DOE Wind Market Reports Overview
August 20, 2014

Coordinator: Good afternoon and thank you all for holding. Your lines will remain on a listen-only mode for the duration of today's conference and I would like to remind all parties the call is now being recorded. If you have any objections, please disconnect at this time. And I would now like to turn the call over to Brie Van Cleve. Thank you. You may begin.

Brie Van Cleve: Thank you (Ylonne). Welcome, everyone. I'm Brie Van Cleve. Together with a great team I manage the wind exchange, the wind program stakeholder engagement and outreach program. The topic of today's wind exchange webinar is the state of the wind power market.

Ryan Wiser of Lawrence Berkeley National Laboratory will provide an overview of the DOE 2013 Wind Technologies Market Report and Alice Orrell of Pacific Northwest National Laboratory will provide a presentation on the Distributed Wind Market Report.

Both reports were released on Monday and are available on the US DOE home page energy.gov. Audience members are in listen-only mode as we often times do for these webinars. That'll be the case throughout the webinar. Each speaker will gladly answer questions so if you have any questions please use the question-and-answer box to type in your question at any time.

We'll go through the questions and the answers after both talks during the last quarter of the hour but please feel free to type in your questions at any time while the talks are happening. I have some upcoming webinars to tell you about at the end of the hour. You can also find out more information about wind exchange on the wind exchange Website.

You can Google wind exchange all as one word if you don't have it bookmarked. It's my pleasure to introduce Dr. Ryan Wiser. Ryan is a Staff Scientist and a Deputy Group Leader in the Electricity Markets and Policy Group at Lawrence Berkeley National Lab. Ryan leads and conducts research and analysis on renewable energy which involves several aspects.

Ryan's research is on the planning, design and evaluation of renewable energy policies on the cost, benefits and market potential of renewable electricity sources, on the electric grid operations and infrastructure impacts, and also on public acceptance and deployment barriers.

Ryan has published over 350 journal articles, research reports, book chapters, and conference reports. Ryan holds a BS in civil engineering from Stanford University and an MS and PhD in energy resources from the University of California at Berkeley. Thanks for being with us today Ryan. I'll hand it over to you or actually (Tessa) will hand it over to you for the next 30 minutes or so.

Ryan Wiser: Great, thanks Brie and hello all. It's certainly a pleasure as always to provide a quick rapid-fire overview of this year's edition of the U.S. Department of Energy's Wind Technologies Market Report. In this case—as in past years—I'll be covering a lot of material, over 30 slides in 30 minutes so let me not belabor the point but launch right into the presentation.

Now most of you I imagine are already aware of the basic goals and scope of the DOE's Wind Technologies Market Report, but for a quick refresher for those of you that have not seen the report in previous years, this is an annual report produced by and for the Department of Energy. Its purpose is to summarize key trends in the U.S. wind power market in this case with a focus

on the last year—last full year—2013. The scope really principally includes land-based wind turbines over 100 kW in size.

I should note that there are separate DOE-funded annual reports, one of which you'll be hearing about after my presentation by Alice Orrell on distributed wind. And then another report produced by Navigant Consulting on offshore wind. The contributors to the report include not only a number of different folks at Lawrence Berkeley National Lab but also individuals and staff at the National Renewable Energy Lab and Exeter Associates.

Again this work has been funded by the Department of Energy's Wind and Water Power Technologies Office and the full report is available at the link identified on this slide. The overall contents of the report and the scope is quite broad as indicated here. Really the heart of the report though comes in its description of technology trends, performance trends, cost trends, and wind power price trends. And so for the purpose of today's presentation, I'm going to very quickly run through some installation and industry trend information and then I'll focus principally on the technology performance, cost, and pricing aspects of the Wind Technologies Market Report. Of course all of the material is available in the report itself for those of you that are interested in more detail.

So again starting off briefly with a summary of installation and industry trends; all of you on the line I imagine are well aware that the year 2013 was a reasonably slow year for wind additions in the United States. A little bit over 1,000 megawatts of new capacity added. Those capacity additions in 2013 were just 8% of the 2012 additions and the 1.8 billion invested in new U.S. wind power projects with a steep reduction from the 25 billion that was invested in the previous year in 2012.

As a result of the somewhat slow market in 2013, about 7% of the new electric generation capacity additions in that year came from wind. That figure is well below the average that we've seen over the last seven years. The figure in the lower left-hand corner here shows that on a U.S.-wide basis 33% of all the electric power capacity additions in the U.S. from 2007 through 2013 came from wind and you can see even higher proportions for certain regions of the U.S., 54% in the interior region and 48% in the Great Lakes region as indicated in that figure.

