the KPIs. But yeah, so 25 is not really a minimum or a maximum; it's just an indication to start from somewhere.

Sean Okay, thank you, Antonio. And another question came in: "In addition to the current status of renewables in Asia, what do you think are the—in your opinion, what are the greatest opportunities out there moving forward in the energy sector for the Asia region?"

Antonio Okay. Well, there are several opportunities. So, we have seen renewables almost everywhere. I do see also on the transmission and distribution business also there is a lot, because you may know that in Asia not all of the countries have 100 percent electrification, so there is business there. Under energy efficiency, I can see some countries, more than a lot are moving from a need to add electricity to a need now to use electricity in a good manner and a clean way. So, I'm working for Singapore now Singapore is pushing, for example, solar, so they have a target on solar. You see they also have a target on energy efficiency for the industry. So, I see opportunity on the generation, transmission, distribution, and also technology and energy efficiency.

One thing that must be said is that the competition is very high, so if we talk about the renewables, if you talk about solar, you know that most of the solar cells are manufactured in China, so China definitely has an advantage to go abroad and do business. And sometimes the Chinese business is different from, say, European or American business, so sometimes the Chinese company will go, "And we'll also provide financing for your project," while maybe the European company will be—will sell only the equipment or the technology and then you need to get financing from banks.

So, you need to also see who are your competitors, and financing can play a differentiator. Because if you go to a country—I don't know, Cambodia. Cambodia needs support, so it could be a European company, it could be a Chinese, it could be an Indian company. So, how do they choose? So, that's very important for you, for your future business. You know? "How I can compete so that the local government or the local department to choose me versus, I don't know, Chinese technology or versus Japanese technology?" I can see a lot of competition on this side.

Sean Great. Thanks again, Antonio. Another question is: "What do you think about the Indonesia 35 gigawatt plan? Does it seem feasible?"

Antonio Okay. So, that policy is quite old—I think it was 2015. And so far, they have reached less than 50 percent of the target, the last two years. So, is it—I would say it's impossible they reach the 35 gigawatts. So, the Indonesia government needs to revise their target. They also need to be a bit more practical and realistic with the numbers, because we do know that Indonesia needs more power generation. At the same time, we do know it is hard sometimes on the bureaucratic side to get approvals, to get PPA. And also at the end of the day you have only one buyer: the PLN. So, there are a lot of things that the Indonesian government really needs to put together and make sure the bureaucracy gets slimmer so that the project can get there faster.

But the good news is we can see some new projects, but—we saw before, for example, that project, the gas engine, 500 megawatts. So, it's still a small number if you compare it to the target that needs to be achieved. So, I think that policy needs to be a bit updated, yeah.

Sean Great. Thank you, Antonio. At this point, that's all the questions we've received. If we do have any other questions come in, we can certainly come back to them, but with that we'll move ahead to the—wrapping up the webinar.

And so, on behalf of the Clean Energy Solutions Center I would just like to extend a thank you to Antonio for the excellent presentation today, and also to our attendees for signing into the webinar and participating in today's webinar. We very much appreciate everyone's time and hope in return that there were some valuable insights that you can take back to your ministries or departments or organizations. We also invite you to inform your colleagues and those in your networks about Solutions Center resources and services, including the no-cost policy support through our Ask an Expert service. And I also invite you to check the Solutions Center website if you would like to view the slides and listening to the recording of today's presentation, as well as previously held webinars. Additionally, you will find information on upcoming webinars and other training events. And just a reminder, we're also now posting webinar recordings to the Clean Energy Solutions Center YouTube channel. Please allow about one week for the full recording to be posted up there. Also, I would encourage you to go out and check Enerdata online as well for more information.

And finally, I would like to kindly ask you to take a moment at the conclusion of the webinar to complete the survey that will pop up. There's only a couple of brief questions, and your responses are very valuable to us.

With that, I hope everyone enjoys the rest of your day, and we hope to see you again at future Clean Energy Solutions Center events. And this concludes our webinar.