

Global Wind Energy Outlook 2016

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Webinar Presenter

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Eric

Hello everyone. I'm Eric Lockhart with the National Renewable Energy Laboratory. Welcome to today's webinar which is hosted by the Clean Energy Solutions Center in partnership with the Global Wind Energy Council. Today's webinar is focused on the new Global Wind Energy Outlook 2016 which presents three visions of the future of the Global Wind Energy industry out to 2020, 2030, and up to 2050.

Before we begin I'll quickly 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. Doing so will eliminate the possibility of feedback and echo. If you choose to dial-in by phone please select the telephone option and a box on the right side will display the telephone number and audio PIN you should use to dial in. If anyone is having difficulties with the webinar, you may contact the GoToWebinar Help Desk at 888-259-3826 for assistance.

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Another important note to mention before we begin our presentation 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.

Today's webinar agenda is centered around the presentation from our guest panelist Steve Sawyer. He's been kind enough to join us to discuss the Global Wind Energy Outlook 2016. Before we jump into the presentation I'll provide a quick overview of the Clean Energy Solutions Center, then following Steve's presentation, we'll have a Q&A session where he will address questions submitted by the audience. At the end of the webinar you'll be automatically prompted to fill out a brief survey as well, so thank you in advance for taking a moment to respond to that.

So the Solutions Center was launched in 2011 under the Clean Energy Ministerial. The Clean Energy Ministerial is a high level global forum to promote policies and programs that advance clean energy technology, shared lessons learned, and best practices, and encourage the transition to a global clean energy economy. Twenty-four countries in European Commission are members covering 90% of clean energy investment and 75% of global greenhouse gas emissions. The Solutions Center is one of the nine initiatives of the Clean Energy Ministerial. Other CEM initiatives include 21 CPP and Global LEAP. All the initiatives work towards the three overarching goals of improving energy efficiency worldwide, enhancing clean energy supply, and expanding clean energy access.

The webinar is provided by the Clean Energy Solutions Center which focuses on helping government policymakers design and adopt policies and programs that support the deployment of clean energy technologies. This is accomplished through support, and crafting and implementing policies relating 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.

The Solutions Center has five primary goals. It serves as the clearinghouse of clean energy policy resources. It also serves to share policy best practices, 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. The Solutions Center also fosters dialogue and emerging policy issues and innovation around the globe. And lastly, the Solutions Center serves as a primary resource for project financing options and information to expand markets for clean energy. This finance technical assistance service of the Solutions Center was announced last year at COP21.

Our primary audience is made up of energy policymakers and analysts from governments and technical organizations in all countries, but we also strive to engage with the private sector, NGOs, and civil society.

The Solutions Center is an international initiative that works with more than thirty-five international partners across its suites of different programs. Several of the partners are listed above and include research organizations like IRENA and the IEA. Programs like SE4ALL, and regionally focused entities such as the ECOWAS Center for Renewable Energy and Energy Efficiency.

A marquee feature that the Solutions Center provides is the no-cost expert policy assistance known as Ask an Expert. The Ask an Expert service matches policymakers with one of more than fifty global experts selected as authoritative leaders on specific clean energy finance and policy topics. For example, in the area of renewable electricity policy, we are very pleased to have Paul Komor from Renewable and Sustainable Energy Institute serving as one of our experts. If you have a need for policy assistance and renewable electricity policy or any other clean energy sector, we encourage you to use this valuable service. Again, the assistance is provided free of charge.

If you have a question for our experts, please submit it through our simple online form at cleanenergysolutions.org/expert. We also invite you to spread the word about this service to those in your networks and organizations.

Now I'd like to provide a brief introduction for today's panelist, Steve Sawyer. Steve is a secretary general of the Global Wind Energy Council where he focuses on working with intergovernmental organizations such as the UNFCCC, IPCC, IRENA, IEA, IFC, and ADB to make sure that wind power is well represented, and to open up new markets for the industry. With that brief introduction, I'd like to welcome Steve to the webinar.

Steve

Thank you, Eric. Let me show my screen and make sure that's working. Okay, good afternoon everyone. Good morning, or good evening, depending on where you might be. Eric's introduced me so I don't need to do that, but just a little bit about the Global Wind Energy Council. It's a trade association set up by a number of national and regional wind energy associations and some of the major companies in the sector initially in 2005 with three main goals. One to represent the sector with intergovernmental organizations. We also publish an annual market update as well as our biannual Global Wind Energy Outlook which I'm going to be talking about today. But the most important thing we do really is to open up new markets for the industry in Africa, Asia, and Latin America primarily. I'll get to that later on in the presentation.

I'm going to do a little bit initially to put the like global power markets into some sort of context, then go into the status of the global wind power markets, our short term projections, which as I said we do on a rolling basis, rolling five-year basis every year. And then the longer term scenarios which is the subject of the Global Wind Energy Outlook. A little bit about new markets, and a bit about draw some conclusions from that and look ahead to what we can expect in the short to medium term future, at least as far as one's crystal ball works these days, which given recent events in U.S. politics proves to be very short indeed.

If you look at the evolution of the global power market over the course of the last few decades, you can see that the growth part of it was dominated by gas and nuclear in the '70s, the nuclear tailing off towards the end of the '80s after Chernobyl, with gas coming up very much in the second half of the '90s, and up through the middle of the last decade, and that's really when the wind and solar markets began to take off, and unfortunately, I have the global statistics only for 2014 because 2015 would show not only a continuation of this growth, but for the first time a really dramatic drop in the quantity of new coal-fired power plant additions largely led by decisions taken in China but also those dictated by the markets elsewhere. Almost everywhere except Southeast Asia where it seems to be growing.

This is the same basic information, but put into a perhaps more accessible pie chart form. You see that while we have undergone extraordinary growth in the past decade, we're still a relatively small part of the puzzle. We're getting there, but we need to get there more quickly.

If you look at total investments, you see a number of ups and downs. The peak in 2011, sort of the early boom years as we call it, and then a couple of years of scrounging for pennies during the financial crisis, but then return to growth again in the last couple of years. And I think the other thing to note of course, is that while the dollar volume in investment particularly in wind and solar has gone up some, the quantity of megawatts installed has gone up very dramatically, which obviously reflects the decrease in the cost of technology which is, of course, one of the main drivers today for both wind and solar.