But notwithstanding the somewhat slow year for wind additions in 2013, wind does represent an ever-increasing portion of the U.S. electric generation mix. In 2013 roughly 4.1% of all U.S. electricity generation came from wind. And in fact we have nine states where wind represents more than 12% of the in-state electricity generation and two states—Iowa and South Dakota—where wind represents more than 25% of in-state electricity generation.

Of course the U.S. wind industry also is not done. The American Wind Energy Association—for example—reports that there are now about 14,000 megawatts of wind that are under construction in the United States and—as shown in this particular graphic which represents a review of transmission interconnection queue data available in the U.S.—there are 110 gigawatts of wind power capacity that have sought transmission interconnection in one of the transmission interconnection queues across the nation.

Turning from installation trends to industry and in particular manufacturing trends, here recent developments are quite decidedly mixed. On the one hand over the last decade or so we've seen a growing number of both foreign and domestic turbine and component manufacturers that have localized or expanded their U.S. manufacturing presence. In fact at the end of last year—the end of 2013—five of the 10 largest turbine OEMs in the U.S. had at least

one—if not more than one—manufacturing facility in the U.S. That compares to just one turbine OEM that had a manufacturing facility in the Year 2004.

On the other hand uncertain demand and also growing competition have certainly also created a good degree of strain within the supply chain in the U.S. and as a result of that strain, the year 2013 saw a decent number of manufacturing facilities either closed or enter into a period of reduced operations. And related to that of course we've also seen a drop in the amount of wind employment or employment in the wind sector over the last year.

As a result of that realignment though, we now have a situation where domestic manufacturing capability for both the assembly of turbine nacelles but also towers and blades is pretty well balanced against near-term demand forecasts. This graphic is a little bit complicated but shows that in the year 2013 the United States had about 10 gigawatts or 10,000 megawatts or nacelle assembly capability, about 8,000 megawatts of tower manufacturing capability and about 7,000 megawatts of blade manufacturing capability. And that manufacturing capability—again—is reasonably well-aligned for projections of market growth over the next three years.

An additional benefit of the realignment—as it were as we've seen over the last couple of years—is that turbine manufacturers—for the first time in a number of years—actually saw their profitability rebound a little bit in the year 2013. And that's what's shown on this graphic for five of the global major turbine manufacturers.

Turning to the import and export of wind equipment from or to the U.S.—largely as a result of the slow year in wind installations in 2013—not surprisingly imports of wind equipment from overseas also declined substantially in 2013 relative to 2012. That's what's shown in the bar graphic

on this particular slide. Exports of wind equipment from the U.S.—on the other hand—actually increased somewhat. Exports of basically completed nacelles increased to about 420 billion in the Year 2013.

And while we don't have the ability because trade codes lack the data for other specific wind turbine equipment beyond the completed nacelle, we can say that there was also a pretty significant export of blades—or sorry—of towers from the U.S. Total tower exports—not exclusive to wind but most of which are likely wind—totaled almost 130 million in the year 2013.

Now based on those same data as well as a number of other side calculations, we also concede that despite the rather significant supply chain challenges that we've seen over the last couple of years that a growing amount of the equipment used in U.S. wind projects has been sourced domestically, at least since the 2006 to 2007 timeframe. And in particular in 2012 and 2013 we find that domestic content for blades, for towers, and for nacelle assembly was actually quite high. Towers in the 50 to 70% range, blades in the 60 to 80% range, and nacelle assembly over 80% domestic content.

At the same time though we also know that domestic content for generators—and indeed for most of the equipment internal to the nacelle—has remained rather low and as a result of that the overall domestic content, considering not only blades and towers and assembly but also all of the nacelle...

Coordinator: This is the operator. Ryan's line has just now disconnected.

Brie Van Cleve: Hi, this is Brie. We'll give him a minute here. I'm sure he'll be able to call back in and if not then we'll transition over to (Alice) a little bit early so let's just give him 30 seconds.

Coordinator: Ryan has now rejoined.

Brie Van Cleve: Wonderful. Ryan are you there?

Ryan Wiser: Sorry, sorry about that. I'm not sure exactly what happened there but nonetheless I'm back at it. I assume that everybody can hear me and I will simply continue at this point.

So with that summary of installation and industry trends, let me now turn again to some of the key findings of the wind technologies market report; those associated with wind technology trends, performance trends, cost trends, and pricing trends. And here I think the news is just very, very encouraging.

