

## Renewables Rising: The Role of Grid Integration

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### Webinar Panelists

**Christine Lins** Renewable Energy Policy Network of the 21st Century  
**Peng Peng** Chinese Renewable Energy Industries Association

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**Stephanie Bechler** Hello, everyone. I'm Stephanie Bechler with the National Renewable Energy Laboratory, and welcome to today's webinar, which is hosted by the Clean Energy Solutions Center in partnership with the Renewable Energy Policy Networks of the 21st Century, REN 21. Today's webinar is titled Renewable Rising: The Role of Grid Integration. One important note of mention before we begin our presentations 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 resource library as one of many best practices, resources, reviewed and selected by technical experts.

Before we begin, I'll go over some of the webinar features. For audio, 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. And, if you choose to dial in by phone, please select the telephone option, and a box in the right hand side will display the telephone number and audio pin you should use to dial in. If anyone is having technical difficulties with the webinar, you may contact Go to Webinar's Help Desk at 888-259-3826. If you'd like to ask a question during the webinar, and we encourage that you do, you can use the questions pane or you may type that in. If you're having difficulty viewing the material through the webinar portal, you'll find PDF copies of the presentation at [cleanenergysolutions.org/training](http://cleanenergysolutions.org/training), or you may follow along as our speakers present.

Also, an audio recording and the presentations will be posted to Solutions Center's training page within a few weeks, and then they'll also be added 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. Today's webinar is centered around presentations from our guest panelist. Ms. Christine Lins and Ms. Peng Peng. These panelists have been kind enough to join us to discuss how increased additions of solar photovoltaics and wind and energy sector electricity sector has driven other energy sectors, and how 2015 marks the first time investment in renewable power and fuel by developing countries who passed that of industrialized countries.

Before our speakers begin their presentations, I'll provide a short overview of the Clean Energy Solutions Center initiative, and then following the presentation, we'll have a question and answer session where the panelists will address questions submitted by the audience. This slide provides a bit of background in terms of how the Solutions Center came to be. The Solutions Center was one of 13 initiatives by the Clean Energy Ministerial that was launched in April 2011 and is primarily led by Australia, the United States, and other CEM Partners. Outcomes of this unique initiative include support of developing countries and emerging economies through enhancement of resources on policies relating to energy access, no cost expert policy assistance, and peer-to-peer learning and training tools such as the webinar you are attending today.

The Solutions Center has four primary goals. It serves as a clearinghouse of clean energy policy resources. It also serves to share best policy practice data and analysis tools specific to clean energy policies and programs. The Solutions Center delivers dynamic services that enable expert assistance, learning, and peer to peer sharing of experiences, and finally, the center fosters dialogue on emerging policy issues and innovation around the globe. Our primary audience is energy policy makers and analysts from governments and technical organizations in all countries, but we also strive to engage with the private sector, NGOs, and civil society.

A \_\_\_\_\_ the Solutions Center provides is no-cost expert policy assistance known as Ask an Expert. The Ask an Expert program has established a broad team of over 30 experts from around the globe who are available to provide remote policy advice and analysis to all countries at no cost. For example, in the area of renewable energy action planning, we are very pleased to have Bill Becker from the National Task Force Solution serving as one of our experts. If you have a need for policy assistance and renewable energy planning and other clean energy sectors, we encourage you to use this valuable service. Again, the assistance provided is free of charge. If you have a question for our experts, please submit it through our simple online form at [cleanenergysolutions.org/expert](http://cleanenergysolutions.org/expert).

We also invite you to spread the word about the service to those in your network and organization. Now I'd like to provide brief introductions for today's panelists. First up is Christine Lens. She's the executive secretary of the Renewable Energy Policy Network of the 21st Century since 2011. I'm sure many of you are familiar with REN 21, but for those who aren't, it's a global public private multi-stakeholder network on renewable energy that convenes international organizations, government, industry associations,

science, and academia as well as NGOs working in the field of renewable energy.

