Energy Department's Distributed Wind Industry Update: A WINDExchange Webinar
September 28, 2016

AMBER PASSMORE: Good afternoon and welcome to the WINDExchange Webinar. My name is Amber Passmore. I'm the Collegiate Wind Competition Manager for the Department of Energy's Wind Energy Technology Office, and I will be your moderator for today's webinar.

For WINDExchange webinars, we bring together a set of speakers on topics important to wind energy technology and deployment. Our webinars are recorded and posted to the WINDExchange website one to two weeks following the live broadcasts. You can find recordings, transcripts, and presentations from previously-held webinars at www.wind.energy.gov/windexchange under "Information Resources" and then "Webinars."

Today's webinar is on the Energy Department's Distributed Wind Energy Update. Distributed wind energy installations compared with traditional centralized power plants supply power directly to homes, farms, schools, businesses, manufacturing facilities and communities. Turbines used in these applications can range in size from a few hundred watts to several megawatts.

The Energy Department and its Pacific Northwest National Laboratory recently published the 2015 Distributed Wind Market Report, which shows you that U.S. wind turbines in distributed applications reached a cumulative wind installed capacity of 934 megawatts from approximately 75,000 turbines, enough to power more than 142,000 average American homes.

We have two speakers here today to provide an industry update. First you will hear from Alice Orrell, who worked on the Distributed Wind Market Report. Alice is an Energy Analyst for the Pacific Northwest National Laboratory. And following Alice, you will hear from Heidi Tinnesand on the Deployment of Wind Turbines in the Built Environment. Heidi is an Engineer for the National Renewable Energy Laboratory.

We will hold the Q&A Session with Alice and Heidi during the last 15 minutes of the webinar. Please note that you are in listen-only mode and unable to speak. So if you want to ask a question, please enter your questions in the Q&A box in your "Control Bar" on your screen and click "Send." You are welcome to submit questions at any time during the webinar.

Additionally, if you experience technical difficulty, you can use the Q&A box to communicate with our webinar organizer; and we can try to get some solutions for you.

With that, I'm going to go ahead and introduce our first speaker. Alice directs distributed wind market research and analysis at PNNL for the Department of Wind Energy Program, and is the lead author for the annual Distributed Wind Market Report. She also manages renewable assessments and wind power project development support for Department of Defense clients. She has a Mechanical Engineering degree from the University of Vermont, an MBA from the University of Washington, and is a licensed Professional Engineer in the state of Washington. She is active in the Society of Women Engineers and Women for Wind Energy – sorry, it's a lot of W's.

Thank you, Alice, for your time with us today; and I'll go ahead and hand it over to you.

ALICE ORRELL: Thank you, Amber.

Hi, this is Alice Orrell with Pacific Northwest National Laboratory. I'm here to present some highlights from the 2015 Distributed Wind Market Report that was published last month. I'd like to take a moment to recognize and thank my co-author Nik Foster and our report contributors, Juliet Homer and Scott Morris.

To make sure we are all on the same page, I'd like to start with the definition of distributed winds, building on what Amber said in the beginning. Wind turbines in distributed applications are found in all 50 states, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, to provide energy locally, either serving onsite electricity needs or a local grid. So this is in contrast to energy generated at large wind farms, which are sent via transmission lines to distant end users.

Distributed wind can provide energy for farms, homes, businesses and manufacturing facilities. This is the fourth year PNNL has produced the annual Distributed Wind Market Report for DOE's Wind Program.

Although we don't define distributed wind by turbine size or project size, we do look at the market based on three turbine sectors: small, mid-size and large. Small is turbines up through 100 kilowatts in size; mid-size is 101 kilowatts to 1 megawatt; and large is turbines greater than 1 megawatt. For details on our data and our methodology, please refer to our full report.

And I'd like to say thank you to the numerous stakeholders who provided data, input, photos and review for this report -- thank you, thank you, thank you!

Now let's dive into some numbers.

