

Domination of Renewables

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Webinar Panelists

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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 REN21. Today's webinar is focused on the domination of renewables. 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's features. For audio, you have two options. You may either listen through your computer or over the telephone. If you choose to listen through the computer, please select the mic and speakers option in the audio pane. If you choose to dial in by phone, please select the telephone option and a box on the right hand side will display the telephone number and audio PIN you should use to dial in. If anyone's having technical difficulties with the webinar, you may contact Go to Webinar's help desk at the number on your screen (888-259-3826) for assistance.

If you would like to ask a question, and we really encourage that you do, please use the questions pane where you can type that in. If you're having difficulty viewing the materials through the webinar portal, you will find PDF copies of the presentations at cleanenergysolutions.org/training. Also, an audio recording will be posted to the Solutions Center training page within a few weeks and will also be added to the [Solutions Center You Tube channel](#) where you can find other informative webinars as well as video interviews with thought leaders on clean energy policy topics.

Today's webinar agenda is centered around presentations from our guest panelists: Christine Lin and Gregory Wetstone. These panelists have been kind enough to join us to discuss the launch of REN21's flagship report, "Renewable 2016 Global Status Report" and to find out what made 2015 another great year for renewables. Before our speakers begin their presentations, I'll provide a short, informative overview of the Clean Energy Solutions Center and following the presentations, we'll have a question and answer session where the panelists will address questions submitted by the audience. We'll conclude with some closing remarks and a brief survey.

This slide provides a bit of background in terms of how the Solutions Center came to be. The Solutions Center is one of 13 initiatives of the Clean Energy Ministerial that was launched in April of 2011 and is primarily led by Australia, the United States and other CEM partners. Outcomes of this initiative include support of developing countries and emerging economies through enhancement of resources on policies related 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 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. 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 sectors, NGOs and civil society.

A marquee feature of the Solutions Center is the no-cost expert policy assistance program 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 green growth strategies, we are pleased to have Thomas C. Heller, Executive Director of the Climate Policy Initiative serving as one of our experts. If you have a need for assistance in green growth strategies or any other clean energy sector, we encourage that you use this valuable service.

Again, the assistance is provided free of charge. If you have any questions for an expert, please submit it through our online form at cleanenergysolutions.org/expert. We also encourage you to spread word about this service to those in your networks and organizations.

Now before we begin, I'd like to provide a brief introduction for today's panelists. First up is Christine Lin, Executive Secretary of Renewable Energy Policy Network of the 21st Century, REN21. It's a global, public/private multi stakeholder network on renewable energy that convenes international organizations, governments, industries, associations, science and academia as well as NGOs working in the field of renewable energy.

Following Christine, we'll hear from Greg Wetstone, the President and CEO of the American Council for Renewable Energy, ACORE, a national non-profit organization dedicated to advancing renewable energy through finance, policy and market development. With member companies from across the spectrum of renewable energy technologies and close ties to the renewable energy finance sector, ACORE's the pre-eminent voice for nations' renewable energy industry. With those introductions, we'd like to welcome Christine to the webinar.

Christine Lins

Thanks very much, Stephanie and good morning or good afternoon, ladies and gentlemen wherever you're joining us today. I'm speaking to you from San Francisco where we are launching this year's Renew 2016 Global Status Report at the Clean Energy Ministerial meeting. Yeah, I'm excited to be able to do an exclusive presentation of the key findings of this year's Renewables 2016 Global Status Report of REN21. As mentioned, where multi-stakeholder network with this multi-secretary at the United Nations environment program in Paris, France.

We are compiling the Renewables Global Status Report now already for the 11th time. It has established itself as the most referred report on renewable energy globally, covering trends in market, industry, investment, policy in the field of renewables, all technologies as well as for all sectors of power, heating and cooling and transport. We are also looking on the complementarity between renewable energy and energy efficiency and always have a blanket feature of the report. This year's feature is on community energy.

All the data that collected on the Global Status Report portrayed on REN21's renewables interactive map, which you can access from our network at _____. This report would not be possible without the contribution of many people around the world that work with us. I'm sorry. I'm just trying to move my _____ here. They are working with us on providing data, on reviewing information. We have expanded this network to over 700 people from all around the world.

Just to give you an idea; in the production of the Global Status Report 2016, we had 180 experts joining the report process, which is the equivalent amount of people that contributed back in 2012. So, as we see, it's an increasing community and if you out there are interested in joining the community, please to get in touch with us. We are an open network and the more information we can get, the better it is. The report is as good as its contributions and we're very proud to say that we do not only feature information from government but also from NGOs in the industry and by this we're able to really provide the most accurate picture about renewable energy development John.

So, in a nutshell, 2015 was really an extraordinary year for renewable energy with a record capacity of 147 gigawatts of renewable power added in 2015. That is the largest annual increase ever and tends to put things into perspective. That's about the total capacity installed on the African continent. So, the equivalent amount of the total power capacity on the African

continent was installed in renewables in 2015 in the world. We also saw some increase in the field of heat capacity, which increased by about 38 gigawatts thermal and also some in case of biofuels production, however clearly the measured ones are to be found in the concept _____.