Following this, we will hear from Ms. Peng Peng. Ms. Peng is the director of policies and such at CREIA. Ms. Peng's focus on renewable energy strategy and policy research which will help adjust China's energy structure and reduce fossil fuel consumption. And with those introductions, I would like to welcome Christine to the webinar to kick things off. Christine, over to you.

### **Christine Lins**

Thank you very much, Stephanie. Good morning, ladies and gentlemen. Good afternoon from wherever you join us this morning, evening. Where I am, I'm based in Paris, Europe. It's 2:00 AM in the morning, so I'm looking forward to taking you through the main findings of this year's REN 21 renewables 2016 global status report. Our annual \_\_\_\_\_ publication that provides an overview on the status of renewed energy.

As Stephanie has mentioned, REN 21 is a global multi-stakeholder network, policy network in the field of renewable energy joining international organizations, national government, industry associations, NGOs, as well as access in the field of science academia together to advance a reputation toward renewable energy. We have the secretariat that is based \_\_\_\_ unit. United Nations Environment Program in Paris, France, and every year, we describe the status of renewable energy in the annual renewables global status report. The 2016 edition is the 11th in the series. It's a report providing market and industry trends and renewable energy, giving an overview on investment roles, policy landscape, keeps the focus on distributed renewable energy, and then also on the linkage between renewable energy and energy efficiency.

And every year, we put this special feature. This year, it is on community energy to show how people or consumers can actually participate in the energy transition. The report covers all technologies and all sectors from power, heating, and cooling, and transport. It is based on contributions of multi-stakeholder community of over 700 experts from all around the world, and all the country data that is collected for the report is available on REN 21's renewable interactive map. The report, the key findings, soon also in Chinese, downloadable free of charge from our net website.

So in a nutshell, 2015 has been an extraordinary year for renewable energy with the largest global capacity edition seen to date. An estimated 147 gigawatts of renewable power capacity was added in 2015. It's the largest annual increase ever. While renewable heat capacity increased by around 38 gigawatt thermal, and total biofuels production also rose. This growth occurred despite tumbling global prices for all fossil fuels, ongoing fossil fuel subsidies and other challenges facing renewables, including the integration of rising shares of renewable generation, policy, and political instability, regulator barriers, and fiscal constraints. So all in all, a record year. In Europe, we just at the moment have the European football championship going on, and we see that people are actually quite competitive. We also notice that this is not only the case in football, but also in renewable energy,

and actually, in the global status report, we always name the top countries for both annual investment and total installed capacity.

So annual investment in renewables, power, and fuel in 2015, China was in the poll position followed by the United States, Japan, United Kingdom, and India, and overall, you see that China is to be found in the poll position in many areas, such as in hydro power and solar PV capacity and wind power capacity, and in solar water heating capacities are all the yellow fields, and third actually in fuel ethanol production. When you actually look at investment in renewable power and fuels per unit GDP, we see that the least is mainly dominated by developing countries and rates \_\_\_\_\_, Honduras, Uruguay, Morocco, and Jamaica.

When you look at total capacity or generation as of the end of 2015, again, big dominance of China as seen in this slide. When you see, however, on the third row renewable power capacity per capita, you see that the list is very much European dominated. They mark Germany, Sweden, Spain, and Portugal while actually, what we see is that many European countries already have quite high shares of variable renewables. So they do have some experience in integrating these renewables into their energy system.

The global status report is also tracking policy, and we see that the vast majority of countries worldwide have renewable energy support policies in place, and many of them have targets. So we have 173 countries with renewable energy targets, and an estimated 146 countries with renewable energy support policies. Most policies to be found in the power sector followed by transport and then by heating and cooling. China has revised its solar PV and wind \_\_\_\_\_ and has increased renewable energy targets and set economy wide targets for deployment. China is committed to increasing its share of non-fossil energy to 20 percent by 2030 and has issued a one-gigawatt solar PV tender.