If you look at it by region or dividing the world into two regions, all these renewable technologies or most of them except, of course, for biofuels started off primarily as developed country phenomena. But for winds it's now the case that you know, 60% or 65% of the investment is outside the OECD. Solar is coming as the non-OECD growth. It's not only China, but driven by China, has come on quite substantially as well and is catching up with the overall annual investment of that in the OECD countries.

So overall where we are at the moment is 23.7% of renewable electricity. We need to get that to a very much higher number in a very short period of time if we're going to have any chance of meeting the Paris objectives. The REN21 report was at 3.7% of electricity provided by wind in 2015. My numbers say it's 3.9, but I'm not going to quibble. You can't get these numbers too precise, and the definitive ones don't come in for years down the road. But that sort of ballpark is we're looking at and we hope that we'll be pushing 5% globally once the 2016 numbers are all crunched across the world.

So for the global wind market this is the story of the evolution of it since 2000. It all looks very smooth and orderly progression. Life of course, is really not like that. The fact that these are global numbers mask lots of boom-bust cycles, particularly in the United States, but in other markets as well. But at this point we're up to 433 gigawatts. That's as of the end of last year, and with any luck we'll be close to 500 gigawatts once we total up the numbers for 2016. A growth last year of 17% which is pretty good given that the volume that we're getting to, but we had some enormous growth years in the

previous decade and before, and keeps the global average over that period up to just over 24%.

If you look at the size of the annual markets, you see a bit more of the reality. Fairly dramatic and fairly steady growth except for 2003 and 2004 which was one of the points at which the U.S. production tax credit was allowed to expire, and when the U.S. played a much more dominant role in the global market than it does now. Pretty smooth growth from then up through 2009, and then you have essentially four years of flat markets following 2009 which is the consequence of the financial crisis, the lack of liquidity and lack of economic growth globally. Fortunately growth in demand, that situation all changed by the end of 2013 and we had an extraordinary growth in annual market terms in 2014, and then again surprising in 2015. I didn't project that it would grow quite that much. Our projections for 2016 are that the market should grow just a little bit, just a couple of percent, but we won't know that until the end of January. Again, a similar sort of growth rate over the sixteen-year period, but very high levels of growth in both 2014 and 2015 in distinction to the four previous years.

Top ten markets. Globally you see China very much at the top of the heap with the U.S. a distant second with just over half, but I should point out as my American Wind Energy Association colleagues are very fond of pointing out, that the seventy-four gigawatts installed in the U.S. generated more electricity than the 140 gigawatts installed in China in 2015. We'll see what happens with the 2016 numbers in the U.S. The central part of the country of course has some of the best wind resources in the world.

Germany had an excellent year last year. Firmly in third place. India passed Spain to move into fourth place in 2015. Spain has the market. The domestic market has been dead for a couple of years now. There's some hope of it reviving, but I don't expect it to be any time soon. Difficulties in the U.K. mean that Canada, France, and in particular Brazil are catching up very quickly. Brazil is already over ten gigawatts. Was by last August. And despite the economic difficulties in the country at present, the wind industry, while I wouldn't say it's immune, it has lived in a bit of a bubble for some time, and hopefully will until and unless economic growth begins again and electricity demand growth continues. They already have contracted out up to close to twenty gigawatts to be built out for 2020, so the numbers at least will remain robust even if the supply chain starts to get a little frayed around the edges, unless there's some new demand.

In terms of the annual market, the astonishing number from China, thirty gigawatts in a single year. That's more installed capacity than all but two of the other countries in the world installed in a single year. It's pretty phenomenal, but they do things big in China. The U.S. had an unexpectedly strong year last year. Some of it due to the uncertainty about the extension of the PTC, but anyway it was a very good year and we're led to believe that this will be the same. Germany had a record year, but it's a little bit deceiving because they had three gigawatts of offshore installations in the 2015 numbers, a number of which were projects which should by rights have come

online in 2013 and 2014, but were delayed for one reason or another. Brazil again with the fourth largest market. India fifth. And then moving down and we see Turkey join the list of top ten markets, the number ten spot for the first time in 2015.

If you look at the regional distribution of the installations over the last six or eight years, I you'll see that I used to be able to say that we had a relatively even distribution between three major markets in Asia, Europe, and North America. North America being the most volatile. The Asian market has developed and that has dominated and we expect that to continue for the time being.

The other thing to note of course is the growing numbers in Latin America. It's not only Brazil, and I should point out that Mexico is not included in these numbers because in energy statistics terms since Mexico joined the OECD, it is now part of North America for statistical purposes. So if you added the growing Mexican market in there, the Latin American numbers wouldn't look quite substantial. We'll see the African numbers bump up quite substantially this year. The Pacific, it's mostly down to Australia. We've had some good news there, but we would expect that the three main regions to lead with Asia dominating, but Latin America coming on strong over the course of the next five to ten years.

I mentioned earlier that OECD versus non-OECD markets for winds. In every year since 2010 with the exception of 2012 the majority of installations have been outside the OECD, and that's resulted in the situation where you see in cumulative terms where the non-OECD installations are catching up rapidly with the cumulative installs in the traditional markets in Europe and North America primarily, which are the main OECD countries. And now a lot of that is China. A very big portion of it is China, but is by no means all. I mean, it includes Brazil. It includes South Africa and, of course, India, and a number of other emerging markets. We would expect the non-OECD market to overtake the OECD in cumulative terms by the end of the decade. It'd be hard to tell these days, but that would be my best guess. 2019 or 2020.

Offshore, which I won't dwell on a lot simply because the future has been so uncertain, dominated certainly by the U.K. and Germany. Started in Denmark. China has made a lot of promises, but haven't gotten as far as they would want to, but still we had a very good year last year with total installations of about 3.4 gigawatts. A lot of that in Germany. But the recent developments in the price of offshore. I mean one of the concerns has been while some of the early projects were able to be done relatively cheaply, as the projects became larger and moved further offshore and into deeper water, of course, the price went up. And a lot of work has been done in the European industry to look at those costs and how to bring them down—various taskforces and intergovernmental workshops and working groups and whatever—and came up with a target that they should get the price under 100 euros per megawatt hour by 2020. Well, that happened this year. We've had now four major auctions in Denmark and the Netherlands, all of which have been well under 100. The first was the first Dutch auction for the Borsela

zones one and two which was seventy-two euros. Then we had a Danish near-shore one for forty-nine. Then we had the Danish Kreigers Flat for fifty-four, and then the second crunch of the Borsela three and four which came in last week at just over fifty euros. So those prices won't be able to be replicated everywhere, but I'm reasonably confident that that's going to be the new normal, and we're going to see prices well below 100 euros per megawatt hour or 10¢ a kilowatt hour, and the trick now will be how to export those prices to the rest of the world.