So, when looking at the champions for renewable energy in terms of energy investment in capacity additions, clearly in absolute term the list reads I would say the usual suspects; China, United States, Japan, United Kingdom and India. However, when you look at investment in renewable power and fuels per unit of GDP then we get a completely different list; Mauritania, Honduras, Uruguay, Morocco and Jamaica, which is an indication of finding total will be found later on, that effectively emerging economies in developing countries have for the first time in 2015 invested more in renewable energy than industrialized countries.

In terms of total capacity, there as well, we listed the top five countries. When you look in absolute terms, again, China, U.S., Brazil, Germany, Canada. When you look at renewable power basically per capita, you have a very European feature; Denmark, Germany, Sweden, Spain and Portugal, which already indicates that many European countries already have very high shares of variable windmills.

The report focuses since more than a decade on portraying the policy frameworks in place in countries and there we have seen an _____ increase in a number of those countries because renewable energy targets and policy frameworks. At the end of 2015, there were 173 countries with renewable energy targets and an estimated 146 countries with renewable support policies in place out of which as you see on the slide, the majority of countries are focusing on the power sector followed by 66 transport policies and 21 heating and cooling policies. In the power sector, the most prominent instrument are still feed-in tariffs here on the graph highlighted by the light blue bar, followed by tendering systems, which are increasing rapidly. We had 64 countries with renewable canvas in 2015. The third bar, second blue bar, 52 countries with net metering policies in place.

So, when actually looking at the blue on the map, we see that regulatory policies in the power sector cover over 87 per cent of all population while regulatory policies in heating and cooling and in transport cover 50 and 73 per cent. So, we see that on the power sector we nearly have overall coverage whereas when it comes to heating and cooling there are still quite some way to go. That's also reflected in the share of renewables in these sectors.

So, by talk about _____, but when it comes to heating and cooling modern renewable energy supply is about approximately 80 per cent of final energy for heating and cooling services, where the majority—over 90 per cent—was supplied by biomass. Solar thermal supplying 8 per cent and geothermal district used technologies, direct used technologies the remaining 2 per cent. Then as well as in the transport sector, an increasing share of biofuels have a contribution of three per cent up to _____ transport often _____ and then increase in electric minibus and policies promoting and _____ coupled with renewable support.

So, the power sector, as I said, was successfully optimized. They get renewables comprised about 59 per cent of global power generation capacity and 24 per cent of global electricity demand. We had an increase of 9 per cent, bringing the global renewables power capacity to 1,849 gigawatts. An estimated 60 per cent of net additions to the global power capacity in 2015 were renewables based and the world now adds more renewables power capacity annually than it adds natural capacity from all fossil fuels combined. This is not just only this year but it's a trend that has evolved over the previous years.

The new dense report goes in very much detail into different technologically areas. I'm just going to touch upon this in a nutshell or to find very comprehensive information about all the different technologies in the report. So, biomass, it makes up 13 per cent of total final energy consumption and we see that biomass, of course, is used for heating. It's used for transport and it's used for power. But energy sectors majority is in the buildings, in heating buildings with 20.6 per cent, 7.2 per cent of heating in industry, then the transport here and then about 2 per cent in power.

Geothermal power and heat is also interesting jumping at the market of money. About half of the new global capacity additions and the new countries for cumulative geothermal power generated capacity are the U.S., the Philippines, Indonesia and Mexico and New Zealand. As far as hydropower is concerned, about 28 gigawatt of new hydropower capacity were commissioned in 2015, which increased the total global capacity to approximately 1,064 gigawatts, which we resulted in the hydropower generation during the year at an estimated 3,940 terawatt hours. Yeah, so you see there, the share of the total markets with China in the pole position.

As far as solar is concerned, solar had a very good year. The solar PV market was up 25 per cent over 2014, _____ 50 gigawatts lifting the global total to 227 gigawatts. What I think is really remarkable is that the annual market in 2015 was nearly ten times the world's cumulative solar power capacity of a decade earlier. So, we clearly see that development is rapidly increasing and in every situation that are nowadays 22 countries throughout the world have now PV capacity installed to meet more than one per cent of their interest demand with photovoltaics, which is—and some countries have higher shares. For example, 7.8 per cent in Italy, 6.5 per cent increase and 6.3 per cent in Germany just to name a few countries.

Concentrating solar thermal power; so new facilities installed in 2015 representing a mix of parabolic or trough and tower technologies and all of them incorporating thermal energy storage. We saw that countries that brought new CSP facilities online in 2015 were Morocco, South Africa and the United States, which raised the global total by about ten per cent to nearly 4.8 gigawatts.

In the field of solar thermal heating and cooling, the overall capacity of glazed and unglazed solar thermal collectors was per more than six per cent in 2015 despite the market slowdown to primarily to continue contraction of

markets in China and in Europe. Of course, in 2015 for heating technologies wasn't an engine year because of low oil prices.