To start, let's look at the annual and cumulative capacity numbers. In 2015, we documented 28 megawatts of new distributed wind capacity, representing just over 1,700 turbine units and $102 million in investments. This breaks out to 4.3 megawatts, the dark blue color in the figure; 2.6 megawatts of mid-size wind; and 21.1 megawatts of large-scale wind. Since 2003, the cumulative capacity now totals 934 megawatts.

In 2 of the 14, we defined a couple of large projects in New Mexico as distributed; and that bumped up the 2014 total. But if you exclude those projects, you'll see that the U.S. distributed wind market has been relatively flat for the past three years. While there is some distributed wind in all states, the 28 megawatts we documented for 2015 was installed in 28 different states. Ohio, Nebraska and Connecticut led the United States in overall new distributed wind power capacity additions in 2015, as a result of a larger project in each of those states. California, New York, and Minnesota led the nation for small wind capacity deployment in 2015. In New York and Minnesota, the majority of the small wind turbine installations reported were at farms and agricultural sites.

In addition to tracking the states in which distributed wind is installed, we also track for what types of projects the turbines are being used. We consider six different categories: agricultural, these are farms, ranches and other agricultural sites; residential -- homes, cabins, boats, apartments; governments, these are cities, municipal facilities such as water treatment plants, and military sites; institutions are schools, universities and rural utilities; commercial are offices, businesses; and industrial are food processing plants, manufacturing facilities and oil and gas operations.

This figure shows the breakdown of project types by number of projects and by capacity. The figure illustrates how a small percentage of industrial projects that typically use the large-scale turbines can account for much more capacity than many residential or agricultural projects that typically use small wind turbines.

Now let's look at small wind specifically.

This figure shows small wind domestic sales, exports and imports since 2003. In 2015, the 4.3 megawatts of small wind sales recorded represent 1,695 units and over $21 million in investment. No refurbished small wind turbine sales were reported for 2015, and U.S. small wind manufacturers accounted for nearly 100% of the 2015 domestic small wind sales. Reported of sales in the U.S. from foreign small wind turbine manufacturers dropped again in 2015, with only a couple of reported sales as shown by the tiny yellow mark in the figure that you might be able to just barely see.

While most of the non-U.S.-based manufacturers who responded to the data request for this report did not have sales in the U.S., they did have sales in other markets – mostly in the United Kingdom and Italy. And exports from U.S. small wind manufacturers remain the big story at 21.5 megawatts, with an estimated value of $122 million from six manufacturers. Exports, the dark blue bar in the figure, from U.S.-based small wind manufacturers doubled from 2014 to 2015.

This map shows the primary reported countries for U.S. small wind exports in 2015 with Italy, the UK and Japan being the top markets in terms of capacity. Other countries reported include Canada, Brazil, China, France, Chile, Mexico, Australia, New Zealand and South Africa. Additional countries reported in past years include Vietnam, Greece, Germany, Nigeria, Denmark and India.

Staying with small wind, now I want to switch over to installed costs. This figure presents the nominal installed costs for newly-manufactured small wind turbines installed in the U.S., as reported by the manufacturers, from 2005 through 2015. Because there is a wide range of small-wind turbine sizes -- a turbine can be anywhere from less than 1 kilowatt up through 100 kilowatts – there's just going to be a wide range of costs. So it's appropriate to look at these costs of small wind turbines in smaller groups.

For 2012 through 2015, we've also broken up small wind into three categories, three different sizes: less than 2.5 kilowatts, 2.5 to 10 kilowatts, and 11 to 100 kilowatts. Small wind turbine install costs are trending downward, driven mainly by the cost of those turbines in the 11 to 100 kilowatts size range. You can see the orange triangles are tracking the yellow bars in the figure.

The overall capacity weighted average installed cost for newly-manufactured small wind turbines sold in the U.S. in 2015, as reported by the manufacturers, was $5,760 per kilowatt. So this value was $6,230 per kilowatt in 2014 and $6,940 per kilowatt in 2013. So these are the average installed costs reported by manufacturers, but actual project costs can vary widely. Let's look at that next.

