Offshore Wind Market Update

November 18, 2015

MODERATOR: Our presenters today will be Aaron Smith, Market Analyst from NREL who will give us an overview and update of the U.S. offshore wind market. We also have Stacy Tingley, Director of External Relations, and Bryan Wilson, Block Island Wind Farm Manager from Deepwater Wind joining us today. They'll be providing an update on America's first offshore wind farm, Block Island Wind Farm.

And we want to remind everyone that we will have a question-and-answer period after our presentations today, so just please type your questions in the Q&A box in your control bar and then click "Send." We will only be addressing the questions during the allotted time at the end, but you're welcome to type your question in at any time, and we will try and get to as many of them as we can towards the end of the presentation.

So I think we could go ahead and jump right on it. I'd like to introduce our first presenter, Aaron Smith. Aaron has been working with the National Wind Technology Center since 2010, and specializes in market analysis, technology characterization, techno-economic model development and financial modeling. He uses these to provide insight into the potential impact of technology and innovation on the economic future land and offshore wind projects. So, Aaron, I'll go ahead and turn it over to you for your update today.

AARON SMITH: Great. Thanks for that introduction, Amber, and thank you everyone for attending. I'm going to talk a bit today about a market update that we just released, and this is basically a continuation of the series of market updates that were prepared by Navigate Consulting and the Navigate Consortium from 2012 to 2014, and then this update basically covers developments between 2014 and 2015. The focus of the report is on the global and U.S. offshore wind industries and we cover market development and drivers, the status of deployment and deployment projections, technology trends, economic trends, and progress towards LCOE reduction in the market. I'll be covering a subset of these topics today, and then I encourage you to check out the report at the link provided below.

This presentation really has five segments, so first I'll give a small overview of the methodology and approach that we used for our market analysis, then I'll talk about offshore wind developments globally and also in the U.S. We'll look at those in a bit more detail in terms of the economic and performance trends we can observe, and we'll also talk about the some of the empirical evidence that's emerging from the European market of LCOE reduction, which should have implications for the U.S. market. And then finally, we'll talk about how are these European cost reduction trends relevant to the U.S. market.

So just a brief summary of our methodology. This report draws on an offshore wind database that is maintained by NREL. It's fairly extensive in terms of its scope, and it's unique in that we track not only the project characteristics like the water depth and distance from shore, but we also are looking at the detailed technical specifications, such as the weight components and the component level of cost. And this really is the basis for a lot to have cost modeling and market analysis work that we do at NREL.

Just a note on the some of the methodologies done for converting currency costs, which are typically in the European market reported in Euros or Krone or European currencies to U.S. dollars. We did do this in 2014 dollars, and so the cost level that are reported do not reflect the appreciation of the U.S. dollar, and that is important because at least for the initial projects they'll need to report some key components from Europe and the cost of those components would now be lower due to fluctuations in the global currency market.

Okay, on to an overview of offshore wind developments globally. So at the time of this report, which was basically at the end of June 2015, we saw the global offshore wind market reach almost 9,000 megawatts of installed capacity, and the market leader here is the UK, with about 50% of that capacity installed, followed by Germany, Denmark, Belgium, and a few other countries. We saw a bit of a slow down in 2014 from 2013 levels, where we had over 2,500 megawatts of capacity installed. But 2015 is really set to be a banner year for offshore wind with over a gigawatt, a thousand megawatts installed by the end of Q1 and another 3,000 megawatts scheduled to come online.

So this second chart shows the cumulative pipeline through 2020, as well as the annual breakouts, and we can see that there is almost 40,000 megawatts scheduled to come online by 2020, which would bring the cumulative result capacity to nearly 50,000 megawatts. Now not all that capacity will likely make it by the time that we get to 2020. There may be some delays. But it really does show that the offshore wind market globally is accelerating.

We also can see an increasing trend towards diversification here. The red bars in this chart are China, and so China would go from having, you know, less than 10% of the global offshore wind market to more like 20 or 30%. We can see that trend a bit more clearly looking at the next slide, which shows the total offshore wind project pipeline, as announced by developers, and this basically does not include any cutoff dates. So we see that there's almost 250,000 megawatts of offshore wind capacity under some sort of wind development.