Let me start with technology trends which actually is a new chapter in this year's Wind Technology Market Report and from there again I'll walk through performance, cost, and pricing trends in turn. So again starting with technology trends, we've seen as shown on this particular graphic over a relatively lengthy period of time a very significant upscaling in the size of wind turbines deployed in the United States. And that upscaling has been significant—as shown here—not only for the average nameplate capacity of turbines, but also for the hub height and rotor diameter of those turbines.

In addition—and perhaps more importantly—we've also seen rapid growth in the market share of turbines that were originally designed for lower wind speed sites. The graphic in the lower left hand corner of this particular slide—for example—shows that from 2002 to 2009 a mix of high and medium speed turbines—that is IEC Class 1 and 2 turbines—were deployed in the U.S.

But more recently—from 2010 to 2013, we've seen the market very rapidly and swiftly shift towards Class 2 and then now Class 3 machines. Basically

machines designed for medium and now lower wind speed sites. Related to that, we've also seen declined in the average specific tower of turbines deployed in the U.S. Basically we've seen growth in a rotor diameter and swept area increasing at a faster pace than average nameplate capacity.

What's also very interesting, though, is that those turbines originally designed for lower wind speed sites are now being deployed really throughout the nation, not only in low wind speed sites but also in some of the highest wind speed sites in the country. This graphic—for example—shows that the lower specific power machines—those between 200 and 300 watts per meter squared—and also the Class 2.3 and Class 3 machines have been installed not only in lower wind speed sites but also medium, higher, and even the highest wind speed sites.

The graphic on the far left hand side, though, shows that the higher hub heights that we're beginning to see in some parts of the region have really been focused on the lower and medium speed wind sites that we see across the U.S.

Now, turning from technology to project performance trends, here the story is just a little bit more nuanced. And it's more nuanced in part because—though the technology advancements that I just described should all else be equal - being equal be leading to increasing capacity factors over time—in fact—as shown on this graphic—we see that fleet wide average capacities factors really have not increased all that much in recent years. Perhaps we see some increase in average capacity factors in this particular side over time, but that increase in capacity factor is not as great as the technology improvements that I've just described would suggest should be happening.

So what's going on here? Well, there's really two trends that are pushing capacity factors below what you might otherwise expect based on the technology trends themselves. The first is curtailment. And as a practical matter—in fact—the nation has made very good strides in reducing curtailment over the last four or five or even six years. But nonetheless, curtailment over the last four, five, and six years has been higher than it was earlier on in the wind market in the U.S. And of course that has the effect of reducing capacity factors in more recent years.

In addition to that—and even more importantly—we've also seen a progression in the U.S. for developers to go - to move towards wind resource sites with slightly lower wind resource quality. That's what's shown in the bar graphic on this particular slide. Now, we've seen some slight reversal of that trend since 2011—but not withstanding that reversal—the average wind project installed in the U.S. in the year 2013 was installed in a wind resource area that was only about 90% as energetic as projects that were installed in the late 1980's.

And this concept—the concept that projects have increasingly over time and on average been sited in somewhat lower wind resource quality sites—is a key reason that the technology advancements that I described earlier haven't increased yet—they may in the future, but they haven't increased yet—fleet wide average capacity factors in a significant way. If you control that trend, though—that trend towards lower quality wind resource sites over time—then you begin to be able to see empirical evidence of the very significant technological advancements that I described earlier.

In this slide—for example—I've binned U.S. wind projects by the quality of the wind resource, lower, medium, higher, and highest—and then also by project vintage. Basically, when did the project come online. And then we

show here the weighted average 2013 capacity factor for each of those individual bins. And here you could very clearly see the significant increases in capacity factors over time within wind resource quality bins.

Similarly on this next slide I've binned projects again by wind resource quality but then also specific powers. I described earlier the specific power is in effect the ratio—or a ratio—that relates the swept rotor diameter of a turbine to its nameplate capacity. As the swept rotor diameter has increased faster than average nameplate capacity, specific power has declined in the U.S. and here you can see that these lower specific power turbines—the GE turbines, for example, with 100 meter rotor diameter—have specific power that is below 220. Those kinds of turbines empirically show much, much higher capacity factors than turbines that were installed in previous years with higher specific power ranges.

Now, in addition to technological advancements beginning to impact project performance, of course the combination of those technological advancements as well as increased competition between turbine manufacturers has also resulted in a pretty significant decline in the cost of wind projects. And let me provide a couple of slides illustrating those trends.