This next figure presents reported project-specific installation costs; for example, 2015 projects representing 1.8 megawatts in 75 wind turbines across 13 states. These reported costs are from the installers or the owners. Most outliers, which are circled, can be explained by their higher-cost location, Hawaii or Alaska, or by the use of a higher cost per kilowatt vertical access wind turbine. The capacity weighted average installed cost for this sample project is $7,820 per kilowatt and $6,940 per kilowatt without the circled outliers – both of which are still higher than the $5,760 per kilowatt overall average I reported in the previous figure from the manufacturers.

So while the managers provide a typical installed cost estimate for each turbine model, mainly based on their hardware costs, the data suggests that actual installed costs are impacted greatly by site-specific issues in soft costs. These could be foundation construction requirements, local installation labor, permitting requirements, and shipping costs.

Now let's look at mid-size and large turbines in distributed applications.

Commercial and industrial – or some people say C&I – are non-utility purchases of wind energy, and they've become a new source of demand driving the overall wind market. In some cases, these C&I purchases meet the definition of distributed wind. Universities, businesses, government agencies, and the manufacturing industry are using wind energy to power their operations.

The example shown here from the top left include a 600-kilowatt turbine installed at the Method Manufacturing Plant in Chicago – Method as in Method soap --7.5 megawatts installed to offset the power consumption of Ball Corporation and Whirlpool Corporation facilities in Ohio; and, on the right side, an 850-kilowatt turbine at the Stafford County Flour Mills in Kansas. While these types of behind-the-meter applications may be growing, distributed wind for commercial industrial clients is not necessarily limited to just the bigger turbines. Just to note, small wind is also installed at places like golf courses and John Deere dealerships and other businesses.

Now let's jump to incentives for distributed wind.

The figure on the left provides the number of federal, state and utility funding awards given in each state for distributed wind projects in 2015, but it does not include the federal investment tax credit. The combined value of all of these 2015 awards is $10.9 million. This is a significant decrease from 2012, 2013 and 2014, when funding levels were $100 million, $15.4 million, and $0.4 million, respectively. This decrease is mainly because fewer states are providing incentives, 10 states in 2015 compared to 14 states in 2014. And while some payments are still being made, eligibility for the Federal Section 1603 cash grant program has ended.

But there are two "howevers" to this overall decline. First, some projects can be successful without state incentives. The projects I showed on the previous slide, while they likely received the Federal investment tax credit, they did not receive any monetary state incentives; but they did likely benefit from other state policies. For example, the project in Ohio benefitted from the state's net-metering policy, which does not have a cap on system size.

The second "however" is that USDA Rural Energy for America program funding has increased, as shown in the figure on the right. Overall funding and funding for wind projects are both up from 2014, but wind still represents a small slice of the pie. The 2014 Farm Bill authorized mandatory funding through 2018, so available funding for this incentive is expected to be stable over the next few years.

I've talked about installed costs for small wind and incentives for all distributed wind, which drive the owners' upfront costs. So let's look at levelized costs of energy.

Levelized cost of energy is a function of a project's costs -- installed costs, and annual operations and maintenance costs -- divided by its annual energy production. In the left figure are levelized costs of energy for a sample of 2015 small wind projects by turbine size. The sample is limited to projects for which we have installed costs, incentive value, and estimated generation values available. The installed cost for each project is reduced by the project's incentive award, and the generation values are the projected values at the time of installation or incentive award.

The right graph are levelized costs of energy for a sample of slightly older projects using turbines greater than 100 kilowatts. This sample is limited to projects for which installed costs, Section 1603 incentive value, and actual 2014 generation amounts reported to the U.S. Energy Information Administration were available. That's the latest year available at the time of analysis that matched up with the project records that we have. The installed capital cost for each project is reduced by the project's Section 1603 cash grant award for the cost of energy calculation.