The categories at the bottom are developed to provide some degree of segmentation of these projects by status, and we see that there are many more projects that are early stage than there are at more advanced stages of construction, and so those early-stage projects should be seen as less likely than the ones that have, you know, been approved by regulators or those sorts of thing, achieved a greater level of certainty indicator.

So just a note on that regional diversification, we're still seeing about 60% of projects in Europe, but the Asian and North American markets are expected to accelerate, with 23% of global capacity and 9% of global capacity respectively.

So this next slide shows a map of the U.S. projects under development as of Q1 -- or Q2, 2015, and I think many of us are familiar with these projects. There's about 15,600 megawatts of capacity that have been proposed, and that includes both projects that are actually under site control by private developers and wind energy areas that have been defined by the Bureau of Ocean Energy Management.

If we look at only the projects that were a private developer has site control, that number is about 6,000 megawatts, and those are the bubbles on this chart that are colored, not gray. Just we are going to hear a update about the Block Island Wind Farm, which is the only offshore project that is under construction later today -- and it's the orange circle that you see on the map -- off the coast of Rhode Island. Several of the larger commercial scale developments are progressing, as are the projects that are sponsored by the DOE for the Advanced Technology Demonstration Program.

Just a little bit more on the Advanced Technology Demonstration Program. So there were three projects that were selected by the DOE in May 2014 to continue to the second phase here, and they are the WindFloat Pacific Project off the coast of Oregon, which would be the first floating offshore wind project in the United States; the Fishermen's Energy Project in New Jersey, which would be use a twist to jacket foundation and four megawatt turbines; and then the Virginia Offshore Wind Technology Advancement Project that's being developed by Dominion, which would have two six-mega watt Alstom turbines on twisted jacket foundations.

So these projects are eligible to receive up to $47 million from the Department of Energy to complete their design and fabrication. All three of the projects have been granted a six-month extension, and DOE will be evaluating their progress towards their objectives, which are basically to obtain permits and power off-take agreements that could see them realized from the financial perspective.

There are two additional projects that can be thought of as alternates to those three projects, and so DOE has selected these, and they provided about $3 million last year for them to advance their design, and they're also providing an additional $3 million this year to further mature those designs and maintain them as viable alternates through the main timeframe. These two projects, the alternate projects, are a concrete semi-submersible floating foundation off the coast of Maine, and a project in Lake Eerie that would include suction bucket foundation types and ice resistant turbine -- or ice resistant foundation technology.

Okay, moving on to the economic and performance trends, before I talk about economic and performance trends, I always like to talk about some of the citing trends and technology trends that are happening within the market, and so this chart basically just shows water depth on the Y axis and distance to shore on the X axis, and basically what we can see is that the projects are increasingly moving from shallower water to deeper water and further from shore. So the shades of these bubbles basically reflect the project status. The dark blue is installed. The lighter blues and grays are at various less mature stages, and so basically the shading here is a proxy for time. And you can see that as time progresses we really do have a move towards these deeper waters further from shore.

The U.S. projects stack up fairly nicely against this trend, but they do really span the full spectrum of depth. So we're seeing everything from 10 meters of water to, you know, upwards of 45 meters of water in some of the wind energy areas off the coast of Massachusetts. So these trends have implications for cost in deeper water, and at further distances from shore you would definitely expect to see costs going up, and we'll get to these cost trends in a little bit.

The second notable trend is the increasing maturity of floating offshore wind technology, and so this slide shows basically the depths that are beyond 60 meters from that past chart and time across the X axis would basically be a commercial operation date for these individual projects that have been proposed, and so we see that the projects to the left of where we are now, installed before 2014, were all single turbine demonstration projects basically. And then moving forward, we're increasingly seeing larger arrays of floating turbines with increased turbine sizes as those progress towards pre-commercial phases. And then we also saw this year the first proposals for full-scale commercial projects in Hawaii.

And then finally, another technology trend is the increase in turbine size. And so we've seen turbine size basically that steadily increased through the early 2000s, and then we had a little bit of a plateauing between 2010 and 2015, where we're hovering between three and four megawatts for the average turbine size. However, we're seeing the turbine original equipment manufacturers or OEMs increasing offering larger turbine sizes to the markets and commercializing those machines, and we're seeing those be rapidly adopted by industry. So we actually expect to see, based on commercial announcements, that the turbine size could grow to between six and seven megawatts, on average, by 2020, which has, also, significant implications for cost.