As far as wind is concerned in 2015, a record of 63 gigawatts was added for a total of about 433 gigawatts. There received known OSCT countries who are responsible for the majority of installations like China and new markets emerged because Africa, Asia and Latin America. The offshore sector had a strong year with an estimated 3.4 gigawatts connected to grids, mostly in Europe, for a world total of more than 12 gigawatts of offshore mean capacity installed. Wind power was the leading source of new power generating capacity both in Europe and in the United States and the second largest in China.

We see that wind power is playing a major role in meeting electricity demand in an increasing number of countries. For example, 42 per cent of Denmark's electricity demand in 2015 was made by wind. More than 60 per cent in four states, in four regions in Germany and 15.5 per cent in Uruguay, which is a good example of variable renewables really—that they sprint all around the world. The Global Status Report also puts an eye on distributed renewable energy for energy excess because let's not forget that still about 17 per cent of global population lack electricity access—that's about 1.2 billion people—and 38 per cent of the global population lacked access to clean cooking. There we see that clean cook stoves are really spreading. By the end of 2015, about 28 million households worldwide were using clean cook stoves.

Although there is little quantitative information sitting on distributed renewable energy markets, we are trying to come up with some numbers in order to show the huge potential that exists in this field. Then what did you report? That distributed solar PV markets continue to flourish. We had about 44 million off-grid pico-solar products sold globally by 2015, which represents an annual market of about 300 million U.S. dollars. There are about 70 countries worldwide that either had some off-grid solar PV capacity installed or had programs in place to support off-grid solar PV educations.

We see that several thousand renew stays mini-grids were in operation primarily in markets like Bangladesh, Cambodia, China, India, Morocco and Mali. We also see that many international experts including at least 30 programs and approximately 20 _____ experts are involved in deploying distributed renewable energy. These programs, many focus on improving energy access with renewables both in Africa and in other parts of the world. Here _____ are some quantitative figures about—in the countries, the total countries for solar home systems, for solar lighting systems, biogas installations and clean stoves.

So, overall, 2015—so the closure on the number of financial agreements who support distributed renewable energy worldwide. We see innovative business models continue to make mature and expense and Bloomberg Energy Finance estimates to drop lead 276 million U.S. dollars are invested in off-grid solar companies, promoting solar lanterns and solar home systems, which brings the total since 2010 to more than 511 million. But then we also see the acceleration of the market, which I think is very encouraging. _____ the

export we see we have a long way to go to provide energy access to all by 2030 as agreed within the U.N. Secretary General's Sustained Energy for All Initiative.

Jobs in renewable energy are growing according to estimates by IRENA, the International Renewable Energy Agency. Global employment continues to increase by about five per cent in 2015 and there are an estimated 8.1 million direct and indirect jobs in the renewables industry, which this number does not count the jobs in last in hydropower. If we also count those, we would need to add another 1.3 million jobs bringing the number up even more. Considering all renewable energy technologies, the leading employers in 2015 were China, Brazil, the United States and India. So, we generally see the countries which they _____ are the ones energy to most from drunk creation.

2015 was also a record year for global investment in renewable energy. There were 286 billion U.S. dollars invested in renewables, which represents a rise in 5 per cent compared to 2014 and, which also exceeds the previous records that we had seen in 2011. If we add investment in hydropower projects slashed in 50 megawatts this now goes up to 329 billion. It's remarkable to note that this amount was more than double the 130 billion allocated to new coal and natural gas generating capacity. So, we see that the difference between investment in renewables and fossil fuel investment in our capacity is increasing. So, much more invested in renewables than in fossil fuels.

What's also interesting here when looking at the global map is that in 2015 for the first time in history total investment in renewables power and fuels in developing countries exceeded the investment of developed economies. So, developing and emerging countries invested 156 billion U.S. dollars, which represents an increase of 19 per cent whereas developed countries invested 130 billion, which is a decrease of 80 per cent. That is mainly due to a decrease of investment in Europe. That's very, very positive.

The emerging economies really taking the lead. China, playing a dominant role. It increased its investment by 17 per cent to 103 billion U.S. dollars, which makes them account 36 per cent of the global total investment. But we see that many other countries already been increasing their investment such as Indian, South Africa, Mexico and Chile and other developing countries investing more than 500 million U.S. dollars and many of those in 2015 were Morocco, Uruguay, Finland, Pakistan and Honduras. So, we see that we have a very geographically spread picture.

As far as technologies are concerned, solar power was the leading sector for money committed during 2015, receiving about 56 per cent of total renewable energy investment. What was very interesting to see is that the developing countries invested as much as the developed countries with 80 versus 81 million. As I mentioned already before, the wind, the situation is even more distant. More OCT countries are the ones that have invested the most heavily in the wind, which have a total investment of about 109 billion U.S. dollars or about 38 per cent of the total.