In terms of our short term forecast, this is what we did last March. See small growth projected in 2016 with the market increasing steadily up close to eighty gigawatts annual markets by 2020, which leads us to cumulative installations up from the current 433 to just under 800 gigawatts by 2020, and that's our bottom-up if you will inductive market forecast based on orders and what we know is happening in different markets.

Here's those cumulative numbers by region, and then the annual forecast by region, and it all looks very smooth and orderly, and whatever. Life is not like that, but we can only really assess that in retrospect.

So overall in terms of the market we had unexpected extraordinary growth last year, mostly in the big three markets. The other thing of course, that hadn't tweaked to me, but my friends at the IEA pointed out that wind supplied more new power generation in 2015 than any other technology. Just under half of all global generation growth in 2015 came from wind power alone. I mean, out of twenty-eight markets with more than 1,000 megawatts, nine with more than 10,000, the ninth one being Brazil, which they just passed that mark in August of this year. And the technology evolution continues. Efficiencies continue to improve. Reliability continues to improve. Capacity factors continue to increase, and costs continue to come down. But not many of these things are very visible except of course, if you have the opportunity to stand next to one of these giant new seven and eight megawatt machines they're using in offshore. That's pretty spectacular. You know, the new machines with rotor diameters in excess of 160 meters are quite something to actually see. Offshore costs are still coming down, but it's taken a dramatic turn and I think that's going to—has the opportunity to transfer the offshore sector pretty dramatically over the course of the last three to five years, but that's a new development which we really haven't had a chance to use to generate any projections thus far.

Okay. So now to the main subjects. The Global Wind Energy outlook. This is a project that we've been working on in one way or another format, it is a cooperation between Greenpeace International and the European Wind Energy Association and BTM Consults back in 1999. Moved into its current formats in 2006 where we take basically—then we use the IEA's reference scenario as a baseline a couple of years later as the new policy scenario of the IEA became the central scenario of the World Energy Outlook where you use that as the basis. And this year for the first time we not only use the new policy scenario, but also their 450 scenario which is the one that is most likely

of the IEA scenario to give us a chance of meeting the Paris target of keeping global mean temperature below 2°.

And then we compare those with our own moderate scenario which is an extension of that rolling five-year scenario which I've described just earlier, and then the advanced scenario which is generated as a result of the modeling done by the German Aerospace Institute, Greenpeace International, and ourselves and others over the years as part of a larger scenario called the energy revolution scenario which was profiled in the IBCC special report on nuclear energy and climate change for those of you who are interested. Basically it's sort of an optimum scenario for wind which we have been on for most of the last ten or fifteen years except for that period between 2009 and 2013 staying on it now is going to be challenging. I'll come to that in a bit.

And then of course—oh, before I get to that, we take all four of these scenarios and run them against the demand projections generated by the World Energy Outlook which go to 2040, so we've extrapolated them out to 2050. And then we have our own energy efficiency scenario which was developed by researchers at the University of Utrecht which basically takes not all energy efficiency measures that are technically available, but those that are economic and those that do not result in stranded assets in and of themselves and apply those and come up with a slightly lower demand projection which makes the penetration of wind energy just a little bit higher, but you'll see that in the charts that I'm about to show.

So here are the results. New policy scenario starting in 2013 getting up to 2050 with about 7.5 terawatt hours of electricity. 2,800, 2.8 million megawatts of electricity of capacity—450 scenario a bit higher than that. Our own moderate scenario following. Pretty much now as the IEA numbers have come up the difference between our moderate scenario and their 450 scenario are reasonably small. There are some areas where they're more optimistic than we are, but the event scenario is still as I say, the one that we're on more or less at present, but comes to a future where we have you know, 5.8 terawatts installed by 2050. 15,000 terawatt hours which is about two-thirds of the current electricity generation but with a projected demand growth that would then give us somewhere in the low thirties in terms of percentage penetration. But these are sort of the range of futures that we're looking at now, which are off by you know, 25-30%, but for most of the time that we've been doing this, the difference between our projections and those of the IEA have been initially in order of magnitude, but many, many hundreds of gigawatts, and the difference is getting less and less. That shows you either that we're becoming too conservative, they're becoming much more progressive, or the interpretation I prefer is that great minds tend to think alike. I'll leave that for you to judge.

In terms of global penetration, this is where we think we ought to be, where we would like to be, somewhere around 9% of global electricity supply by 2020, increasing to somewhere between 18% and 20% by 2030, and then an optimum scenario in a 100% carbon free electricity system by 2050 at the

latest, and somewhere between 35% to 40% of global electricity supply. A lot can change between now and then, but those are the numbers that we're talking about.

If you look at the regional breakdowns, here are the two IEA scenarios. They're not very different anymore. The IEA was considerably less bullish on China than we were, and more optimistic on North America than we were. At the moment there's not a great deal of difference except as you see—well, you can't see very well—we're still a little bit more optimistic on China than they are, a little less optimistic on Europe, and they ironically are much more optimistic in the short-term for India than we are. But you know, for those of you who want to delve into the details of this, I won't spend a lot of time on it here.

If you look at CO₂ emission reductions, obviously these are estimates based on an assessment of the distribution of wind installations and what they are displacing. Obviously if they're displacing dirty coal plants in China and India, then they're doing a ton or more, or half a ton or more per megawatt hour. If they're replacing hydro or complementing hydro in Brazil and Norway, then it's very, very little. We use the global average of about 500 grams of CO₂ per kilowatt hour which is a pretty good global average, but obviously it is an estimate. But where we get to is a maximum by 2020 under the event scenario about 1.3 billion tons per annum. 1.17 in the moderate scenario. A significant contribution but still only the beginning of where we need to be if we're going to get to a zero emissions power sector well before 2050, which is what the Paris Agreement demands if we're to have any chance of meeting those targets. Large, round numbers.

Costs. Again, this is a difficult one simply because you have to denominate them in something, but given the distribution of global installations, what we should really be doing is denominating everything in RMBs, the Chinese currency, since that's far and away the largest part of the market. Of course, if we don't that would make it incomprehensible to most people. But again, the global average costs are interesting for comparison purposes, but don't actually mean anything because the economic decision to build a plant or not, or how it will fit into the system, is very, very specific and can be very much higher or very, very, very much lower than what we see here, and actually the capital costs are one thing, but what's really of interest is the cost of energy which comes out the other end.