When actually looking at the global map, we see that electricity continues to dominate policy-makers' focus. Regulator policies in the power sector cover over 87 percent of world population while regulator policies in the heating sector, that's the orange map on the bottom. Cover over 50 percent, and in the transport sector, the green map on the right covers 73 percent respectively. China continued to lead the world in installed capacity of solar thermal, geothermal, and bio\_\_\_\_\_ fueled heating systems in 2015. I already saw—the country saw declining investment in solar thermal collectors for the second consecutive year. Also, demand increased in some market segments.

For example, in the field of family residences. So let me now turn to the power sector. Renewable energy comprised about 29 percent of global power generation capacity, and about 24 percent global electricity demand. The most significant growth occurred in the power sector with global renewables power capacity exceeding 1,849 kilobytes, which represents an increase of almost 9 percent over 2014. In 2015, renewables made up an estimated 60 percent of net additions to global power capacity and represented for higher shares of capacity added in several countries around the world. Renewables accounted, for example, for 77 percent of new EU generated capacity for the

eighth consecutive year, and China led, again, the world in additions of hydropower capacity, was a leader in biopower capacity, and set new world records for wind and solar power installations.

Wind power is now playing a major role in meeting electricity demand in an increasing number of countries, including Denmark where 42 percent of electricity demand in 2015 was covered by wind, and Germany, where wind covered more than 60 percent in four German regions, German \_\_\_\_\_. And we see that an estimated 22 countries around the world had enough PV capacity at the end of 2015 to meet more than one percent of the electricity demand with far higher shares in several countries, such as for example 7.8 percent in Italy and 6.4 percent in Germany.

So actually, the champions of the energy transition with renewables last year were clearly solar PV and wind. In solar PV, 50 kilobytes were added globally. China was one of the top three markets for additions along with the US and Japan adding 15.2 kilobytes and bringing the total capacity to 227 kilobytes. And actually, when you look at the curve, it is quite impressive because you see it at the annual PV market in 2015 was nearly ten times the words cumulative solar PV capacity of a decade earlier. So quite steep growth, and by 2015, China accounted for 87 percent of global module production.

In the field of wheat, wheat was the most cost effective option for new grade based power during 2015. There were 63 gigawatts of capacity added globally out of which 30.8 gigawatt in China, bringing the total capacity up to 433 gigawatts. The second highest source of power generation capacity in China was wind, and 3.3 percent of electricity generation in China was from wind generated, 186.3 terabyte hours. China is one of the five countries worldwide that account for 50 percent of global turbine manufacturing, and also Chinese companies dominated the top ten manufacturers of wind turbines. Also, wind played an important role as well.

There was an estimated 3.4 kilobyte of grid connected capacity added during 2015 for a world total exceeding 12 gigawatts, and China added about 360 megabyte of offshore wind capacity, bringing the total \_\_\_\_\_ capacity to one gigawatt. Then effectively, when we look at the winds, we clearly see the history projections fall short. In '97, the World Bank predicted about six kilobyte of wind for China for 2020. Nearly ten times of this amount were reached nearly a decade earlier with close to 60 kilobyte installed through capacity in China through 2011. And of course even more with the 145 kilobyte in 2015. So that's just one example where we see the projections can fall short.

And it's not only the projections of the World Bank that were wrong, but also the projections of the industry associations and also different NGOs. 2015 was also a record year when it comes to investment. Global new investment in renewables was estimated as 286 billion in 2015. That is a new record high and represents an increase in five percent from 2014. If investment in launch hydropower is added, the total goes out to 329 billion. And then when we

actually look at that is investment for power and fuels, when we just look at investment for new renewable power capacity—that is at 466 billion.

That is more than double the \$130 billion allocated to new coal and natural gas fire power generation capacity, and the difference in favor of renewables—so more than double—is actually the largest \_\_\_\_\_ to date. What is also interesting that in 2015 for the first time in history, total investment in renewable power and fuels in developing countries exceeded that in developed economies. The developing world, including China, India, and Brazil committed a total of 156 billion. That was an increase of 19 percent compared to 2014. China in that respect played a dominant role, increasing its investment by 17 percent to about 103 billion, accounting for 36 percent of the global total.