So the range and scatter in both of these figures really demonstrates that projects can achieve diverse costs of energy. And these different costs of energy aren't always comparable. For example, the highest dot in the small wind figure on the left is the 7.5 kilowatt turbine with an estimate $0.43 per kilowatt hour cost of energy in Alaska. So the small wind turbine will power a remote telecommunication site that is currently being powered by diesel generators, and the fuel needs to be flown in. So $0.43 might not make sense at a residence in the Continental United States, but this Alaska project is cost-effective.

So where does this leave us?

As I mentioned before, the U.S. distributed wind market has been relatively flat. What could make this change either way? There have been two major recent changes to the investment tax credit. As of January 2015, small wind turbines must be certified to either the American Wind Energy Association Small Wind Turbine Performance and Safety Standards, or to IEC Standards, to be eligible to receive the business investment tax credit or residential renewable energy tax credit.

Secondly, the Consolidated Appropriations Act signed in December of 2015 extended the expiration date of the residential credit for solar PV and thermal technologies, but it did not extend the credit for other technologies, including small wind; so small wind is no longer eligible for the residential credit after 2016. This pending could create a sense of urgency, pushing sales up in 2016 but then result in another boom/bust cycle, with lower sale in 2017 and beyond. And how or if the small wind certification requirement has affected the market may be more clear after 2016 ends.

Partially because of these changes in U.S. policies, U.S. small wind manufacturers are expected to continue focusing on international markets as a source of revenue, such as Italy, the UK, and Japan that have feed-in tariffs and other policies that support small wind. In 2010, exports accounted for 29% of U.S. small wind manufacturers' total sales; and in 2015, it was 83%. State and utility incentive funding has been decreasing.

So strong state incentive programs, such as the one in New York, will continue to drive growth; but other factors, policies, and drivers will have to help facilitate distributed wind as well. One of these factors could be interest from commercial industrial facilities in securing onsite energy generation. Whether this interest is because of energy security and resiliency concerns or a desire to go green, this market could grow.

That wraps up what I have. The report can be found on DOE website. The Excel file that has the numbers used in the figures is also available to download; and we now also have a new PNNL webpage that just went live yesterday, so please check that out. Thank you for your time.

AMBER PASSMORE: Great, thank you, Alice.

And just a quick reminder, if you have any questions for our presenters to make sure and type them into the Message box at the bottom of your webinar screen; and we'll make sure and try to answer those at the end of the presentations.

Now I'm going to introduce Heidi Tinnesand. Heidi joined the Market Acceleration and Deployment Group at NREL in 2015. At NREL, Heidi is focused on conducting wind and water resource assessments, advancing distributed winds, and furthering public adoption of wind power through outreach education and workforce development.

Prior to joining NREL, Heidi earned her Bachelor's degree in mechanical engineering from Portland State University and went on to work for Vestas Americas and DNV GL. Work included site suitability analysis using complex loads and terrain analysis for prospective wind farms, design and installation of data acquisition systems, and comprehensive power performance testing of installed wind turbines.

Thank you, Heidi, for joining us today; and I'll go ahead and hand it over to you.

HEIDI TINNESAND: Thanks, Amber.

Good afternoon, everyone. I'll be talking about installing turbines in the built environment and some research we conducted over the last year and published a report just a little earlier this year. And I want to call out the report authors that are on the slide here as well: Ian Baring-Gould, Jason Fields, Robert Preus and Frank Oteri. Thanks for their work on this – very cool.

So what is the built environment?

It's really a market niche, not a particular size or category, of turbines that are mounted on buildings. They are integrated into the building architecture or mounted in and among buildings. And as you can imagine, there are unique considerations for installing turbines in this environment, not the least of which are standards and testing protocols, which initially (inaudible) in this work.

There are some obvious benefits in selling turbines in the built environment. It's a clean and renewable energy, just as any other wind turbine technology. It also can be a visible invitation that a project owner's interest in clean and renewable energy or in sustainability in general. It's also close to end use and close to load centers.