Investment numbers. Again, using average investments and employment numbers. We have used a formula to estimate jobs created and investments—well, we use the investment numbers from the previous page that are generated by the model, but the annual investment of course, according to the market size. Employments varies very widely from market to market, but again with the global average numbers that we use, they come out pretty good in comparison to the ground true thing that we're able to do in markets where accurate job creation statistics are generated. So you see we have just over a million people employed by the industry at present. We expect that to increase by almost 30% between now and 2020, and then continue going up

from there. I note with pleasure that the U.S. Department of Labor has defined the fastest growing job in the United States to be wind turbine technician. We think that's a good sign and we'd like to see more of that.

Moving on to the new markets where we would expect an awful lot of this growth to happen. For the past four or five years other than the initial work in China and India to help boost those markets, our focus has been on these three. On Brazil, Mexico, and South Africa. Brazil is well established in the top ten in both the annual and cumulative markets now. South Africa, after experiencing a rapid takeoff after a very long period of getting up speed on the runway, basically ten or twelve years, but it's now going quickly. And Mexico, of course, with the energy reform renewables are playing a much, much larger role in terms of the procurement in the power system in Mexico these days. So we're quite confident about those markets becoming major growth centers for the next ten to twenty to thirty years.

Elsewhere in Africa the many interesting markets. We've heard about Morocco which as far as I know how has the lowest price for a commercial windfarm with the 850 megawatt project that was signed earlier this spring to be developed at 2.9¢ a kilowatt hour. Egypt is just a little bit more expensive than that. We also see exciting developments in Ethiopia, Kenya, Tanzania and now in Ghana.

Asia is a bit more difficult to call. It's a bit more politically complex and dispersed. Mongolia is now well underway. It has some of the best wind and solar resources in the world, but it's a small pasture-less land-locked country. It's completely surrounded by both Russia and China so it has its own challenges. We see big possibilities in Vietnam now. In Thailand there's been substantial development. In Pakistan there's been substantial development. And of course, the big prize in the Middle East certainly is Iran. We have political issues there, but the wind conditions are excellent. The industrial conditions are good. The demand is there. We just need to unblock some of the politics and I think we'll have a major vibrant market in Iran.

And then of course, the real success story in the developing world over the last couple of years is Uruguay which is now challenging Denmark for the highest penetration level of any market in the world. By the end of their buildout next year they'll be somewhere around 40% of their electricity from wind, and an increasing percentage of the time running their electricity system on 100% renewables. Chile's market is doing well. Just in the past year, twelve months ago, in Argentina we had nothing. We had a brand new government that was making some positive noises, and here we are twelve months later with a 1.4 gigawatt pipeline as a result of the first two rounds of the RenovAR project as well as a gigawatt of solar. They will all be built between now and the middle of 2019 and they intend to have another auction next year, and the year after, and the year after in pursuit of their goal of having 20% of their electricity from new renewables by 2025. Which they probably won't make the 8% by 2017 goal since none of these projects, or very few of them will be complete by next year, but we think they're well on their way to meeting their 2020 targets.

So the central challenge for us really is to figure out what we need to do to keep the industry on the advanced track and not fall back to the moderate track, which is still very good, but we would like to stay there. Key issues are of course, that while people complain about the subsidies to renewable energy, they don't know enough about the actual subsidies to their competitors. Which fuel subsidies range from somewhere between \$500 billion which is the IEA estimate to the IMF estimate which is more inclusive and includes externalities of somewhere around \$6 trillion per annum.

If governments are serious about climate change, that has to stop and it has to stop soon. I've been saying that for thirty years. Lots of other people have as well. We'll see what the Paris Agreement means at the end of the day.

We see major disruptions to the wholesale electricity market system, in Europe in particular, and the old models are dying. We do not yet have a clear or a simple means to replace them. There are a number of experiments going on particularly in the Scandinavian electricity market where it seems to be working. Lots of discussions going on.

International financial institutions are still financing fossil fuel projects within international development finance more than they are renewables. Quite contrary to their rhetoric, but that's what they're actually doing. But the good news, of course, is that even against these heavily subsidized incumbents, both wind and solar are now winning the price war in an increasing number of markets. And the only other thing I really need to say or would like to say, that I keep saying to governments who were very happy that they all came to this agreement in Paris last year, and I say you do understand that any plausible scenario that gets you to 2°, never mind 1.5°, means that any decision to invest in a fossil fuel plant today, assuming it takes five years to build it, means either that you don't believe in the Paris Agreement or you have designed the plant with an economic lifetime of substantially less than thirty years, or you're knowingly investing in an asset that will become stranded. They don't like it when I say that, but it's the truth, and that's basic physics, and it doesn't lie, and until and unless they come up with some magical system to spear carbon dioxide out of the atmosphere and send it to Mars or something, then that's the reality that we're faced with.

Just a few conclusions that says we expect Asia to continue to drive global growth in the economy, and also in the renewables business. European market is a bit uncertain. Now they have the new package. We'll see what emerges after it goes through the legislative and consultative process. Yeah, North America uncharacteristically stable through 2020, at least on the basis of the deal that was done twelve months ago to extend and phase out the production tax credit. What impacts on that the new administration is going to have I have absolutely no idea. I don't think anyone else does, including the new administration, but we'll see. Certainly the new appointee for the Department of Education or the nomination for the Department of Education knows wind power and understands wind power, the former Governor of Texas, but we'll have to see how all that plays out. We live in interesting times, and new markets continue to spring up all across Asia, Africa, and Latin America.

Yeah, we're somewhere at about 4% of electricity supply now. We need to get to somewhere close to a third by 2050 if we're going to get to grips with the climate problem. And that's as part of a completely decarbonized electricity system, whether it's eighty, ninety, or 100% renewables is another discussion, but governments are going to have to be called to account as to whether they're serious about actually meeting those targets. And it does mean complete decarbonization of the power sector because that's the one where we have the technology. Well, heating we have the technology. We just don't have the economic drivers. Transport is the challenge.

So I guess just to wrap up here, the only thing that I would like to say is that while we're very encouraged by the Paris Agreement and the multilateral moves that are being taken on climate, they don't really make any difference yet in practical terms. They do in political terms, they do in atmospheric terms, but they don't in practical terms yet because there is no real mechanism for implementation. We're still wondering what's going to happen with this Green Climate Fund, whether or not there is going to be some sort of a revitalized carbon market. I know my friends who were carbon traders under the Kyoto Protocol are now very excited about the possibilities within the Paris Agreement to develop not the same kind of system, but to link up the markets that are emerging around the world. But until and unless that happens our focus needs to be on individual national legislation and markets one market at a time.