And this represents, for example, more than double the investment in renewables in the US. Renewable energy investment, but also increased significantly in India and South Africa and Mexico, and in Chile just to name a couple of countries. By contrast, renewable energy investment in developed countries, in industrialized countries as a group declined by eight percent in 2015. So mainly all city countries, to about 130 billion. We also saw that China's level of R&D spending challenged Europe's for the first time, and we saw that mainly commercial banks provided most of the project level depth for wind farms and solar parks.

When it comes to jobs, the renewable energy sector is a job model, and according to estimates from IREA, International Renewable Energy Agency, global employment continued to increase by about five percent in 2015. There were about 8.1 million \_\_\_\_\_ jobs in the renewable energy industry. Where solar PV and biofuels provided the largest numbers of renewable energy \_\_\_\_\_. Large scale hydropower accounted for an additional 1.3 million direct jobs. China is the world leader in employment in 2015 with about 3.5 million jobs in the sector. China is leading in solar PV employment with about 1.7 million jobs, and solar heating and cooling, and nearly half of all wind power jobs were in China.

Employment in the small scale hydropower industry in China decreased by about five percent, and furthermore, China is one of the world's leading employers in large scale hydropower with about 440,000 jobs. So actually, all this is very positive. However, we must not forget that we still have about 17 percent of the global population lacking access to electricity, which represents about 1.2 billion. Thirty-eight percent lack access to clean cooking, and they received—we are making progress with the dissemination of clean cook \_\_\_\_\_. And we also see despite the fact that there is little quantitative information on distributed renewable energy that there is progress there.

In 2015, about 44 million of the \_\_\_\_\_ solar projects were sold, which represents an annual market of about 300 million US dollars, and we see that about 70 countries had off grid PV capacity or programs to support off grid PV in place. And we also see positive market trends and increased investment in distributed renewable energy with a \_\_\_\_\_ business model spreading. For example, the pay as you go companies or we also see that off grid solar

companies attracted about 256 million US dollars in investment, which shows that this sector is quite a dynamic one, and that is—that brings the total since 2010 to more than 511 million.

So we also see the development is rapidly speeding up. As I mentioned before, very much consider them in order to focus on energy transition, it is important not only to look at the supply sector—supply side, but also to look at the demand side, so we are also portraying the advancement of energy efficiency. And we see that we have nowadays 146 countries with policies and 128 with targets to foster energy efficiency in place. China of course also is playing quite the leading role, being among the top five leading countries in \_\_\_\_\_ capacity \_\_\_\_\_. And China is the world's largest manufacturer of \_\_\_\_\_.

Well, all this is very positive. However, when looking at the shared renewable energy and final energy consumption, we see that the percentage is only very slowly increasing. We have at the end of 2014, an estimated 19.2 percent of global final energy consumption provided by renewables. We see that the share of modern renewable energy is increasing while the share of traditional biomass is decreasing. So we see that we had the largest capacity additions from renewables to date.

2015 was a very positive year because it was the second year in a row where global carbon emissions associated with energy consumption remain stable while the global economy grew. However, the progress we make in absolute terms is relatively slow because there is still relatively slow progress in the field of heating and cooling and transport, and we need to put more emphasis in the future on these two sectors as well as on sector coupling. There is a need to remain—to keep the majority of the remaining fossil fuel reserves in the ground in order to reach the two degree climate target, and there is a need to build a smarter, more flexible system that accommodates both centralized and decentralized generation.

So the aspect of grid integration is effectively one that is becoming one more important. And I guess this will also be one of the central topics of the G20 energy \_\_\_\_\_ meeting that is at the moment taking place in Beijing in China, and that also gave the reason to this webinar today, and it is now my great pleasure to introduce to you Mrs. Peng Peng from CREIA who will provide you with some insights on the outlook for renewable energy in China.