So, on the one hand, very positive for solar wind. On the other hand, the word of caution when actually looking at investment for the other technologies, the numbers went down. So, which of course is a bit of a challenge especially if you are at a transition and _____ renewables that many countries are committed to and there's definitely a need to revisit this before four high chance renewables we really need to promote all renewable energy technologies in a mass basket.

We at REN21 consider that it does not make sense to only look at the supply side. This needs to be coupled with demand side considerations. So, we have in the past years continued to put a focus also on energy efficiency in the Global Status Report and there we see, for the first time, we are presenting a policy map showing that 146 countries around the world have policies promoting energy efficiency in place and about 128 countries some kind of targets. So, yes, we are also making progress in energy efficiency and that will be very important especially when thinking about—talking about meeting the final objectives.

A phenomenon that we have seen in 2015 is the expansion of the 100 per cent renewable energy movement. We have more and more cities and local governments focusing on 100 per cent targets. Some of them are listed here from different parts of the world; Australia, Canada, the U.S. Small jurisdictions, big cities such as San Diego, for example, and in addition to the city and local government, you also see that corporations are promoting 100 per cent renewable energy targets. For example, at the end of December there were over 2,000 companies all around the world that have committed—that have pledged to two reductions and 154 U.S. companies employing more than 11 million people have committed to 100 per cent renewable energy target. This is an invitation that global renewables are effectively cost competitive.

So, this year's Global Status Report has a feature on community renewable energy. These initiatives have existed since the middle of the 19th century. That _____ there to enable communities to share their resources and can be used to power mostly industrial activities. We see that many communities are turning to _____ renewable energy production. Most projects are focused on electricity generation but we also have some examples there in the heating and in the transport sector.

Also consolidated is very limited. We are trying to give it—to quantify things a little bit because we see that since 2008 there has been a market rise in initiatives focused on community renewable energy especially in Europe. Europe has more than 2,800 energy cooperatives, 772 of these in Germany and the Netherlands. But we also see that this is a phenomenon that is now taking place in Australia, in the United States and Canada and even some countries in Asia have community energy projects particularly around micro hydro generation.

Also in Latin America, these models are playing important role in the electrification of rural areas. So, very interesting. That is also I think something that you'd want to see more than happen, which of course is still changing the pattern of the edge system away from very centralized to much

more decentralized pattern of energy generation but also closer to actually energy is consumed.

So, in a nutshell, a very possible here, however when we look at the advancement of renewable energy in final energy consumption we see that the development is relatively slow. So, we had about 19.2 per cent of renewables in final energy consumption in 2014 where a share of modern renewables is increasing and the share of traditional biomass is effectively going down. One of the reasons that the overall share of renewables is only slowly increasing is clearly the progress in heating and cooling and transport is slower than in the power sector and is not yet at the speed we need to see.

So, in conclusion, the largest global capacity additions from renewables to date. We have the second years now in 15 mach—the second year in a row where global CO2 emissions remain stable despite the fact that global energy demand increased and that was mainly because of the renewable energy and energy efficiency programs. We have seen very encouraging statements at the Hot 21 in Paris in December, which would mean that the majority of the remaining fossil fuels reserved have to be kept in the ground if countries are very serious about reaching this two per cent climate target and then means a massive ramping up renewable energy and energy efficiency. We need clearly a big emphasis on renewable energy in the heating and cooling as well as the transport sector. I think what we're going to see in the future is much more focused on coupling these two sectors.

Last but not least, the need to build a smarter, more flexible system that accommodates both centralized as well as decentralized and community-based generation. I'm going to stop here. The Global Status Report is down—you can download it from our website, Infographics, massive presentation, key findings, the full report as well as a video which tells you the main findings in a nutshell. With this, I hand over to Greg Wetstone from ACORE for more insight into the North American market. Thank you for your attention.

Stephanie Bechler Thank you so much, Christine. Now, Greg, when you have a chance the floor is yours. Are you able to see the screen share?

Gregory Wetstone I just got that, Stephanie. Thank you. I guess I'm ready to go here.

Stephanie Bechler Okay.

Gregory Wetstone Great. Well thank you very much, Christine. I am the CEO of the American Council in Renewable Energy. I'm having trouble moving my slides. The ACORE is a non-profit organization. I want to mention at the outset, our membership includes the range of—there we go, the range of companies that build, own, operate, invest in and use renewable energy. As you can see here, it's a broad collection of companies and the diversity you see here really represents the nature of the growth in the renewable sector in the United States, which is now much broader than you might assume historically.

So, let's look at what's happening in the United States in the renewable world. It is very much consistent with the conclusions of the new GSR report. We see historic growth in 2015, and as a trend, this chart shows close to 16 gigawatts of new renewable power last year, essentially wind and solar growing at breakneck pace. That's a really impressive number when we consider both that electricity demand in the United States has essentially been flat over the last several years and that natural gas, which is the central alternative, the major competitor to renewables in terms of new power generation is now at record low prices.

So, renewables are doing surprisingly well in the U.S. and a very competitive economic environment. One other trend to note here is the yellow line, which is solar, just continuing to increase. That's a trend that is likely to continue and certainly along with wind growth bodes well for the future.