And in particular this first slide shows wind turbine pricing over the last good chunk of time. And what you can see here is a pretty significant increase in wind turbine prices from roughly the 2002 timeframe until 2009. But then you can also see a steep bending downward of that curve such that turbine prices today are about 33% lower—or so—than they were at their peak in the 2009 timeframe.

As a result of those declines in wind turbine prices—not surprisingly—we've also begun to bend the curve on average installed project cost. The red bars on

this particular slide is basically the capacity weighted average project cost for any individual year during the - really the full breadth of the history of market development in the U.S. And you can see a very significant reductions in the installed cost of projects over the last four years.

For a rather small sample of projects completed in 2013, the average cost was $1,630 per kW. A somewhat larger sample of projects that are currently under construction and that will be build either this year—2014—or next year 2015 shows average installed costs that are about $1,750 per kW. Both of those figures—of course—being well below the averages that we saw in the 2009 and 2010 timeframe.

Not surprisingly, an impressive gains that we've begun to see in wind project performance and also project cost are also beginning to show up very significantly in trends in wind power purchase agreement prices; in effect, the price that electric utilities pay for wind energy. This slide—for example—is a bit messy but depicts project level levelized power purchase agreement—or PPA—prices by the date of PPA execution on the X axis. And we've also segmented projects by both their size—the size of the bubble—and the region - the color of the bubble.

And what you can see here is the rise in PPA prices from 2004 to 2009 and then a subsequent very, very steep drop in PPA prices since the 2009 timeframe such that in 2013, PPAs signed or executed in that year achieve a new all time low in terms of the history of wind market development in the United States.

Now, this next slide shows exactly the same data as the previous one, but rather than providing data for every individual project, we've simply provided the overall averages for the national PPA price—the bars—and then a variety

of regional PPA prices. Again, the figure very clearly illustrates the steep reduction in PPA prices over the last five years or so. It also shows the very significantly low prices being in the interior region of the country, with PPAs that were just over 3 cents per kilowatt hour for those projects that signed PPAs in the 2011 and 2012 timeframe and then in the year 2013 you can see that PPA prices in the large interior region of the country were signed at an average of just 2.2 cents per kilowatt hour. Very, very low PPA pricing.

Not surprising - not surprisingly, those very low wind PPA prices have also boosted the economic positioning of wind relative to its competition. This slide—a bit hard to explain—but in effect shows that the price of wind PPAs signed in the year 2013—that diamond shape in the far right hand corner of the slide—that the average price of PPAs for wind singed in 2013 was at the bottom end of the wholesale electricity price range in that particular year. Demonstrating the strong economic competitiveness of wind relative to wholesale prices in the year 2013.

This next slide, meanwhile, shows that the average PPA prices for wind that was signed in 2011, 2012, and 2013—those are the dashed lines and then also the kind of orange looking line—that those average PPA prices—again for projects that signed PPAs in 2011, 2012, and 2013—are all extremely competitive to just the operating cost of a natural gas power plant.

And that's true based not only on the EIA's reference case fuel price projection for natural gas—the black upward sloping line—but those wind PPAs are in fact even competitive with the low end of the range of gas price projections that the EIA has provided. Again, demonstrating very clearly the strong economic competitiveness of wind relative to other generation technologies with the PPAs that have been signed in recent years.

So—to conclude, then this very rapid presentation—in large measure—as a result of the technology, performance, cost, and pricing trends that I just described—but also, frankly, because of the design of the federal production tax credit most analysts are predicting a rather strong market for wind power capacity additions in the year 2014 and 2015. As indicated in the table on this slide, expectations for 2014 range from about 4,400 megawatts of new wind additions up to about 6,400 megawatts, whereas projections for 2015 are higher still, ranging from 6,000 megawatts to 9,100 megawatts, depending on the forecaster.

For 2016 and beyond—on the other hand—uncertainty returns. You can see a pretty wide range in the forecasts provided on - in the table on this particular slide. And that uncertainty is due to the various factors that could push the market either in a strong upward trajectory or alternatively towards the lower end of the range.

On the one hand, we have very low prices for wind energy that we can see today. We have the prospect for continued technological advancements bringing those prices lower still, and of course we also have new EPA regulations that have been proposed and that are being implemented that could impact the cost of conventional fossil generation. On the other hand, a variety of headwinds also exist, most prominently the lack of clarity about the fate of federal tax incentives, but also including the potential for continued low natural gas prices, modest electricity demand growth, and other factors that may push in the other direction.