## Peng Peng

Hello, thank you. This is Peng Peng, and it's a very \_\_\_\_\_ to talk about China energy strategy at a situation with you. And I have a few slides, and I'll open this. Now my presentation is about new energy outlook for China in 2016. One second. I'm having a problem. And this is about renewable power sources application in 2015. And we can see from the number, the cover is still very large. Yes, in China last year, we have the high recall for wind to solar, too. It's about 33 kilobyte for wind and almost 15 kilobyte for solar power. But for the whole—still very large. The reason we have this is \_\_\_\_\_ still have the feeding tower for thermal power plants. The price is related to coal price, but able to—but are able to \_\_\_\_\_.



[Audio begins cutting in and out]

So the more plants is very \_\_\_\_\_ a lot of new thermal power plants in last year. The \_\_\_\_\_ from the \_\_\_\_\_ new coal power plants. So I think China increasing \_\_\_\_\_ future will be very, very ridiculous. \_\_\_\_\_ for China and energy totally is growing very slow. From this figure \_\_\_\_\_ we have very little increase from last year. It's only 40 \_\_\_\_\_ housed in \_\_\_\_\_. The growing—that means the market is—

**Stephanie Bechler** Peng, are you able to hear us all right? I think the audio is cutting out.

**Peng Peng** So the market is—that means the new market share would be very small for the new capacity. But now, China energy action plan how doesn't—2020, the target for 2020 is 4.8 million pounds total consumption. Reach 2 point figures—we don't think we can still increase so quickly as we go. Now this is the current state of the power markets. From the most 47—no, sorry. 4.3 \_\_\_\_\_ markets, it's almost 15.5. \_\_\_\_\_, but if we can see the share of the power generation, the great part is the coal. It's almost more than 70 percent. It's still the \_\_\_\_\_ electricity market, and the blue one is the hydro.

And the yellow is New Korea. The green is—we are happy to see the wind share is larger than New Korea, but the solar and \_\_\_\_\_ is still in this here. So we have the \_\_\_\_\_, and this apply—the time is—it doesn't match the 33—2020, weeks \_\_\_\_\_ China market had \_\_\_\_\_ still energy. The \_\_\_\_\_ energy, that means include water, nuclear, wind, solar, and biomass. And the CSP like that. If we have more co-fair power, that means \_\_\_\_\_ -

**Stephanie Bechler** Peng, if you don't mind—I'm going to interrupt you for a moment. I believe your screen—okay, your screen had just frozen for a bit. Okay, excellent, you can continue. Apologies.

**Peng Peng** All right. If we have more co-fair power \_\_\_\_\_ energy power. And from this field, we hope until 2020—this figure, we hope until 2020, the water, the water is the capacity reach like 3.5 billion \_\_\_\_\_ is I think the unit is wrong. The water needed to be reached like 350 gigawatt. The nuclear can reach like yeah, 48 gigawatt. The wind need to reach like 200 and 50 gigawatt, and for solar, it actually is 150 gigawatt—includes 140 and PV, and ten gigawatt for CSP. But for—so we calculated the operation hour, then we can have the power generation. If we use the electricity and to \_\_\_\_\_ and the \_\_\_\_\_.

To the solar PV market. Now this figure shows the total—yeah, total capacity yield \_\_\_\_\_. It's 43 gigawatts, but if we divide it into the \_\_\_\_\_ plans—let's see, the distributed PV is still very small. It's just six—this means the investors can vary—cannot get the financial distributed PV. The problem is that \_\_\_\_\_. For the \_\_\_\_\_ roof is especially for the rooftop. I need to fix the rooftop of other peoples' rooftop. So it is not protected by the law. And another problem is very hard—I see the rates cut by the payment is difficult to collect the electricity bill.