So, the investment numbers are up and very substantial. Over 44 billion. The only reason 2011 is larger is because that was the end of a very important policy program in the United States and there was all kinds of investment to try to get projects completed before a deadline. So, we're looking at a cumulative investment in the U.S. of over 360 billion, which is substantial.

So, where are we? Big picture stepping back. What this chart demonstrates is that over the past really five years, renewables have outcompeted gas for new electricity capacity in the United States. That's really impressive. Actually, it's more like seven years as you look closely at the numbers.

So, the mission of our organization, ACORE, is to lead the way to the transition to renewable energy economy. What this chart really demonstrates is that that transition has begun. What I'd like to turn to now is why. What are the factors that are leading to renewable growth in the United States? The one that stands out is cost competitiveness.

Right now, this is Lazard on levelized cost of energy. You see that particularly utility scale, photovoltaic solar and onshore wind are cost competitive with virtually all other new energy sources including combined cycled gas. That's a pretty surprising inclusion. The reason is that the levelized cost of both wind and solar are dropping, have been dropping dramatically. That's a trend that we think is going to continue.

So, an 82 per cent reduction in solar costs over 6 years is very impressive as is 61 per cent reduction in the cost for wind. That's translating into lower electricity prices. I think a lot of folks would be surprised by this one. If you compare the states that have the most renewable electricity deployed with the states that have the least renewable electricity deployed what you find is that electricity prices—and this is data—are actually lower in the states that have the most renewable and higher in the states that have the least. Not surprisingly, the rate of electricity price increases is also lower in the leading renewable states. That's to be expected because renewables obviously are not subject to the volatility that you can see in commodity prices and that's particularly true for fuel prices.

So, cost competitiveness is a key part of the reason we see the growth in renewables. Another is the stability in the single renewable policy really—single—big picture renewable policy that we have in the United States is really in tax policy where we have credits in the tax code. In December of the past year, we saw a five-year extension for wind and solar. Both credits will phase out. The wind credit phases out more rapidly. So, what you see in this chart is that we're—the projections. This is from Bloomberg New Energy Finance are for roughly comparable growth for both wind and solar over the next several years: 19 gigawatts of wind, 18 of solar.

But if you look at the trend line, you see that as the production tax credit for wind phases down you see more of the growth on the wind side sooner. One reason for that, there was recent guidance from the U.S. Treasury Department that allows any wind project that begins construction this year, in 2016, if it's completed in 4 years will clearly qualify for the tax credit. So, you see today, a lot of effort to start construction really on a four-year portfolio of wind projects. So, a lot's going to be happening very quickly in the wind sector. In solar world, they have more time because the solar phase out is slower.

It is worth putting the subsidies in perspective. In the United States, the history has been that federal policy has had a huge role in the direction of electricity generation in this country. This goes back to the days when the federal government built big hydroelectric projects, built the transmission lines connecting to a lot of coal areas. From a historic perspective, the subsidies for renewable energies are low compared to subsidies provided to other types of fuels. I should mention this is 2010 data. We're updating that. If you updated today, the green line would be maybe double what it is but still much smaller than in the range of other areas assessed here.

So, another key policy driver in the United States obviously is the state standards for minimum levels of renewable electricity on the grid. It's a patchwork structure in the United States because we do not have a single federal energy policy that promotes renewables. But this state by state structure has had a massive impact on the market with 29 states and Washington, D.C. having mandatory RPSs, renewable portfolio standards, and many of them in some of the most populous states in the country including 50 per cent standard in California and New York with currently a 29 per cent standard but moving toward a 50 per cent standard as well. So, that has played a really important role in driving growth in this country.

But what we're seeing is that renewables are growing at a faster rate than can be explained than just the renewable portfolio standards in the states. One key reason for that is electricity consumers in the U.S. are increasingly choosing renewables and they're doing that in several different ways. One is in unregulated markets where they have a choice. In many cases, consumers are simply selecting the clean electricity option. Electricity consumers and residences across the country are using rooftop solar to meet some of their energy needs. That's gone from being a fairly minor factor to one that's significant where we've seen over two gigawatts of rooftop solar installed last year in the U.S. That's a big number.

Then if we shift to the corporate realm, there has been a really noted increase in the emphasis in sustainability among corporations. We have today, if you just look at reporting on things like greenhouse emissions, only 20 per cent of Fortune 500 S&P 500 companies reported 5 years ago and today that's quadrupled. Not unrelated to that is the trend of companies actually going out and procuring their own renewable electricity. This has gone from a relatively small niche effort to an increasingly widespread phenomenon. The White House Business Act on Climate Pledge, which really emphasized corporate efforts to use renewable energy garnered commitments from over 150 companies. So, this is a growing trend.