So with that, I'm going to close my presentation. Sorry I dropped off for a minute or two, though. I fully recognize that we went through a lot of material very quickly. For those of you that are interested in the underlying report on which this presentation was based it can be found on the link here. And in

addition a full PowerPoint briefing and even an Excel file that contains much of the data that I just presented are also available online.

And with that I will turn it back to Brie.

Brie Van Cleve: Great. Thank you very much, Ryan, appreciate that. Also the presentations for today will be posted on the WINDExchange Website. So thank you, again, Ryan, appreciate that.

Please enter your questions for Ryan in the Q&A box and we'll - again, we'll cover those in the last quarter of the hour.

And now I'd like to introduce Alice Orrell. Alice is an Energy Analyst at Pacific Northwest National Laboratory where she performs renewable energy assessments and wind power project development support for Department of Defense clients and distributed wind market research and analysis for the Department of Energy.

Alice is a professional engineer in the state of Washington, has a BSME from the University of Vermont and an MBA from the University of Washington. She's an active member in the Society of Women Engineers and Women of Wind Energy.

Thanks for being here today to update us on the distributed wind market, Alice, and I'll hand it over to you for the next 15 minutes or so.

Alice Orrell: Okay great. Thanks, Brie. Hello everyone. I'm Alice Orrell. I'll be providing highlights from the 2013 Distributed Wind Market report. This is DOE's second annual report. Last year we called it the Market Report on Wind

Technologies and Distributed Application but we've simplified the title this year and going forward.

First let's start with what is distributed wind? Maybe you've already heard this but I'd like to take this opportunity to make sure we're all on the same page. Distributed wind is defined in terms of technology application based on the wind project's location relative to end use and power distribution infrastructure rather than on technology size or project size.

Distributed wind is the use of wind turbines of homes, farms and ranches, businesses, public and industrial facilities, grid-connected or off-grid to offset all or a portion of local energy consumption at or near those locations or wind turbines connected directly to the local grid to support grid operations.

This definition means that distributed wind - the distributed wind market includes wind turbines and projects of many sizes. For example, distributed wind systems can range in size from a 1 kilowatt or smaller, off grid wind turbines at a remote cabin to a 10 kilowatt turbine at a home or a farm to several multi-megawatt wind turbines at a university campus or a manufacturing facility or another large energy user.

So while distributed wind projects can use any type or size of turbine distributed wind is not wholesale power generated at large wind farms and sent via transmission lines to substations for subsequent distribution to loads and distant end users.

On site distributed wind turbines allow farmers, schools and other energy users to benefit from reduced facility bills, predictable controlled costs and to hedge against the possibility of rising retail electric rates.

So a little housekeeping before we dive into the report highlights, the report is prepared for the Wind and Water Power Technology Office at DOE by (PNNL) (unintelligible) other key author. We also have help from - contributions from the American Wind Energy Associations and (Larry Flowers) and (Kimberly Williams) helps with our database and the Distributed Wind Energy Association, (Jennifer Jenkins) also helped establish some data for this report.

The full report is available at the energy.gov Website. And this year the report, you know, we broke the report up into two groups; small wind, which are turbines up to 100 kilowatts and then turbines greater than 100 kilowatts used in distributed applications.

All of our data sources and methodology are spelled out in the report. The methodology section at the end of the report is new this year, explains how we go through our process. And thank you to everyone who provided our data, reviewed and other contributions, we really appreciate everyone's help.

Okay all right now let's get into the numbers. There was a total of 30.4 megawatts of distributed wind installed in 2013 from about 2700 units - turbines representing a $90 million value.

The dark green is annual additions for turbines greater than 100 kilowatts. The light green is annual additions for small wind, which was 5.6 megawatts as the total. And the orange markers are the cumulative totals. The 2003-2013 cumulative distributed wind capacity is now 842 megawatts.

So according to (AWEA) and what Ryan said, there's only about 1000 megawatts installed overall in 2013 and distributed wind was about 3% of

that. And in 2012 there was over 13,000 megawatts of wind installed overall so it was a down year all around.

New in this year's report we looked at the market applications for the 2013 distributed wind installations using four buckets, residential, agricultural, industrial and commercial and government and institutional. On a project basis, the residential market is the biggest. But most of those projects are very small turbines so on a capacity basis the industrial and commercial projects have the bigger slice of the pie.