Okay, to those cost trends, this chart shows commercial operation date for projects on the X axis and CapEx on the Y axis. This is kind of what has been termed the negative learning curve for offshore wind, but it's actually not. It's much, much flatter than it appears from a CapEx perspective, because we'll also see that moving to deeper water and further from shore increases the capacity factor and largely offsets the capital cost increases. That all said, the CapEx trends that have been increasing in the past do seem to be falling and should appear to be stabilizing around $5,000 per megawatt or per kilowatt in the 2015 to 2020 time period, and at those levels, we see, you know, very -- we see offshore wind becoming much more competitive.

You can also see there is a considerable spread for those projects looking out into the future, and so a lot of that spread is dependent upon local site conditions, and other aspects dependent on local market conditions. So to basically offset those CapEx trends that we've seen, this chart shows the corresponding increase in capacity factor as you move further from shore and into those deeper water locations, and so we can see that in the early part of the deck -- or in the early part of the offshore industry we had capacity factors that really ranged between about 20 and 30%, but now we're seeing capacity factors that range between 30 and upwards of 50%, which has significant implications for the amount of revenue that you can generate with a given offshore wind project and is a large contributor to lowering the overall cost of energy.

Okay, so we're going to talk a little bit about this empirical case study that we did to kind of look at what sort of cost reductions are actually bing achieved in Europe. And so as a basis for this, Europe has set cost reduction goals basically between the industry and policymakers that basically say that continued subsidies for offshore wind are contingent on the industry showing progress towards reducing cost of energy and bringing the cost of offshore wind in line with other sources of generation. And so the goals are as follows:

In the UK they've set a target of a hundred pounds per megawatt hour or at 2014 exchange rates, this was $164 per megawatt hour. By 2022 in Continental Europe, the goal is a hundred Euros per megawatt hour or $130 per megawatt hour by the same date. The reason for the difference here is that in Continental Europe, generally the developer is not responsible for the electric system, so the substation and the cable to shore; whereas in the UK the developer is responsible for those costs to some degree. And so there is a slight difference in scope there.

So we have two sources that we looked at to look at these different trends. The first one is a study out of the UK called the Cost Reduction Monitoring Framework, where basically the Krona [ph] State went to the industry in the UK and looked at what their actual LCOEs would be and then they developed some methods for reporting those that hid the identity of the projects and showed weighted averages for different time periods. And then the second was competitive contenders for subsidies in the UK and Denmark, where basically the government designated a auction for a long-term PPA-type off-take mechanism and allowed companies to bid competitively for those. And that's actually a really good way to determine what the levelized cost of energy is, because it forces the industry to compete on price, and so you actually have some visibility into what prizes the industry think they can deliver the power under.

So in order to do this case study, we had to go from nominal revenue that's available to a project to real levellized cost of energy, so this is kind of a financial conversion. We set up a little cash flow model based upon the disclosed terms of these various contracts in the different markets, and so this slide basically shows that case study for one project in the UK. Basically you can see that the gray bars are the underlying electricity price for the project. The blue bar is the subsidy that the project would receive, and then the black line is the average subsidy that the project would receive throughout it's lifetime. Basically after the subsidy period the project is only eligible for the project price. And so if we take it from nominal dollars to real dollars, it's give us an LCOE of $167 per megawatt hour, which is about a 33% reduction from previous projects that were installed in 2010 or so.

If we look at this project in Denmark called Hornes Rev III, the subsidy looks a little bit different, and the calculated LCOE is significantly lower at $95 per megawatt hour. There are several reasons for the spread that we're seeing between the project and the UK and the project in Denmark. As mentioned previously, there is differences in scope and so Hornes Rev III is not responsible for that transmission infrastructure, which might add 20 to 30% to the lifecycle cost, bringing total LCOE to $120 per megawatt hour or so.

There's also differences in project characteristics. Hornes Rev III is in much shallower waters, much closer to shore, and actually has a higher wind speed than the other two sites, and that can lead to lower costs. From a technology point of view, Hornes Rev III will use larger turbines and the others, and that can matter. And there there's some other factors that we can't consider, like the policy conditions, market structure, financial structure, that also could be contributing some of the difference.