Last year we saw on the order of 3.4 gigawatts of renewable energy procured by corporations. This has been predominantly wind but as you can see from the chart, a growing sector of solar as well. That's a lot of power if we were to go back and look historically at, say, what was a good year for solar power. Three point four gigawatts would have been a good year for the whole country not very many years ago. The same is true for wind. So, this is a very significant trend. If you combine this with what's happening in rooftop solar you're looking at over five and a half gigawatts of renewable power completely outside of what's happening in the traditional realm of utilities' centralized power grid procuring renewable power.

So, this is just a quick overview of who the corporate leaders are. As you can see, companies with big data centers are investing in a major way. They're doing it for sustainability but also they've demonstrated they can save money and in some cases even make money with investment in the renewable sector and Google has been a big leader there, as has Amazon. Walmart was an early pioneer. I'm proud to say many of these companies are members of ACORE and big supporters of the renewable sector and the effort to green the grid at large.

So, turning to another really critical policy looking to the future to grow renewables is obviously EPA's Clean Power Plan. That gets us close to a 30 per cent reduction below 2005 levels. But there's a big question mark there. The Supreme Court a couple of months ago issued a stay, which means that the Clean Power Plan is not enforced by the EPA or the states until it is upheld in court. There is at the end of September the DC Circuit Court of Appeals will begin hearings on the case. I think there's every reason to expect this case will be back at the Supreme Court. We could see action by the very end of this year or early next year.

As a practical matter, what this means is that the Clean Power Plan is going to be left in the hands of the new president that will be elected in early November and take office in late January. If that plan goes into force, it will have the biggest impacts in many cases on the states that have the most coal generation that have not had ambitious renewable electricity standards. For the most part, that's not strictly true but you see in this map sort of where the Clean Power Plan has the biggest impact. Clean Power Plan will have—is projected to have a substantial impact on deployment of both solar and wind power in the United States in the period between 2020 and 2025, 2030.

So, that's very important for this sector to have that demand creation. However, we should be clear that the Clean Power Plan does not get us to the objectives that the United States endorsed in their nationally determined commitment in Paris. The U.S. would get about halfway there under the Clean Power Plan, maybe a little more than that. But there's clearly much further to go. I would offer that there is at least in our view regulatory authority for the U.S. to make up the difference under the international provisions of the Clean Air Act.

There was a major article published in the *Columbia Law Review* on the international provision of the Clean Air Act, section 115 that goes through in some depth that case. That obviously will be a decision left to future administration. So, that's my overview. I'm not sure I—I hope we'll have some opportunity for questions. I appreciate the opportunity to participate today and, again, congratulate REN21 on a stellar report this year. Thank you.

Stephanie Bechler Thank you so much Greg. That was excellent. Before we take control back for the question and answer section, we had a question come in about slide 16 and 17 concerning the growing consumer demand. Is there —yeah, for corporate—yes, for both of those. Someone was asking if this slide that you're currently showing should be in gigawatt instead of megawatt and if it is supposed to be in megawatt could you elaborate a little bit on how that demand follows through to the next slide, which is so much higher on what exists?

Gregory Wetstone Thanks for that. Yes, the vertical line should be—on the left should be megawatt—should be gigawatt. I apologize. Yes. Because it is over three point four gigawatts last—this past year. The cumulative line on the right should also be gigawatt and not megawatt. Thank you for that catch. This is correctly labeled megawatt chart 16. This is courtesy of Bloomberg New Energy Finance. So, we're looking at a single company, Google, with over a gigawatt. It looks like about one point two-five gigawatts. So, yes, that is in megawatts, the single company contributions. Thanks for that.

Stephanie Bechler Great. Thank you so much. We have a question for Christine on the report. Regarding the developing country investment in renewable energy, people want to know how is that measured. Are you looking at the investments in the country regardless of who the investor is or is it just the governments and national companies? For example, in Mexico is it just the government of Mexico's investment and Mexican companies or does it include international investments?

Christine Lins Thanks for the question. It is I think investors outside by Bloomberg New Energy Finance and it covers both public and private sector investments, not only government investments.

Stephanie Bechler Okay, and the public and private is also international investment as well?

Christine Lins Yes.

Stephanie Bechler Okay. Thank you. Someone would like to know if the Global Status Report or ACORE's efforts, have you looked at electrical vehicle integration with the grid to deal with intermittency issues of renewable energy via smart charging or vehicles to grid? Or has it looked at developments from other forms of storage that can help with intermittency?

Christine Lins Yes. As far as the Global Status Report is concerned, we do have a section on electric mobility in there, in the transport section where we see the integration of transport and electricity policies are gaining ground in order to address reliability issues. We are planning for the year to come to enlarge this section on cross-cutting technologies because we think it is going to gain in importance and that's also what I meant when I talked about sector coupling at the end in my conclusions because I think that as we move towards higher shares of variable renewables we will automatically need to look at the better coordination between different sectors and all of these aspects will gain ground. There is something addressed, however we have still room for making it more comprehensive.