This graph shows the top states for distributed wind. In 2013 Colorado, Kansas, Ohio, Massachusetts, and Alaska led the nation for new distributed wind capacity additions across all turbine sizes but Texas still leads based on its cumulative total.

And although Kansas had distributed installations in 2013 it lags on a cumulative basis so it doesn't make it onto this top (unintelligible). Of the 30.4 megawatts of distributed wind capacity deployed in 2013 24.8 megawatts was for just nine projects using turbines greater than 100 kilowatts for a total of 18 units, 18 turbines, and those were in Colorado, Kansas, Ohio, Massachusetts, Alaska, Indiana, North Dakota, and Puerto Rico.

And just looking at small wind Nevada, Iowa, Minnesota, Oklahoma, New York, Texas, and Hawaii deployed the most small wind capacity in 2013. And, again, while Oklahoma and Hawaii had 2013 small wind installations they are not cumulative leaders as of right now.

One of the drivers behind these top states is the availability of incentives. This figure provides and overview of the federal, state and utility funding provided for distributed wind projects in 2013 in the states with the most funding

awards that we track. And it shows that the full number of awards given in these top states was about - was about $15.4 million.

This contrasts strongly to the scale of distributed wind awards given in 2012 which totaled more than $100 million. And those are mainly from the now-expired US Treasury 1603 cash grants.

For 2013 the tradeable Iowa state production tax credit, which is the green bar in Iowa, and the (MD) Energy in Nevada, those rebates, remained important. And then the New York State Energy Research and Development Authority, (NYSERDA), their on site small wind incentive program emerged as one of the most significant state programs for distributed wind with the most 2013 incentives awarded of any state.

Just in contrast is an example, California's incentive program only made awards for one small wind turbine in 2013; in previous years California has been a national leader in small wind but is now outranked both cumulative small wind capacity by Iowa and Nevada as shown on the previous slides.

While there are instances available in this year's report we looked at the growing imbalance between distributed wind funding and solar PV funding. As an example, at the federal level, from the USDA's Rural Energy for American Program, REAP, energy efficiency projects get the majority of the funding followed by solar with wind way behind of that.

At the state level Massachusetts and New Jersey both provide significantly larger amounts of funding to solar PV projects compared to distributed wind projects. And while not on the same magnitude as Massachusetts and New Jersey, this (unintelligible) offers another example of this discrepancy and

similar balances between solar and distributed wind funding that exists in other states as well.

This gap may continue to widen as a result of states, for example, Massachusetts passing solar carve out programs specifically targeting PV capacity levels and creating policy objectives that support an in-state solar PV industry rather than the general distributed generation industry.

On the flip side, the distributed wind industry is taking steps to improve the market by adopting strategies that the solar industry already has, namely offering no money down financing options and long term leases.

Industry leaders consider these leasing and related business models as an opportunity to reduce the resource financial and operational risk customers. In the report this year we modeled some example scenarios of how a wind turbine lease could work using the distributed wind policy comparison tools which is available online.

This example is based on a 10-kilowatt turbine in New York State that leverages state and federal incentives. The energy savings over the lease period is the result of displacing a higher cost electricity from the utility less the upfront payment and the monthly lease payment.

Now I'll change gears a little bit and look at small wind a little more closely. In 2013 there was 5.6 megawatts of small wind capacity added at a value of $36 million. And as I discussed in that first cumulative draft 2013 was a down year overall with a 92% decline in total wind installations. Small wind saw a drop also but less so with a 70% decline.

This graph shows small wind sales over the years by turbine size. In the less than 1 kilowatt size range 2013 sales were fairly steady with 2012 sales. In the larger size ranges sales dropped more significantly.

The demand for remote power, which was primarily provided by off grid wind turbines which are very small and these other smaller units may be less sensitive to inconsistent incentives and policies and other market drivers and thus the extent (unintelligible) these different sales levels amongst the sizes. If you have a need for remote power, you know, you could get your power somehow.

Next figure compares small wind domestic, import and export sales. In 2013 US distributed wind deployments encompassed 69 different wind turbine models ranging from 100 watts in size up to 2 megawatts, from 38 different suppliers.

Eight of the top 10 models of all 2013 wind turbines installed in US distributed applications on a unit basis were manufactured in the United States. US suppliers continue to dominate the domestic market for small wind turbines. Domestic sales from US small wind turbine manufacturers accounted for 86 percent of the 2013 US new small wind capacity - I say new because this graph does not include any refurbished turbines - which is up from 71% in 2012.