Okay, so moving on quickly to the results here, basically this line shows that UK cost reduction goal line that's kind of our benchmark for seeing if the industry is on progress or not, these three data points shown in blue are the LCOE averages from the cost structure monitoring framework that show about an 11% reduction over the study time period. These two projects are the two projects in the UK that show LCOEs of between %155 and $167 per megawatt hour based on real contractual bids.

And then finally, this last data point shows the Hornes Rev III estimated LCOE with a 25% adder for the transmission infrastructure that we put in to prapoximate that variable. And so from this chart you can really see that the industry is in advance of its targets and moving towards those goals. And you can also see how important site selection is for LCOE with that Horne Rev III data point.

Okay, so from this process, you know, we can see that the European deployment is really reducing the cost of energy for offshore wind projects, and this really should translate to the U.S. market. So just a few bullets here, the Block Island Wind Project, the Advanced Technology Demonstration Project that DOE is sponsoring and the other projects that are underway are going to provide the experience that could enable the U.S. commercial projects to leverage these cost reduction opportunities and build U.S. capabilities. So these really include the state-of-the-art turbines foundations that are developed for U.S. conditions, and streamlining and de-risking offshore wind investment in the United States to make financiers become as comfortable with wind technology as they are in Europe.

So these actions could allow the industry to emerge or even advance beyond the cost production trajectory that we see in Europe. But there are a number of barriers that could limit the extent to which we can realize cost reductions. So these really are related to infrastructure and the fragmentation of revenue mechanisms between state and federal authorities that really are not providing long-term certainty that is needed to invest in the industry. So this really limited visibility into the future market size, I think, makes it very challenging for the supply side to justify investments in technology that could lead to these -- and cost reductions and so that's something that we need to figure out.

So, in summary, U.S. industry is clearly ready for launch. You know, the European experience and the initial construction of the Block Island Wind Project, I think, moved that. But we really need stable and coordinated policy in order to offset our kind of high initial costs and to make clear what the deployment potential is so that investors have visibility. These cost reductions are declining rapidly in Europe. Industry is poised to meet the target of reducing LCOE by 40% by 2020, and, yeah, I think that once again, just emphasizing that a pipeline is needed to encourage these investments and really enable the U.S. to take full advantage of those innovations that we're seeing from Europe is necessary. That's all from me. I look forward to your questions.

MODERATOR: Great. Thank you, Aaron. And just in case you hopped on after we got started, our question-and-answer session will be at the end of the presentations, so we'll just keep moving right along. Our next presenters are Stacy Tingley, who is responsible for external relationships at Deepwater Wind and leads the company's Public Affairs Community Relations and Stakeholder Engagement Operations in Rhode Island.

And Bryan Wilson, also joining us from Deepwater Wind, manages Block Island Wind Farm, over seeing on-island operations and public engagement. He also previously served as the company's island liaison. So Stacy and Bryan, I'll turn it over to you now.

BRYAN WILSON: Okay, can you hear me all right?

MODERATOR: We can hear you.

BRYAN WILSON: Okay. I'm sorry, Stacy had to step off the webinar for a few minute minutes, so I'll just pick up for her. Can you see my presentation on the screen?

MODERATOR: Yeah, we sure can.

BRYAN WILSON: Okay. Well, again, thank you very much for the opportunity to give you an update on the project. I'll keep this brief, because I think the pictures speak more eloquently than I ever could. Just a little background, I've been engaged with the wind project for about six years now. My primary role is to act as the interface for all the various activities on Block Island. That means I get to spend an awful lot of time on the water this summer and fall doing a lot of really amazing stuff. So I'm going to just give a really brief background on it. I'm going to assume that most folks are familiar with the project.

Block Island is down here in the center of the image. It's demonstration project on many different levels. It's not particularly about the technology. The technology is fairly well proven, both for the foundation and for the turbines themselves, but more to provide an opportunity for the regulatory agencies and the various stakeholders, as well as the financial interest groups to develop a level of comfort on a small scale before we move on to the larger project.

I think we're all familiar with the fact that Block Island is located in a very robust wind resource area, Deepwater ONE, our larger proposed project, about 16 to 18 miles offshore also has very robust wind resources, in close to proximity to some the largest electrical loads in the country. I won't go into too many detail on that.