Gregory Wetstone Yeah, this is Greg. I would certainly echo that and echo we really are very much engaged in promoting what we would term grid flexibility. Today, the electricity grid in the United States really reflects the design in the 1950s, a very antiquated and volcanized structured where different electricity supply areas don't communicate with one another very well particularly in the American West where you have a lot of different balancing areas. You could have investment to build a new plant in one balancing area and right next door, they're curtailing because they have too much energy. So, obviously it's incredibly inefficient not to have these areas better connected.

We also really aren't taking advantage of technologies available today that can provide two-way communication across electricity distribution lines and allow us to do very—a short time period electric supply decisions; 15-minute, 5-minute ahead electricity purchase instead of day ahead or hours ahead, which is what we have now in many balancing areas. We don't take advantage of the ability of storage including electricity vehicles to help manage the supply and demand on the grid. We don't really have good demand response systems. So, we need a market place that values smart electricity, smart grid technology, that values energy storage, which can help electricity distribution in a long list of ways on kind of both sides of the meter. We need a better infrastructure for charging electric vehicles to deal with range anxiety issues. All these issues are connected.

But to continue the growth of the renewable sector, we are going to need to modernize our grid in this country and that's going to need to happen pretty soon as we continue to grow. We have demonstrated it is possible to have very high levels of renewables on a functional grid. It's happening today in several states that are up like Iowa, which is in the range of 30 per cent renewable electricity. So, we need to get up to those high numbers nationally and we need a much more flexible modern grid to do it.

Stephanie Bechler Thank you. Our next question is for you, Greg. Someone would like to know how the increase in solar is exceeding if not almost equal to that of the wind

increase. What is causing that given that wind should be so useful on U.S. terrain and coastlines?

Gregory Wetstone Well I think there are a number of factors but photovoltaics have—the price decrease for solar has been steep; 81 per cent over the past 6 years is just—that's kind of mind-blowing, really. That level of cost decrease. Also solar can be deployed in a much broader number of locales than wind power, which is a little bit constrained. You have to look for the good wind resource. There's clearly plenty of opportunity to do more at wind, but wind tends to be large, centralized scale is where the economics really work.

There's a lot more opportunity for both but clearly solar's growth is reflected. Lower costs and the ability for consumers in that metering stage to go ahead and provide their own power in a distributed way is a very attractive option to many people if their configuration and their location works for it. So, the fact that we have over two gigawatts of rooftop solar here in the U.S. last year, that's part of a bigger picture. But that's an important factor that really isn't there the same way on the wind side.

Stephanie Bechler Excellent. For your presentation, Greg, where the slide that included electricity rates by state with the most and the least renewable, was that including hydro?

Gregory Wetstone I believe that—let me just look and see. It's a good question and I'm not sure of the answer. So, if we can get an email address for that person I'm happy to send along the answer.

Stephanie Bechler Great. Another question. If the levelized cost of certain renewables such as utility scale solar and wind is competitive with fossil fuel power plants, why are subsidies such as PTCs still needed? Are there computations of levelized costs including these subsidies already?

Gregory Wetstone I don't have the levelized cost with the subsidies, but the reality is that virtually every sector of the grid has built in federal subsidies including virtually all fossil sources including nuclear. Really, the key difference is that the subsidies for renewables are now scheduled to phase down, and in the case of wind, out whereas subsidies for other energy sources in the United States are currently permanent law and don't change. So, I think a level playing field is something we're supportive of. I think that's the spirit of the question. I think renewables can compete well in that. But remember that none of these calculations consider the massive externalities that really has a global focus on renewables and that is obviously the contribution to global climate change. So, we're just looking at a part of the picture with these costs because we're not considering what are the costs of using electricity sources that contribute to global climate change.

Stephanie Bechler Thank you. This next—oh Christine, did you have something to add?

Christine Lins Yes, I have something to add on the fossil fuel subsidies from a global perspective. We did have a situation that did—as effect 04 between fossil fuel subsidies and renewable support. There were according to estimates of the

International Energy Agency 490 billion U.S. dollars invested, put down on fossil fuel subsidies compared to 135 billion U.S. dollars on renewable support. That is clearly something that needs to change. That is also probably easier to change at moment of low oil prices. So, I think it's important the government really taking up their commitments made in Paris to galvanize the energy sector and just phasing out the fossil fuel subsidies would be an important step to get us there.

Stephanie Bechler Thank you. This next question is actually going to be for Christine. Does the Status Report tackle new types of fuel such as hydrogen fuel for vehicles? Do you have any available information on the global use of hydrogen fuel for the 2015 transport sector?

Christine Lins No. We don't cover hydrogen in very much detail. Hydrogen is an energy carrier and is not a source. So, it depends on how the hydrogen is produced. But again, I think that goes a bit back to the statement I made before. We are planning a more comprehensive cross-cutting technology section in future Global Status Reports because we see that there is interlinkage to these and it's not yet very much based there but will be in years to come hopefully.

Stephanie Bechler This next question is for both of you. What are your predictions for the deployment of renewables based on the Paris talks, your predictions for both developing and developed countries?