It would be nice if we had some big magical multilateral framework which would make it all work. We tried that. It did not come to the fruition that we wanted it to and came crashing to a halt in 2009 in Copenhagen, but you know, we're working with the new reality. And all the market drivers that got us to where we are today are still in place and increasingly prominent. Energy security, cost stability, and now of course, we are in an increasing the number of markets. The cheapest way to add new capacity to the grid. Certainly competitive with coal just about everywhere. Competitive with gas in most places, not everywhere, but getting there, and all the other benefits that investing in the wind industry bring.

So I'll stop there, and say thank you very much.

Eric

Great, thank you very much, Steve. So we have some great questions coming in. I just want to remind all of our attendees to type your questions into the question pane as they come up. Our first question, it's a two-part question about offshore wind. The first is if you could expand on the impact of these new low offshore prices. In general and specifically how they relate to onshore procurement as well. That's the first part. And the second part of the offshore question is just more generally what the main risks and uncertainties are in this space.

Steve

Well, I think two things. Those prices, you have to bear in mind, both of the Dutch prices and Danish prices do not include the cost of the interconnections which are depending on the estimate somewhere between eight and twelve euros a megawatt hour. So what you have is now for Germany, the Netherlands, and probably the U.K., offshore wind prices which are more or

less directly competitive with onshore wind prices. And certainly cheaper than solar in northern Europe, and certainly much cheaper than new built coal or gas, and way, way, way cheaper than new built nuclear. So you have just another option for meeting—and some of the countries have very, very aggressive targets. So I think that's the main implication. And then I think the companies that have invested heavily in both the technology but also the developments. People like DONG. People like Vattenfall. People like Iberdrola on the investor and operator side. And technology companies like Mestas, and Siemens in particular, and also now we have Adwin. And what's going to happen to Adwin in the merger between Siemens and [Inaudible] we don't actually know what's going to happen to the awesome technology. Now that it's a part of G.E. we don't really know, but we see a fairly dramatic stratification of the market where there's a few very large players who are operating leveraging their balance sheets and their portfolios in a situation in a very, very low interest environment to come up with some very low prices which are now setting the standard. And I think that will mean a lot more interest in investing in offshore. The Dutch government has already talked about increasing its investments in offshore. There's a bit of a question mark will they wrestle with their more existential questions, but certainly for Denmark, for Scandinavian countries, and for the rest of the countries surrounding the Baltic and the North Sea, I think this is going to be a great imperative to accelerate the growth of offshore wind.

And the second part of the question was—I don't actually see the question on the screen here.

Eric

Yeah, it was just about main risks and uncertainties.

Steve

Oh, main risks and uncertainties. Well, the technology risks I think have been minimized, which is one of the reasons why you see much more conservative investors moving into the space. But it's a more risky technology than onshore simply because of the consequences of your ability of any failure in the machinery. I was at a meeting in London the other day and they said that last December for one windfarm somewhere off the coast of the U.K., for December there were four days where you could actually get to the machine. So if a machine breaks and it's a six megawatt machine generating which costs you know, you know, \$10 million and then again that much at least to install, and is generating money for you every day, a part breaks, it goes down and you can't get to it for ten days, that hurts. As a consequence, with the new generation of machines, there's a lot more emphasis on the ability and redundancy and whatever to minimize those risks, but they still are there.

There is still some construction risk, although I think in the European industry they've made most of the mistakes already and learned from them, but anything that's operating in the North Sea in the wintertime there's an inherent risk. It's just a nasty piece of water. Very windy, but nasty, crowded, shallow. Terrible storms and tides and all the rest of it. Almost anywhere else in the world it's going to be easier, which makes me very imperious about the possibilities in the medium term for places like the United States, and China, and Japan, as long as you stay away from the hurricane or the typhoon zones.

Those are I think the main risks at the moment. The technology I think is pretty solid now, and there's a lot of confidence in the technology. There's a lot of confidence in the installation by the big groups with lots of experience.

Eric

Good. Thank you very much. The next question is about the scenario that you and your colleagues have put together, and that is if the future scenarios consider potential climate change impacts on the wind resources themselves,

Steve

The climate models now, with their current level of sophistication, are unable in any meaningful way to predict anything about wind speeds on a regional basis, never mind on a local individual site basis. You know, as the world heats up you would expect that there's more energy in the system, there's more wind, there's more extreme wind, but what that does [Inaudible]. I've read studies that say it will go up, that it will go down, and I'm afraid that the fact is that we just really don't know yet. We do know with some degree of certainty that there will be more extreme weather events. How that will affect the industry we don't know, but I don't expect it to go markedly up or down. It will change, no doubt, but I don't have any reason to think it will go predominantly in one direction rather than the other.

Eric

Got it. Yeah. Makes sense. The next question is about some of the regional conversations, specifically for south Asia. The attendee asks do you foresee incentives or subsidies for wind energy in south Asia in the next five to ten years coming down the pike? You mentioned there's some uncertainty, and I think they'd like maybe just a little bit more on that.

Steve

You mean Southeast Asia? Well, if they mean Pakistan. Pakistan certainly. India there has been—the evolution of the market in India is such that it's more competitive, getting very competitive with incumbents. Southeast Asia. In Vietnam at the moment they have a Feed-In Tariff. It's been deemed to be too low. Not because they don't have good wind resources, but because of the availability of finance. And the difficulty with finance in Vietnam is like so many state-owned utilities, the electricity company of Vietnam, EVN, which would be the off taker, is on paper bankrupt. For a complex set of international relationship reasons, the government will not guarantee, even though its affect does guarantee every day, but it will not give a guarantee to a bank on a PPA signed with EVN, therefore the cost of capital in Vietnam is quite high. So unless you've got people who can come in with capital, dollar, euro, or bring in their own finance, then the costs are quite high. And that's why it will require substantial support, at least in the early stages, in Vietnam.

In the Philippines, they had a very generous Feed-In Tariff to start with. They're revising it downward now. And with any luck in a relatively short period of time they should be able to do away with that because the Philippines has very good wind resources. They have many other challenges, but on a resource basis.