But there are some unique challenges as well, safety and reliability being a couple of paramount issues; and these encompass many of the activities around installation and operation and maintenance. There is also performance and economics that are questionable in this environment. We're seeing projects underperforming across the board and incurring more costs than conventional installations.

But what we've found is there are quite a few people engaging in these types of projects, without a whole lot of information in the marketplace about the viability of these projects. So that's one of the reasons we took up this effort to put a report to provide a good baseline and a good reference to help inform stakeholders, if they should choose to do this kind of project, and to demystify the space a little bit. You can see the cover of the report here on the right-hand side. And the title is really indicative of the work. It's Deployment of Wind Turbines in the Build Environment: Risks, Lessons, and Recommend Practices.

We listed a number of case studies, and from these extracted the risks and lessons learned and developed a set of recommended practices. And like I said, the report is targeted towards stakeholders, the individuals considering buying turbines and installing them in the built environment, with the overall goal of having these project developers and owners having a safe, reliable, and successful project. This work includes contributions from a number of our partners on the international side. And I want to call out IEA's Task 27 in particular for doing some great work on CFD simulation.

A couple of caveats to this report -- it is specific to the United States, all the (inaudible) in the United States, but it is applicable to other markets. And it doesn't focus on building integrated turbines, but many of the same principles apply.

So here's an overview of the six case studies and projects we looked at. They're certainly not all-inclusive, but they are indicative of how projects tend to get developed and where they occur. They were selected for having data available and being able to find a project owner who could be reached for an interview. NASA was unique in that we were able to collect and measure detailed preconstruction and post construction measurements.

For the rest of the projects, the information gathering was a combination of published information and interviews. And like I said, this is pretty comprehensive look at the built environment. There were 7 different models of turbines, 32 turbines in total. There's horizontal and vertical access. They were across the country, certified and non-certified turbines, private and governmental project owners. Detroit Metro was the only ground-launched system; and like I said, there are no case studies on building integrated.

Here's a little closer look at those six case studies and the turbines that we looked at. I want to call your attention to the last line of this table. One of the most interesting parts of this research to me is the owner's view of the project. In the surveys and in the interviews, we asked the owners if they viewed the project as successful; and half of them said that they were. We really have to go into the details to understand why they considered it successful. By and large, the success wasn't power production but other reasons.

The Museum of Science is a great example. Their goal was education. And over the course of installing 10 turbines, they learned a lot about turbines in the built environment, building launching technologies. and innovating the energy into their overall energy picture. And this was valuable information that they could pass on to the public. But this is definitely the exception not the norm.

In looking at the lessons learned in these case studies, the lessons really fall into three categories: planning, costs, and performance and reliability. When we think about project planning, there aren't a whole lot of built environment projects out there relative to conventional installations, even in a given region. There is a general lack of development experience and experienced installers; and as a result, project planning overall is generally less comprehensive than desired, due in part to a lack of understanding of potential challenges and additional requirements that might occur. One great example is the project's impact on the local aviation procedures, which can add unanticipated steps to the permitting process.

But what we found across the board is that projects that had objectives other than power production tended to be perceived as successful. And going further, project owners that had clear priorities for these multiple objectives were the most successful of all.

And finally, the projects that really thought through the process – brought in experts, did modeling – they ended up being more happy with their project, even if the generation was less than expected. These are all great things to keep in mind.

Looking at project costs, they tend to be higher than expected for a number of different reasons. There are often additional architectural and engineering requirements that you don't have in a conventional installation; for example, building reinforcement requirements for distributing loads if the building wasn't originally designed with the turbine in mind, and the same goes for reducing vibration.

The photo on the right is a great example of the extra costs that can be in the installation and maintenance phases of a project. This is a 1 kilowatt machine that required a crane to install it on the top of the building, and special work in heights training for the installers. And being installed in this environment can expose turbines to forces not typically seen in conventional installations, such as increased turbulence, which can also lead to added O&M costs.

Digging into project performance, when we looked at project performance for our case studies, *none* of the projects met their pre-construction energy estimates. The best example was the 12 West Building, and even this project only realized about 60% of the expected energy production.