And imports declined sharply from 2012 as foreign manufacturers focused their efforts on other markets outside the US. Exports from US-based small wind turbine manufacturers continue to be a bright spot for the industry as well with an increase of 70% from 8 megawatts in 2012 to 13.6 megawatts in 2013 at a value of $103 million.

(Unintelligible), you know, in the ballpark of what Ryan presented earlier the value of exported large utility scale US (in) power generating (unintelligible) where I think Ryan is finding that value is what he called included nacelles so he said that value of $421 million in 2013. So the small wind value is significant given that the capacity of the small wind exports is not comparable to the capacity of the utility scale exports.

Okay one more slide focusing on small wind. This graph presents installed cost ranges for turbines up through 100 kilowatts. The orange triangles are the manufacturers' reported averages (unintelligible) cost, you know, what do they say their average cost is (unintelligible). And the blue circles are reported project specific installed costs for a sample of projects.

So these are not all the 2013 small wind projects, just the ones for which we have cost data. So while only a relatively small sample size is represented, about 2.2 megawatts and 85 turbines, the data suggests a few trends. First, project installed costs can range widely because of site specific issues such as foundation requirements, local installation labor particularly for the smaller turbines.

And second, larger wind turbines generally exhibit a tighter range of costs and a lower cost per kilowatt. Installed costs is a driver of the project's (levelized) cost of energy and the turbine's capacity factor, how much energy a turbine produces annually divided by its total potential energy production is another driver of (levelized) cost of energy. This figure plots the capacity factors and costs of energy for a sample of projects.

While the data shows some scatter the plot does show the correlation between capacity factors and (levelized) cost of energy. That is the higher the capacity factor the lower the cost of energy. The capacity weighted average capacity

factor, that was a mouthful, for these 59 projects that were installed between 2006 and 2013, was 15%.

And their capacity weighted average cost of energy was 14 cents per kilowatt hour. A detailed discussion of the methodology behind this analysis and the origin of the projects included is covered in the report.

The amount of annual energy production that can be achieved by a distributed wind project, this capacity factor, is driven by many variables, primarily a project's available wind resource and (siting), for example, what's the tower height, are there local obstructions and other micro-(siting) issues.

In this sample of projects, for example, the capacity factors for the 30 projects using 10 kilowatts in turbines range all the way from 1.7% up to 21.9% supporting the idea that (siting) issues strongly influence capacity factors.

One more topic before we wrap up: certification. Certification bodies continue to provide wind turbine buyers with reliable third party verification of important safety, acoustic and performance data and to provide wind turbine sellers the ability to demonstrate compliance with regulatory and incentive program requirements.

Just to clarify, certification standards define wind turbines based on their rotor swept area rather than their nominal capacity. For certification purposes a small wind turbine is that having a rotor swept area of up to 200 square meters which translates to approximately a 60 kilowatt turbine.

And medium wind turbines are those having rotor swept areas between 201 and 1000 square meters or approximately 50 kilowatts to 500. And the

certification (unintelligible) on this slide cover both domestic and foreign manufacturers of certified turbines.

So, as I mentioned in the beginning, this presentation hit some of the highlights on this year's report but there are other topics in the report as well, there's manufacturer's country of origin, types of turbines and towers, capacity additions by states, policies and market drivers and more so be sure to check out the full report. In addition to the report being available on the energy.gov Website the data tables that support the figures are in the report are also available.

So we know how 2013 was, what is the outlook for 2014? Given that this is already August, we kind of have a good idea of where we're going as we followed Ryan's slides as well. Based on our review of the 2014 second quarter market data from (AWEA), more distributed wind has already come online during the first two quarters of 2014 than all of 2013.

And based on mid year sales reports from a number of small wind turbine suppliers, about as much US small wind turbine capacity has already been sold in 2014 to date as during all of 2013 so 2014 is looking up.

Also, distributed wind industry leaders (unintelligible) innovation and third party financing such as that leasing model as key to maintaining small wind's competitiveness and are eager to expand its reach.

The new farm bill, which is tied to the USDA (REAP) funding now provides (REAP) with mandatory funding at $(50) million per year for 2014-2018 which is a substantial improvement over the uncertain schedule and variable authorizations in past years. And exports are expected to stay strong but still

be influenced by changes in policy such as (unintelligible) in countries such as UK and Italy.

So that wraps it up for me. Here are the links to get the report and the data table and fancy graphics and photos and thanks.

Brie Van Cleve: Thanks very much, Alice, appreciate it. We have a couple questions. Alice, I'll go first to you. Can you tell from your report whether wind capacity is coming from individual energy companies or from utilities?