In Taiwan I know they're hoping to take advantage of these crashes in the offshore. They have an ambitious offshore plan in Taiwan, and they're hoping to take advantage of the new breakthroughs in price, and trying to do

everything they can to make offshore wind directly competitive from the get-go there, but they're obviously supporting the first couple of pilot projects.

Thailand, which doesn't have very good wind resources but has very high electricity prices has what by international standards is a fairly generous Feed-In Tariff, which has made it attractive to invest in some plants there in the central highlands, and I would expect more. Unfortunately, the places with the best wind is also where the fanciest tourist beaches are, so that's a conflict which will get worked out over time.

I guess the short answer is you have to go market by market, and look at them. I think you know, Southeast Asia is not the windiest part of the world except along the coast of Vietnam. It's very, very strong winds and quite reliable. And in the Philippines, but certainly in Malaysia and Indonesia where things are just getting started. You don't have the strongest winds in the world, and up until the evolution of the new technology over the last few years with the higher towers, longer blades, and down-rated generators giving you a higher capacity factor and lower cut-in speeds, it was very difficult to make a case for commercial wind in parts of Malaysia and Indonesia. Now there is a case, and the first commercial PPAs have been signed and projects are moving ahead, but it's very early days there.

I don't think we're going to see much in Singapore. Good place for solar, but there's no space for wind turbines, although maybe offshore. Maybe floating offshore. That would be the other thing that we're looking at as possibly evolving into a commercially viable option in the medium term.

Eric

Perfect. Thank you. The next question actually relates to that last comment a little bit there. One attendee is wondering how the rapid drop in solar energy [Inaudible] costs influences wind energy investments going forward.

Steve

Well, it gives us a bit of competition, which is a good thing, as long as all the other parameters are fair and everything else. I mean, you know, on a microcosm you look at Germany. It's windy in the north in Germany. Got lots of wind. They built lots of solar when they had high tariffs. In northern Germany it doesn't necessarily make a lot of sense. But southern Germany is really sunny, and is now the focus of most of the growth of solar. And there are some wind projects in southern Germany, and some successful ones, but I think the majority of the investment there is going to be in solar and biomass and other maneuverable technologies to help Germany meet its energy goals. And they're still going to need that north-south transmission line to make it all work.

And you know, they've had record low prices for solar in the Persian Gulf where there's not a lot of winds. Makes perfect sense. The other places, you know, we've had very competitive prices in Mexico and Peru, and in Argentina, in the auctions where wind is about the same or wind is a little bit cheaper but not much. And then in places in the Atacama Desert in Chile where you can't beat solar. It's the best installation of any place on the planet, or any accessible place on the planet, and solar is winning big there. But that's a long way from Santiago and the major demand centers as well.

So it's courses for courses. You know, the technologies will do what they can where they can. I mean the inherent advantage of solar is that it's very predictable in that the sun goes up and comes down on a very predictable schedule. That's also the weakness. Is that it virtually never shines at nighttime whereas it's often very windy at nighttime. And wind, we're getting better at predicting it, but it's easier to predict solar. It's also easier to put large quantities of offshore wind say outside of New York City, but then again with solar, you've got enormous potential in rooftop or small scale plants embedded into the generation system.

So I think we're getting to the point now simply because we are so cost competitive, but the focus needs to be much more on overall system design, and using the best aspects offered by solar, by wind, by biomass, by energy efficiency. By heat pumps. By whatever it is, resources you have available to suit the needs. What is the long [Inaudible] list of [Inaudible] for COE for connected electricity? It's a bigger and more complex problem that needs solving at the moment. We have the technology to solve it, we have the tools to solve it. It is proceeding quite rapidly in some places and not in others. But you know, markets can do a lot, but you need a strong regulator and you need strong intelligent system planning and system management. All of them in the right degree which fit with the economic model of the country or the region that you're working in. So it's not a simple question, but I think are we going to see winds dominate solar, or solar dominate winds? Globally I don't think that's the case, although you know, there's not much room for solar for most of the area in Norway. And as I said, there's not much wind in the Persian Gulf so that's going to be dominated by solar.

Eric

Thank you.

Steve

I could go on with that for hours. I do, as a rule.

Eric

The next question is perhaps a touch outside of the scope of this particular report, but one attendee is curious if you have thoughts on small wind or off-grid applications of wind.

Steve

I do. I have thoughts about it. My members that I showed on the first page there are singularly uninterested and don't want me to waste my time on it. Waste being their word, not mine. Having some personal experience with small wind, for instance in an expedition we did up into the Arctic in the winter of 2000, which ended up being completely supplied by wind because it actually worked so much better than we thought. I think that it was surprising with very small, you know, 150 watt machines, but we basically didn't need the kerosene we brought because we could heat ourselves with the surplus wind energy.

I think there are many off-grid applications in places where it's very windy and maybe not very sunny where there's tremendous opportunity, and I think the technology is improving. I think if you're talking about village scale, small scale stuff. I mean the first port of call has to be solar simply because there's no moving parts and very little that can go wrong. But if you're talking about a slightly larger quantity of resource, then I think small wind

can play—or slightly larger demand and you have a good resource, then I think there's a tremendous opportunity there. The difficulty, of course, is that every situation in every village will be different both in terms of what its demand is, and also what the available resources are.

The case for grid-connected small wind. They've tried that in the U.K. I think in places where there's quite expensive electricity, I think it could work quite well. And maybe if we get the volumes, we'll see the costs of that small, say ten, ten, thirty kilowatt size machine, the economics of that improve. And it may have already improved dramatically. It's not something that I pay attention to on a daily basis. I don't think it's ever going to be dollar terms and megawatt-hours terms anything to compete with grid-connected wind or probably not with you know, small scale solar. But I think there's a role, and there are plenty of places. King Island in Australia is run like—it's a very windy island in the middle of the Bass Strait, runs 98% or whatever of its electricity on wind, and a lot of that is from small turbines. There's some big ones as well. So for islands, for remote areas, for off-grid, I think if you've got a good resource and a large enough demand to justify it and a means to balance it, then by all means I'm sure it's a very good opportunity. But it's not my expertise either.

Eric

That was great. Thank you. The next question is about project structuring and finance. The attendee asks do you expect windfarms to be developed in joint ventures similar to what we know from the oil and gas industry. In other words one operator and several active partners for each asset. Or will we see the current trend of operators teaming up with the passive partners to continue?