Next, there are numerous stories about OEMs going out of business at various points of the project life cycle; and this often had an impact on warranty fulfillment, the ability to get replacement parts, and having turbines serviced in a timely manner, which also had an impact on performance.

Finally, the standards and testing protocols don't reflect conditions typically experienced in the built environment. As you can see in the image on the right, which is a CFC simulation showing the complexity of the flow around this rectangular building, notwithstanding the rest of the buildings around, this can have a huge impact on the performance and reliability of turbines.

Here is a little closer look at the estimated versus actual production at that 12 West Building; and, like I said, this is the best-performing built environment turbine project that we had. Estimated at 9 megawatt hours per year, which is still only about 11% capacity factor; and what they realized was about 5,500 megawatt hours per year. And you can see at the bottom, the average Portland retail rate is about $0.125 per kilowatt hours; and this project realized $4.50 per kilowatt hour. So having other project expectations was key in the project.

Here is a closer look at that NASA project and Building B12. As I mentioned, the NASA project is the only project we took measurements on. And the first four lines are the actual power produced during March of last year, and then the last line is the measured wind speed during that same month multiplied by the manufacturer-supplied power curve and what they expected. And as you can see, there is a couple order of magnitude difference between the expected and actual production for that project. So we actually had a new metric here to calculate the energy – light bulb hours.

A couple of notes about this project, or one real key note, is one of the lessons learned is having a thorough technical evaluation before you decide to install the project. This building ended up being the shortest building in the area; it was surrounded by taller buildings. So that, obviously, had a huge impact on the production here.

In summary, a couple of the key outcomes and risks to a built environment – again, we couldn't find a single example of a built environment project that the energy production met pre-construction estimates. And our measured capacity factor went from less than 1% to 7% at the 12 West Building. And turbines are often shut down or removed early in the built environment because of excessive vibration, noise complaints, or reliability issues. And OEMs often fail, voiding warranties and reducing spare parts supply. And project costs are often much higher than expected.

In general, there are a lot of unique challenges in the built environment that stakeholders really should be aware of before they consider installing a turbine in this kind of space. The certified turbines are recommended across the projects we studied; we saw that these are the most successful in the built environment. But because they're not certified for these conditions, the performance is still less than expected.

Project owners may consider projects successful if other drivers, in addition to economics, are prioritized. And project design and planning, including safety planning (audio break), and education for interested stakeholders is sorely needed. And this report is a great start, but more needs to be done -- could be done.

In summary, successful built environment project attributes: thoughtful and diverse project goals. When you look at goals of education, marketing, or views certification, in addition to energy production, supporting onsite generation and utilizing incentives, those projects are seen as much more successful. And you need to have thorough technical evaluation, including site evaluation and resource assessment and a production assessment modeling and/or measurements in order to really understand the risks associated with turbines in the built environment. And always deploy turbines on buildings taller than the surroundings, and the highest rate of success is using certified horizontal access turbines.

Going forward, we plan to continue engaging with the IEA Task 27. For those of you don't know, it's turbines in complex terrain, which includes the built environment. And I have put a couple of links here. The first one is for the report we talked about here today, and then links to more information and data for the NASA Building 12.

Thanks.

AMBER PASSMORE: Great, thank you, Heidi and Alice.

We would like to move into our question and answer period, so please continue to type in your questions if you have any. I'll just start asking a few questions that have come up here already.

First question: "Has leasing of distributed wind facilities increased over the past few years?"

ALICE ORRELL: Yes, this is Alice. Yes, more companies are starting to adopt the leasing business model. There are a few manufacturers that do so – Northern Power Systems and (inaudible) are a couple. And then United Wind, which is a third party, continues to be the main player in the leasing space. They've had success in New York; and they are expanding out to other states such as Colorado, Kansas, Minnesota and Iowa. So we'll see how much more this leasing model grows over the new two years.