Gregory Wetstone Well effectively, in the Global Status Report we don't make any predictions. We are at the moment at REN21 working on a second edition of the Global Futures Report where we look into the question of 100 per cent renewable energy and the likelihood of this to happen in different jurisdictions. Personally, I think that the rate of investment that we have seen in 2015 is a very encouraging thing that we are going to see accelerated in the years to come because the momentum that was created in Paris in December is not yet reflected in these figures and with the fact that costs have come down so much we will see more and more deployment of renewables happening. I think we are really on a good track to decarbonize the power sector; however, we need to see more in heating and cooling and in transport and that is going to be the main challenge in years to come.

Gregory Wetstone Yeah, I would certainly say in the United States over the next—between now and 2020 I think there's reason to anticipate continued substantial growth predominantly in wind and solar. Right now the policies are not as favorable for development of other forms of renewables but I think wind and solar are going to continue to grow substantially. I'm not sure if we're going to see the level of growth we saw this year, but close. Between now and 2020 I think you're going to continue to see a great deal of growth and investment and certainly comparable to what we saw in 2015. I'm not sure if the numbers will be as high or higher but I think we'll be right in that zone.

Stephanie Bechler Thank you. We have one last question that's come in. If there's any other questions that the audience wishes to ask, please type that into the question pane. Do you have any data available on hydro resources or tidal wave energy that you'd recommend?

- Christine Lins** Sorry. Could you repeat the question?
- Stephanie Bechler** Of course. Do you have any data available on hydro resources or tidal wave energy that you'd refer for the audience?
- Christine Lins** Yes. I mean there is information about ocean marine technologies. In the Global Status Report, there is a technology section there. I have not referred to it in the presentation for the sake of time. Also because there was not so much development happening in the last year. But there is something out there. Of course we have a very detailed hydro section, which describes the state of the sector, which—but if there is a specific question on potential, we can also get back to, for example our member in the National Hydropower Association, to make sure that the panelist gets the information—the webinar participant gets the information he or she wants.
- Gregory Wetstone** Yeah. I was actually going to make the same reference to National—NHA, National Hydropower Association who tracks those issues. I think there is in particular some excitement around tidal and wave power. But you don't see it being deployed quite yet really at scale commercially. But I think there's a lot of hope that that's going to be coming soon.
- Stephanie Bechler** Thank you. We had one last question come in that we'd like to ask. What is your outlook in terms of commercial use of waste cooking oil as a biodiesel and is there promising growth in this type of energy source now or in the future?
- Christine Lins** I would need to get back to report. I'm not a specialist on waste cooking oil. If you would be able to send us the contact details of the panelist we're looking into this and get back to him or her.
- Stephanie Bechler** Okay, great. So, we will end the question and answer there. If you have any other questions for the panelists, please submit them and we can send them out after—oh we just had one more come in. This one is, "How would you suggest a way to assess rooftop capacity of a geographic area?"
- Gregory Wetstone** Well I mean I'm reluctant. I'm sure there's satellite data and data from NREL but I suspect the folks at SEIA, the Solar Energy Industries Association here in Washington could probably provide a more authoritative response on that one. At least than I have. Christine may have a better answer.
- Christine Lins** No. I mean I don't fully get the question. I think there is a lot of space on rooftop surfaces to install solar, but I'm not fully sure that I get the question that was asked by the participant.
- Stephanie Bechler** Yes. We can also answer part of that, too. There are tools available through NREL that would help with this kind of information. So, we can skip along to the attendee survey unless either one of you have any closing remarks.
- Gregory Wetstone** No, thanks a lot.
- Stephanie Bechler** Great. So, now —

[Crosstalk]

Christine Lins Thank you all, also, from my side and thanks to the Clean Energy Solutions Center for always guiding us through these webinars and organizing them. I think we have a series of talkative webinars coming out and it was great to be able to at the webinar the day of the GSR launch.

Stephanie Bechler Excellent. Thank you both for the Q&A and the excellent presentations. Now we ask our audience to take a minute to take a quick survey that you'll view on your screen. The first question up, "The webinar provided me with useful information and insight." Great. The second question, "The webinar's presenters were effective." The third question, "The webinar met my expectations."

Gregory Wetstone I know.

Stephanie Bechler The fourth question, "Do you anticipate using the information presented in the webinar directly in your work and/or in your organization?" Our final question, "Do you anticipate applying the information presented to develop or revise policies or programs in your country of focus?" Thank you so much for answering the survey. On behalf of the Clean Energy Solutions Center, I'd like to extend a thank you to all of our panelists and our attendees for participating in today's webinar. I invite our attendees to check the Solutions Center website if you'd like to view the slides or listen to a recording of today's presentations as well as previously held webinars.

Additionally, you will find information on upcoming webinars and other training events. We are now posting webinar recordings to the Clean Energy [Solutions Center You Tube channel](#). Please allow about one week for that audio recording to be posted. We also invite you to inform your colleagues and those in your networks about the Solutions Center resources and services including no cost policy support. Have a great rest of your day and we hope to see you again on future Clean Energy Solutions Center events. This concludes our webinar.