Steve

Oh, I think we have lots of that already, certainly in the offshore sector. I think in the offshore sector in the beginning there were companies saying oh, we can do all this ourselves, and learned very quickly that they couldn't. So there is you know, separate partners or subcontractors or contractors working on the marine engineering side, on the electrical side, on the wind turbine side, and of course, the fabrication of these enormous foundations, and the fabrication of the turbines themselves, and managed by one operator overall. And then once the plant is up and running, then the ownership structures are obviously, they evolve in different ways.

I think we're seeing that quite a lot onshore as well in places like Morocco, and we see it in the recent tenders in Mexico, and in Argentina. Although you have one primary developer, but not thinking that they need to do everything. But onshore winds in a sort of normal environment will always be coming up pretty standard kind of procedure where there's lots of people who can actually do the job and do it well. So I think a lot of people now just subcontract out that and put it up for tender. The EPC contracting the electrical connection. The transports. All the different components putting together an offshore windfarm, not onshore windfarm. But the main economic players of course, are going to be the primary project developer on the one hand, and then the turbine manufacturer on the other.

Eric Okay, thanks. There's a few questions about a few specific markets. I'll name them and then you can stick to whichever ones you're most familiar with.

Steve Okay.

Eric Russia, Ukraine, and Brazil were asked about.

Steve Okay. Well, Russia, yes. I love Russia. I've spent a lot of time there. It's a fabulous country. Fabulous people. But the tragedy of the history of the last 1,000 years of them very, very rarely doing anything in their own long-term self-interest just continues. They have obviously modern wealth built on raw materials primarily, and now oil and gas, which they are spending at profligate rates at home at ridiculously subsidized prices. So we've been telling them for years that they should save that, or at least sell it and invest the money in taking advantage of their enormous wind and solar resources, and biomass resources, and hydro, and geothermal. I mean, Russia is a huge country with vast [Inaudible]. You know, depending on whatever your perspective on oil and gas, that is the main—that and gold are the main sources of their accumulated wealth, which they've been hemorrhaging from every orifice since the oil prices crashed. And there are noises that they want to open up these markets, and I really, really hope they do. And I think it would be an extraordinary benefit to the country, to the economy in every other way. But no signs yet. They have put these Tenders out there with 80% or sixty-five I think is the most recent local content requirement with no turbine manufacturers in the country. So who can bid on that? Nobody. It doesn't make any sense.

They passed a reasonably progressive renewable energy law in 2007, and we've been waiting for the implementing regulations now for a long time. There's 5,000 or 10,000 megawatts of projects developed, ready to go as soon as they resolve administrative and regulatory and financial issues, but not yet. It will come, and when it does come it'll probably be big and it'll probably come out of the blue, but I don't see it happening immediately.

Ukraine was doing great until Russia invaded them and took over a big chunk of the country. That kind of put most everything on hold. I mean, the Ukrainian industry had been evolving for some time and was beginning to take off, but you know, a big chunk of their early development was in fact in Crimea which is now at least in some way annexed by Russia. And I don't really know what's happening to the projects there. I think there are some projects being built in the western part of the country, but they have some bigger issues to sort out before people are going to come back and want to invest.

And then Brazil. Brazil has been the great success story and pioneered this reverse price auction system which has really been a big boom to the industry in a lot of ways. The first auction was in 2009, the end of 2009, and they're up to the fourth largest annual market and the tenth largest cumulative market in the world in that period of time. They have both political and economic difficulties at present [Inaudible]. There's no substantial [Inaudible] growth. The legitimacy of the current government was obviously called into question

enough to take out the previous President. The new one is having some difficulty establishing himself, and they're going to have a tough few years politically and economically.

As I mentioned with the projects that have been contracted, say the ones since 2013-14-15, we'll still be building there for a while, but I just got news today actually that the only renewable power auction that was scheduled for this year which was scheduled for next Monday has now been cancelled due to lack of demand. So that does not bode well. Especially does not bode well for the companies who in response to the local content requirements imposed by the financing conditions in Brazil who invested in plans. We have nine original equipment manufacturers in Brazil with three or four gigawatts of capacity in a two-gigawatt market. And that two-gigawatt market or 2½ gigawatt annual market could shrink dramatically unless there's some new procurements in the course of the next year or so. But for that to happen the economy needs to start to turn around, and then we get back to the political process.

So Brazil has been one of the great success stories and great, bright spots for the future of the industry. Now they're going to have a rough couple of years.

Eric

Thanks. One more country to add to the list that just came in. Norway.

Steve

Norway, our battery. The Norwegian hydro referred to as the battery of the North Pole system along with the hydro in Sweden to balance. You know, it's why Denmark doesn't—while it's not easy, but they have 42-43% of their electrical demand last year met by wind, and quite frequently they'll get to a situation where their production is more than 100% of demand, particularly in the winter at night. And that energy is in effect stored behind those hydro dams.

There's been discussions about building offshore wind in Norway. Certainly the first full scale test project for a floating offshore wind project was a joint venture between Statoil and Siemens. [Inaudible] project there. I understand that there's a push now to develop some onshore wind just to keep them into the industry and to diversify the city supply which is now, of course, dominated by hydro. I would presume as they move more and more towards the energy system onto electric, electric transport is big there, and more and more industrial and mechanical demands that in the past have been met with fossil fuels are being met now with electricity. I think they just want to diversify the supply. I don't think they're going to be building anymore hydro soon. But I don't think it's going to be a huge market either.

Eric

Okay. Last country. India. You mentioned India briefly when we were talking about south and Southeast Asia, but if you could talk a little bit more about India.

Steve

I can talk a lot about India. Again, I love India. India is a fabulous country with fabulous food and fabulous people, and culture and history, and wonderfulness, and the largest English-speaking democracy in the world as they're fond of saying. But that Federal system and the democracy and the

multi, multi, multi, multi, multi, multi, multiparty system makes life difficult sometimes, The electricity system is controlled mostly by the states. There is some Federal involvement. But just to give you an example, until relatively recently the largest wind producing state in the country, the big state in the south of Tamil Nadu was an electrical island from the rest of the country. And it is now possible to trade electricity, but difficult to [Inaudible]. But it's also hard to do things like there's legislation for a national renewable portfolio standards, but the central government can't enforce it. But having said that, the new government does—well, it's not new anymore, but the Modi government does have very aggressive targets for both wind and solar for 2022. They're working hard to try to see them happen. We do see substantial growth. I think when we get the numbers next month for calendar 2016 we'll see that India had quite a good year. I think it'll have a pretty good year next year. Whether it will live up to its potential, somebody needs to spend an awful lot of money on infrastructure. Grids. Markets, roads, railways, airports, et cetera. All that sort of thing.