AMBER PASSMORE: Okay, next question looks like a comment/question combo: "It would be interesting in the next year's Distributed Wind Report to estimate the installed base of small wind turbine towers that will need repowering in the coming decade, given turbines reaching their end of life. Has DOE explored ways of estimating this opportunity guide?

ALICE ORRELL: Yes, that is a good question. The answer is, I guess, yes and no. We track sales of small wind turbines from the manufacturers, what they report; and then we also track projects based on what installers and owners and state agencies that tell us about projects that have been installed. And so we don't always know the status of the installed project. Is it still operating? Has it been taken down? We're not always sure about that, and there are a lot of small wind turbines all across the country.

But that is an interesting question that we can think about trying to figure out how to estimate this opportunity, yeah.

AMBER PASSMORE: Great, our next question is for Heidi: "Will you be sharing (audio break) and other Federal agencies?"

Are you muted?

HEIDI TINNESAND: Hello?

BETHANY STRAW: We can hear you.

HEIDI TINNESAND: Yes, well, we've published the report online. And I don't know what the distribution plan is beyond that, but I'm sure that we will if there was any agency that is asking us for advice on how to consider the built environment and projects in it and planning.

AMBER PASSMORE: All right, the next question is two questions: "How does capacity factor impact a project's economics, and what are capacity factors to open field installations compared to built environments?" I'll repeat the first question: "How does capacity factor impact economics?"

ALICE ORRELL: Well, the higher the capacity factor means that you have a higher amount of energy production from your turbine which, if you take the cost of energy calculation, that's your denominator, is your energy production; so the bigger the base, the smaller the cost of energy. So, yeah, you want to make as much energy as you can without increasing the costs to get that energy.

And then capacity factors for open field versus built environment, well, Heidi's sample of projects is a small sample; but they had extremely low capacity factors from what I saw on her slides. And in our report, we do take a sample of projects and do some estimated capacity factor calculations; and they're more in the range of 25% to 30% capacity factors for regular, open-field, horizontal access wind turbines.

AMBER PASSMORE: Another question for Alice: "Do any of the project owners you talk with have a more positive outlook for the next five years or so?"

ALICE ORRELL: Yes, I mean, most owners are excited about their wind turbines; they've made a good investment. And then manufacturers, developers, installers, do have some positive outlook for the next five years. As mentioned, the leasing model could help change the market some. And then there are just some places where wind makes sense; and it's the best option, cost-effective. And then there are always going to be opportunities for those kinds of situations.

AMBER PASSMORE: We've actually had a request for the new PNNL web link again. Could you give us that again, Alice, please?

ALICE ORRELL: Sure, the straightforward, simple address is: www.Wind.PNNL.gov. And if you go to that webpage, in the left-hand navigation panel, there will be a link to the Distributed Wind Page.

AMBER PASSMORE: Alice, is DOE planning a 2017 workshop on distributed wind that involves the BEWT report? Will that report be addressed at that workshop? Will there be a workshop on distributed wind where Heidi's report will be addressed?

I'm not sure if anybody knows that answer yet. Does anybody know that?

HEIDI TINNESAND: No, I don't know that answer.

SUZANNE TEGEN: Was this report presented at the small wind conference this past June?

HEIDI TINNESAND: Yes, it was presented at the small wind conference this June.

AMBER PASSMORE: But no plans at this time for presenting it at a workshop in 2017?

HEIDI TINNESAND: Not that I know of.

AMBER PASSMORE: All right, it looks like that was all the questions. I'll hang tight for a second more here to see if anyone has anything else they'd like to ask.

[Pause for responses]

AMBER PASSMORE: Anything from your end, Bethany?

BETHANY STRAW: It looks like that's it.

AMBER PASSMORE: Okay, great, well, if anyone else does have any questions, we have the contact information up there, which you can reach out to any of us at the DOE or NREL addresses; and we can try to get your questions answered.

Thank you so much for your time. We very much appreciate it.

And thanks to the audience. Everyone have a great day. Thanks so much.

Thank you.