The project scope itself is five, six megawatt turbines. They were developed by Alston, which is now a General Electric company. They're direct-drive units. They'll produce enough electricity for approximately 17,000 homes, and they're in the CRMC Coastal Resource Management Council Removal Energy Zone, which was delineated as part of a long-term process called the Ocean Special Area Management Plan, which I imagine you're all familiar with.

The image, the Block Island Wind Farm is down in this corner over here. It has an export cable that exports the electrons to Block Island, where about approximately 10% of the electrons will be distributed around Block Island. 90%, the balance of those electrons, will then be exported to the Mainland. That's the electron flow. The actual dollar flow will be essentially deep water selling all of our electrons to national grid, and national grid will then send them to the various end consumers.

The various benefits of the project are already manifesting themselves. Over 300 construction drops were developing a core group of folks who will be able to move on to the larger projects and help train more and more people as this nascent industry develops, obviously the national leadership positions, not only for Rhode Island but for all the various people working on this project, and I mean on a governmental level, NGOs, all the subcontractors and so forth, everyone's been very, very helpful, very excited to work on this project which is essentially lead thing country in this regard.

We are utilizing -- relying very heavily on the European experience. Our president is Chris van Beak, who has built some of the largest offshore projects in the world; Jens Hansen, who some of you may be familiar with his work in Copenhagen and other areas as well. We also a lot of folks working from the Gulf, from Louisiana and Texas. So we're drawing on a lot of resources, so we're not starting from scratch, and it's been proven very helpful.

Status of the project currently, permits are all complete. Engineering is complete. Financing is complete, which is as any of you know, an enormous hurdle. Construction is in progress, and we anticipate commercial operations, flipping the switch, at the end of 2016.

Part of this project -- an essential part of this project over the past six years has been under the auspices of the OSEM Plan, Ocean Special Error Management Plan, but also straight out of our initiatives, it's been engaged with a broad group of stakeholders including environmental groups. You may be familiar with the agreements we struck with the environmental groups to avoid -- during marine mammal whale migratory periods, Native American Tribes, primarily the Narragansetts and Wampanoags. With regards to this project it's actually one of the really rewarding aspects of this project for myself personally. Commercial fishermen, obviously, we're staking a claim in fishing ground, and early and extensive engagement with the commercial fishing industry has proven not only effective but essential.

This is an overall slide that gives just a very cursory look at the various activities, construction activities that have transpired this year, and continue to go on. The fabrication, the primary fabrication of the jackets and deck structures in Rhode Island at Quonset Point. The center slide shows becoming a very telling graphic. I see it popping up all over the place. That's setting one of the jackets. Up in the top right-hand corner you see the corner image of the Liftboat Robert. Let's get a better shot of that later, pile driving some of the piles into one of the installed jackets. Again, Liftboat Robert, the center image on the right, and that's there's actually two Derrick barges in the background there. We've had three large vessels, with the Robert, the Derrick barge 533 and the Derek barge 526, all 520-crane vessels working on this project.

So here is that image. This was actually the lift for jacket number three. That's being set in the water depth of about 90 feet there, so that's about 112 feet tall, so there's a portion of that -- the yellow portion sticks above the water there. That gets set on the sea floor, and then piles get driven down into the four-corner legs to a target depth of 200 feet below the seabed. Those piles, you can see the installation process here. On the left-hand side, this is, again the left coat Robert jacked up about 40 feet in the air. These are P-1s, which are approximately 200 feet long, and they're stabbed into each of the legs in the jacket, which is set level on the seabed and to within half a meter tolerance of its precise location, as delineated on the maps.

The device right here in the center that you can somewhat see, that's 120-ton hydraulic hammer that drives the pile down to target depth. Because the target depth being 200 feet, we have to add on additional pieces, P-2s, and P-3s, and what you see over here on the right-hand side is a P-2 being stabbed into a driven pile there. Once that's stabbed into there there's a weldment that takes place here, and it requires a substantial amount of high-quality welding. Everything is UT tested, and we have numerous oversight agencies. We have London Offshore Consulting, American Bureau of Shipping, and Mott MacDonald all working to protect the interests and provide oversight for the various parties involved, including the CRMC, the banks, and other agencies.