But you know, the developments in the last couple of years have been quite positive, and at the moment we're coming up to the end of the third year of a 4½ year project financed primarily by the European Union to develop a roadmap for the development of offshore wind which when we start will [Inaudible] India, are you nuts? But no, I don't think we are, and I don't think it's a nutty idea. They have some very good offshore wind resources in India. There's plenty of places with modest to good offshore wind resources in India. Very near to the large load centers. And India can leverage some of its natural advantages in terms of labor and their own offshore maritime engineering experiences which is not inconsiderable to help drive costs down. And of course, at the time I was reasonably confident or at least very hopeful that the target of getting the cost of offshore down below 100 euros of megawatt hours by 2020 would happen. What we've seen now I think will make the appetite even stronger.

But for larger centers like Mumbai in the west and some of the best offshore winds as in that slot between Tamil Nadu and Sri Lanka in the southeastern part of the country, to begin with I think there's quite substantial possibilities for development of significant offshore there. And with the prices that we're seeing now it becomes much more of an economic possibility.

So India is difficult. It's complicated. It can be infuriating. But generally in my experience it's very much worth the wait and worth the investment because it has, you know, as the Chinese economy moves much more towards a inwardly looking service—not service oriented, but much more of a domestic economy, and much less based on manufacturing exports, we're going to see India continue to be one of the major engines in global growth increased electricity demand, et cetera, over the course of the next decade or two. And I think wind energy can play an important part of transforming the power sector in India to one which is sustainable in the long term. So my counsel, don't get over-optimistic, don't get your expectations too high, but do pay close attention. And its long-term prospects are very good and enormous, but prepare to be frustrated and learn a lot particularly about how

to culture differences in the way of doing business between India and the west. I have, he said very humbly after having made just about every mistake possible. But yeah, it's going to be—it's one of the oldest cultures on the planet and will continue to be a major force in our world as long as we're around. And hopefully the millions of Indians still mired in poverty will be brought out of that or will bring themselves out of that as they are doing at present in large numbers, and they'll need power to do that. And they need clean power, especially with the quality of air in Delhi and some of the other big cities. Now it's atrocious. Worse than China even. And that has to be fixed, and wind and solar and other renewables can and must play a big role in that.

Eric

Thank you. One more question. It's about the U.S. market and human capital. The question is so what human capital needs there'll be with this rapid expansion, and particularly what feedback mechanisms are required between industry and academia to facilitate people being in place to support growth going forward.

Steve

Gosh, you guys are probably in a much better position to answer this question than I am. I do know that many of the companies that are my members have invested in and developed cooperative relationships with local community colleges, technical colleges in the main market growth areas. In Iowa, in Kansas, in Nebraska, in Texas for sure, and in other parts of the country to make sure that wind turbine technicians and electrical and the other supporting trades that are needed to develop the wind industry are included and supported and advanced within those curricula. I think that you know, close to 100,000 people, or 90,000, whatever it is at the moment, employed in the wind sector I think it's going to—well, the Department of Labor says that it's going to grow pretty dramatically over the course of the next five to ten years.

Whether or not the current feedstock from these technical colleges is sufficient, my guess is probably not, and that it would need to be beefed up. But again, you'd have to ask—despite my accent I haven't actually lived in the U.S. [Inaudible] colleagues from [Inaudible]. Pass.

Eric

Thank you very much, Steve. Yeah, that was great. Thank you for that very informative Q&A session, and thank you to all our participants for all those great questions. If there any questions we didn't have time to get to, we'll connect with those attendees offline after the webinar.

Before we conclude, Steve, do you have any concluding remarks you'd like to share?

Steve

I'd just like to, in this time of year in particular—I'm an old guy now, just turned sixty so I like to look back to when I first got involved in talking about renewable energy and actually used to see the first commercial windfarm in the United States outside from my kitchen window and southwestern New Hampshire when I was—how old was I? Twenty-three? When the Crotched Mountain windfarm was built in 1980. And just think about you know, we are now—we in the wind industry now produce by far and away the world's

largest pieces of rotating machinery. And we used to say that we had a lot to learn from the aircraft industry. Now it's more or less the other way around. And as my friends from Siemens said, we're constantly pressured to produce helicopter level technology at farm tractor prices, and it seems like we've succeeded pretty much because we more or less won the price war with fossils. Which I've always hoped and was confident was going to happen eventually for both wind and solar. I think it's happened much more quicker than we ever expected simply because of the rapid scale of both technologies. What the future will bring, don't really know. I'm [Inaudible] biggest risk to the long-term growth projections for the wind industry, I would have to say the biggest threat is technical breakthroughs and developments or technologies that we haven't even thought of yet is probably the biggest risk. And just looking back at you know, I'm continually telling stories to my kids or whatever about—and you have to remember, we had no internet. We had no cell phones. We had no computers. And that doesn't seem very long ago to them, but to me it's so far in the dim and distant past I can't even imagine it. And when we're talking about what the energy system is going to look like in 2035 or 2040, I'm very sure it's going to be dramatically different than it is today. And I think I have some idea of some aspects of it, but I'm sure also that it's going to be influenced by technologies which we can only begin to imagine now.

So I'm generally a cautious optimistic about the future, however pessimistic I might be about the immediate present.

Eric

Okay. Thank you again. Thank you very much, Steve.

Steve

Okay. Thank you. Thanks to the Clean Energy Solutions Center for all the good work you guys do, and of course, all your colleagues, all of you at NREL in general with whom I have multitudinous and very productive relationships.

Eric

That's good to hear. Thank you as well to the attendees for joining today, and we appreciate your time as well, and hope in return there's some valuable insights that you can take back to your ministries, departments, and organizations. I would also like to invite attendees to inform your colleagues and those in your networks about Solutions Center resources and services including the no-cost policy expert support through the Ask An Expert service that I mentioned earlier on.

I invite you all to check the Solutions Center website if you would like to view the slides and listen to the recording of today's presentation. Also previously held webinars. Additionally you'll find information on upcoming webinars and other training events, and we're now posting our webinar recordings to the [Clean Energy Solutions Center YouTube channel](#), but please allow about one week for the audio recording to be posted.

Again, I'd like to kindly ask you to take a moment to complete the short survey that will appear at the end of the webinar. Thank you again. Please enjoy the rest of your day, and hope to see you again at future Clean Energy Solutions Center events. This concludes our webinar.