Alice Orrell: Yes, I think the answer is yes, I could tell. Most small wind turbines are individually owned and then there are some installations that are installed by utilities or private organizations. Yeah, we can usually track that if they're larger projects we have more information on the larger projects. But on the smaller projects we don't always know exactly who the owner is. Does that answer the question?

Brie Van Cleve: I think so. If it doesn't feel free to put in another question to clarify and we'll get to you. Ryan, if I could go to you, quick - it's a quick clarifying question. Does your - do the export figures include small wind turbines under 100 kilowatts?

Ryan Wiser: Yeah, the USITC trade code that tracks basically completed nacelle exports should, in principle, include both utility scale and smaller scale turbines. Unfortunately, though, it doesn't break out the two so you cannot ascertain from the trade code data itself how much of those exports are kind of the utility scale sector versus the smaller wind sector.

Brie Van Cleve: Okay, thank you. And, Ryan, while you're at it, assuming - so maybe I'll read this one twice. "Assuming no PTC, how effective of a substitute would be the

application of tax incentives oil and gas receipts such as intangible drilling costs which provides first year expansion of about 80% of the development costs and the percentage depletion as an example of another incentive that allows depletion depreciation to exceed cost bias."

Ryan Wiser: Yeah, so one thing maybe to clarify here from the get-go is that in addition to the production tax credit that wind has obtained for a good number of years, wind and other renewable technologies also already benefit from five-year modified accelerated deprecation which has advantages that are not dissimilar from that provided to other conventional fuels through the tax incentives that were just described.

If the question is, you know, were the production tax credit to go away but were we also able to eliminate federal tax incentives for fossil fuels would the playing field somehow equilibrate? And I think the answer to that question is generally no, it's not true. And it's not true because the tax incentives delivered to the fossil sector, if converted into an equivalent cent per kilowatt hour of value are well, well lower than the value of the production tax incentive.

And so there still is some additional gap there that would need to be filled through some alternative policy. It doesn't have to be the production tax credit of course, there are plenty of other options that are available as well.

Brie Van Cleve: Thank you. Back to Alice, can you please describe some of the innovative business models in the distributed wind market in the US?

Alice Orrell: Sure. The big one right now is the leasing model where a third party comes and - to the customer's site, does the site assessment, selects the turbine, installs it for the owner or the leaser and then either the customer site, the host, you know, either pays, you know, a small up front fee or pays nothing up

front and then pays monthly payments to that third party company in exchange for the energy that's generated on their - from their turbine on their site. That's one - that's one model.

And other turbine manufacturers are providing direct financing to customers as well offering more no money down options to their customers instead of the customer buying the turbine up front they're offering some financing options.

Brie Van Cleve: Okay, great. If there's a refinement to that question go ahead and put it in the question and answer box and we'll get it to you. Thanks, Alice.

Ryan, what's the average balance of plant cost for utility-scale wind in the US?

Ryan Wiser: Yes of course it varies by the size of the project and the location of the project and plenty of other project specific factors. But I think it's pretty commonly recognized that for typical projects in the US that roughly 65%-70% of the cost of those projects are related to the wind turbine purchase and that the remaining cost, that is all costs beyond the 65%-70% level, are represented by balance of station costs.

Brie Van Cleve: Okay, thank you. Well we're nearly at the top of the hour. Thank you very much to the speakers. The two reports are available online right now, because they just came out on Monday they're available on energy.gov is a easy place to find them for now. The Offshore Wind Report that Ryan mentioned is not out yet but when it is out it will also be available on the Website.

We have a couple upcoming webinars to tell you about. The next webinar next month will be on wind energy and (eagles) and then following that we'll have

a collegiate wind competition update, that is the competition that was held for the first time this year with undergraduate teams across the United States. Following that we'll have an update on offshore wind topics, that'll be another place to find out more about the Offshore Wind Market report and then following that siting considerations. And we maintain a list of webinars on the Wind Exchange Newsletter.

The webinar series is supported by Department of Energy. Thanks again to our speakers and also the organizing team at NREL. To tell us what you'd like to hear more of or with questions if you have questions that you think of that we didn't get to today please send us an email, here's the contact of my email as well as (Ian Baring-Gould) and (Suzanne Tegen) at NREL, we'd be happy to receive your emails.

So thanks, everyone, and thank you very much to the speakers. And with that this concludes the call.

Coordinator: Thank you. And this does conclude today's conference. You may disconnect at this time.

END