This is a pretty dramatic image of the Liftboat Robert. It can accommodate 120 people, and this is really very much of a game changer with regards to how to install these things offshore in the United States. Relying strictly on Derrick barges, which are waterborne is problematic because we have quite a bit of inclimate weather days up here in the Northeast, even in the summertime, so the ability to basically negate that, the sea state as a factor in installation that has proven to be really very helpful. Again, this is an image of the hydraulic hammer pile driving P-1 into the seabed.

This is another image where P-2s have been set, and if you look closely, you can see there's little tents built around here. There's four to six welders in each tent at a given time. The weldments that takes place there can take 12 to 16 hours. They're very extensive, very detailed welds that need to be inspected on a very tight -- to very tight standards. In the background you can see the 526 and the 533 working on another one of the jacket structures.

So here is a jacket structure in the water with the P-2s complete there. The next step on this is to cut these off precisely level. The tolerance that we have to work to is .2% deck level. For obvious reasons if you have a nacelle that's up a hundred meters up in the air, if you have a deck that's out of level underneath it, you're going to have a turbine that's out of plum, which is a bad day for everybody. You can see in the background here the Liftboat Robert, again, working on one of the other jackets.

Once the piles are cut off to those precise tolerances, then the deck structure, secondary part of the turbines -- the jacket, the nacelle structure is set in place. The final height above water here is about 68, 70 feet. In this particular instance this vessel is working on welding the placed jacket to the pilings themselves.

This is just a reminder that we are living and working in paradise. I like these images. It is a 24/7 operation. Here is a close-up image of the jacket and deck number two. It still has temporary staging on the lower area here, and there are certain areas that will have cowls built around them. You can see up top here that we have solar panels that will be powering on a temporary basis our [indiscernible] navigations, our patent, private navigation for the duration of the winter.

Next year -- essentially what we're shooting for right now is we've got four of these jackets on. We have one more to go. I think we'll be able to get the last one on in a weather window that we have coming up on Saturday. So we should be wrapped up within a week or two for this construction season offshore. We will be doing the terrestrial work. That will be initiated in January. That's the duct bank work and the substations, both on Block Island and Narragansett that will provide the interconnect for the sub-C cable.

The cable is being manufactured and will be installed in the spring, just in time for the installation of the turbines themselves.

We are receiving the first five pieces of the mono piles for the wind farm at Prov Port, Providence Port today. Those will be put into a temporary structure, and various electronics components will be installed therein. The rest of the components of the turbines are being manufactured. We've got the blades complete. The nacelles are well underway. Most of those components will be coming over to Prov Port as well, then they will be taken out on feeder barges to the Fred Olsen Windcarrier, which is one of the largest, if not the largest turbine installation vessel in the world. That will be coming out next summer, July, August, and September to install the wind farm.

This vessel down here is a typical example of a cable-laying vessel. We've got about 20 miles of cable, six-inch cable that needs to be installed from there Narragansett to Block Island, and from Block Island to the Wind Farm and then daisy chain between the turbines. We're also building the first CTV for offshore wind in the U.S. in cooperation with a boat builder in Rhode Island, so building up the supply chain is a big part of this project. And this is a graphic that gives some sense of what the Fred Olsen Windcarrier will be doing offshore here. So, again, we're looking to flip the switch late 2016. That concludes my segment.

MODERATOR: Great. Thank you, Bryan. Let' see here, why don't we jump right into our questions and answers. Let me go ahead and put some questions up here. This first question is for Aaron. Besides the main project, are any of the demonstration projects in the water yet? If not, when?

AARON SMITH: Right. So the main project was -- they installed a, I think 1/20th scale prototype off Castine Bay, and it has since been removed, and it was out there to collect data and testing, but it's not a commercial installation. But it will inform the future deployment of that project full scale.

None of the other advanced technology demonstration projects have been installed yet. They are all in the engineering and early-stage procurement phases. They're still working on getting their permits and financing arranged, and they're power purchase mechanisms secured. So it will be a few years before any of them are installed and operating. I believe that most of the projects are targeting a 2018 commercial operations date. So that would be three years from now.

MODERATOR: Great. I'm going to throw this -- both of you may have an answer to this, so I'll just throw it out there to whoever wants to answer it can. What can be done to align state policies or procurement mechanisms?