The DP \_\_\_\_\_ in China is still very slow, but for the next four years until 2020, we can see the different situation because of all the grand plans. The



fitting tariff would be lowered very quickly. From this year, we have new policies for the plans. That means they needed to \_\_\_\_\_ tariff, and a computer for that. For this auction and policies also, the market have the extreme very large number on the first half of year in this year. We focus at the first half year in this in 2000—last six months, we will have new capacity for 15 gigawatt. That is almost equal for the 2015. But in this year because the policy is changed. The new capacity on the first six months is really high.

So if the \_\_\_\_\_ has a lower \_\_\_\_\_ tariff, that means the investors will move to some other business. So typically, I think it's good choices for them. Let's move to the benchmarking price change of the solar PV. As I mentioned –

**Stephanie Bechler** Peng, it looks like we lost your presentation. There we go, it's back now.

**Peng Peng** This is price change of solar PV in China from 2012. At that time, it's the first feeding tariff in 2012 is a \_\_\_\_\_, only it's \_\_\_\_\_. And depends on each change that China have a very different market situation at that time. If the policy is at a change peer rate, the new capacity will be very, very high. So last year, we have the new policies, and I think that we can see the new feeding tariff dropped very much at the end of 2016 and the next year. Let's move to the wind power market. So last year is the new hire \_\_\_\_\_ in China with \_\_\_\_\_. The reason the push reason is still policy change because in this year, the new project, the new—we'll have a new feeding tariff, and a Chinese packed—Chinese expect to cut off sub- so at the 2018, we will have new policies for the tariff. That means we will lower again.

So we can see the 2015 will be the top of the new capacity, and this year, we'll have I think like 20, 25 gigawatt for the new wind capacity. And I think for the 2020 market, China now think about new policies for this growing electricity certificate. We borrow some experience from UK market \_\_\_\_\_ market. That means China will issue—have the new system for the whole electricity. We will require like thermal power electricity generation to have the green electricity qualification.

That means that we will drive the \_\_\_\_\_ company and investors to invest more green electricity generation capacity. Okay, that's this of my presentation. If you have questions, we are very happy to answer. I'll pass the microphone to you.

**Stephanie Bechler** Thank you so much. That was excellent, and now we have a couple questions from the audience. Just a reminder for everyone to please enter your questions in the questions pane on the go to webinar toolbar if you'd like to ask anything of our panelists. Our first question is for Christine. Christine, has the global status report looked very much into electric vehicle integration with the grid to deal with intermittency issues? And also, did the status report tackle any new types of fuel such as hydrogen fuel for vehicles?

**Christine Lins** Yes, we are looking into mobility. However, this is the section we're going to enlarge in the histogram. We're going to put more focus on these cost cutting issues. We have a situation that in—actually in the field of electric vehicles in the field of cars. It took us about 20 years to get this to about one million

electric cars globally on the road, where as the forecast for of program energy finance is that we take us another 18 months to get to actually the next million.

So we already see that there is quite a quick upscaling of electric mobility as it is actually happening that is scheduled to happen. We see also that China is really very impressive in all these things that are happening in the mobility sector. So there's a lot of activity in China, be it in the field of electric mobility, but also be it in the field of actually \_\_\_\_\_ and other forms of transport as far as the electric mobility research is concerned. It has advanced. We also see metals to integrate renewable energy into EV charging stations continue to expand. There is—there are things happening, however, we also see that much more needs to happen in the future. In the report, we do not look really into hydrogen options. Hydrogen is an energy carrier, is not an energy source, but we do foresee that for the next addition of the global status report, we will place more for more emphasis on integration of the electricity \_\_\_\_\_ transport sector, and particularly on highlighting and cross-cutting technologies more such as electric vehicles and other forms of sustainable mobility. And also storage.

**Stephanie Bechler** Excellent. Thank you so much. And this next question is directed for both of you. One of our audience—I'm going to ask this for Peng first, and Peng, I'm typing into the questions pane just to make sure you can hear me. The question is what would you say some of the contributing factors are for the very conservative predictions for China's renewable growth? Specifically that wind slide that you had shown. Peng, your thoughts first?

**Peng Peng** Hello.

**Stephanie Bechler** Peng, were you able to hear the question?

**Peng Peng** Yeah, got it. I think for the wind, we actually are very—yeah. We are happy to see—we have—we will have to see until the 2020 coming to the \_\_\_\_\_ subsidy. So that means the market can be opened very large. That means if you don't—you can invest in this without any authority approved from the government. And before 2020, at least 210 gigawatt is the minimum. That means we still have like 90 gigawatt capacity, the new capacity to applicate. So the market is fine. Hello? I'm finished.

**Stephanie Bechler** Yes, wonderful. Christine, do you have anything to add—some explanation to what you think the contributing factors were for the very conservative estimates?

**Christine Lins** Yes, I think I mentioned in 2015, 30.8 gigawatt of capacity were added in China. That's nearly half of the global additions. I think Peng Peng mentioned that the focus for next year is 25 gigawatts, or it's lower than what we saw in 2015. I think that one of the issues of the more conservative estimate is effectively the curtailment issue. I think China is facing the situation that there are some issues related to stability of the grid, which make it difficult to integrate these high shares of variable renewables. And we're actually \_\_\_\_\_ what is happening, which of course is the putting some negative impact on

output of these renewable generators. And then of course also reduces the profitability of the investment, and that's probably one of the key issues we need to be taking in order to advance the energy transition towards renewables an ensure higher shares of market transitions for the years to come.

**Stephanie Bechler** Excellent. Thank you very much. We only have one more question to ask, so if any attendees would like to ask something, please enter it in the question pane. This question is for Christine. Christine, you mentioned a significant increase in investment for developing countries. Is all of that money internally from the country, or does that include external investments from say the United States, Australia, or any other European Nation?

**Christine Lins** Yes, absolutely, it's not only—it's investment in these countries, in renewables. It's also investment coming from my collateral development banks and other donors. It's for the first time that developing and countries and emerging economies have invested more than industrialized countries, 156 billion versus 130 billion, for me, this is a clear indication that cost of renewable energy have come significantly down, which makes many renewable energy options cost competitive with fossil fuels.

It's also very encouraging to see because it's these parts of the world where additional energy capacity is needed, and where we see that countries actually leapfrog and do not make the same mistakes as industrialized nations that heavily invested in fossil fuels and that now are confronted with that they need to replace existing infrastructure with new technologies. But they are basically—the investment immediately goes to renewables, and this development is quite an encouraging one.

**Stephanie Bechler** Thank you so much. That is all we have for questions right now. If anyone would like to ask a question, please enter it in the questions pane, and we can always ask—send it to our panelists once we've concluded. We now would like to go to the survey portion of our webinar. Would all the attendees please select the response to the first question being displayed on the screen? The webinar content provided me with useful information and insight. Okay, thank you so much. The next survey question is up. The webinar's presenters were effective. Thank you very much. Now a third. Overall, the webinar met my expectations. Thank you very much.

Do you anticipate using the information presented in this webinar directly in your work and/or organization? Thank you, and our final question, do you anticipate applying the information presented to develop or revise policies or programs in your country of \_\_\_\_? Great, thank you so much for your participation on the survey. On behalf of the Clean Energy Solutions Center, I'd like to extend a thank you to all of our panelists and attendees for participating in today's webinar. I invite our attendees to check the Solutions Center website. If you'd like to review the slides or look into a recording of today's presentation as well as previously held webinars. Additionally, you'll find information on upcoming webinars and other training events.

We're also posting the webinar recordings to the [Clean Energy Solutions Center YouTube channel](#). Please allow about one week for the audio recordings to be posted. We also invite you to inform your colleagues or those in your network about the Solutions Center resources and services, including the no-cost expert policy assistance. Now we want everyone to have a great rest of your day/evening, and whatever time of day it is where you are, and we hope to see you again on future Clean Energy Solutions Center events. This concludes our webinar.

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