AARON SMITH: So I can give a bit of a maybe unsatisfactory answer to start, and then, Bryan, if you want to follow up, feel free. So I think it's, you know, the way that the system works in the United States is a bit more complicated than what we've seen in Europe, where, you know, we do have a separation between state and federal power, we do have a number of different federal agencies that have jurisdiction over, for example, the outer continental shelf where the project will be located; whereas, you know, the state agencies really have the agreement or the ability to commit to enable power purchase agreements. And so there's that disconnect.

And then there's the disconnect between these different states, where states are really thinking about how to position themselves for basically supplying the future offshore wind industry. And there is some regional coordination that's, you know, talked about but nothing has been done formally. So what I think would be helpful to see is basically some commitment among a group of states to support offshore wind industry and to maybe potentially look at the benefits of offshore wind over a larger area than just the state boundaries. So looking at offshore wind benefits to a regional economy rather than just to the state economy and have various states make commitments to secure a certain number of megawatts. And so, I mean, you know, we really can't advocate for policy, but I think coordination can provide the scale that's needed to really encourage supply chain and progress towards that would be helpful.

BRYAN WILSON: Yeah. And I would concur with everything you said there. I thought that was a very satisfactory answer, quite honestly. The only point I would add to that, and I think it just reinforces what you're saying, is that we need to convince the states that they need to look beyond their own boundaries. As this nascent industry moves from the hundreds of millions of dollars investment to billions of dollars, there's going to be plenty of work and plenty of services required all up and down the East Coast to supply -- to build and operate these large wind forms. So if we can get the states to coordinate, as you mentioned, and to see that there's a synergy associated with working together rather than working solely within state boundaries, I think we'll all benefit.

MODERATOR: Great. Bryan, how did you avoid the not-in-my-backyard problems of tape wind?

BRYAN WILSON: That was a very -- with every wind farm project that I've researched, that's always been an issue. We actually learned quite a bit from tape winds not only what to do but also whatnot to do. Boots on the ground from the very first day, getting involved in the community, hiring people in the community, listening to people, engaging with stakeholder, letting everybody, whether they're pro, con, or somewhere in between, have an opportunity to speak to the project.

On Block Island, we have a long-standing environmental ethic out here, where 40% of our island is in conservation. We have sole source aquifer protection of personal discharge harbor, et cetera, et cetera. So the notion of getting rid of five diesel turbines burning a million gallons of fuel that's imported from the Mainland and, instead, trading that for five wind turbines three miles offshore is a very attractive thing for most people who are engaged with Block Island.

That being said, there was a small and very vocal group of folks who were opposed to the project, pretty much from day one. They never really gained too much traction, because I think the overwhelming sentiment on Block Island was very much for this project and recognized that the introduction of five turbines into the seascape that we have here is a beautiful thing and not an industrial blight.

MODERATOR: Another question for you, Bryan. What have you done to protect against hurricanes and nor'easters.

BRYAN WILSON: Okay, the foundation jackets and deck structures are based on long-standing technology that's been utilized in the gulf for decades. They're designed to withstand the thousand-year storm. So if something compromises those, we've got a lot of other things more serious to worry about than the wind farm. The turbines themselves are rated to withstand well in excess of any major wind events that we've had in the Northeast. They are designed to feather out, the blades feather out and the nacelle [indiscernible] away so it minimizes the wind profile of the unit itself. It's an interesting thing that the turbine is under more stress when it's operating normally than it is under wind conditions when it's feathered and the -- wind state.

MODERATOR: Great. I'm going to try and make sure -- I'm trying to understand this question. It's referring to the twisting jacket. And they're wondering is it only the top part or does it go all the way to the ocean floor, the twisted jacket?

BRYAN WILSON: Okay. For clarification purposes, we're not utilizing twisted jacket technology for this project. We have basically a rectangular footprint to the jackets. They have four-corner tubes. Those go all the way to the seabed, and there's large mats that sit on the sea floor that temporarily hold them in place. Then we have the piles that are driven inside the four outside legs, four-corner legs. Those are five-foot diameter piles, two-inch steel, and, again, they're driven down to a depth of about 200 feet below the seabed. Those piles themselves are the structural component that resist all the forces associated with the turbine itself. The turbine deck is welded directly to the piles. That's not to say that the jacket structures themselves are not essential for various loadings, but the largest loading is picked up by the pilings themselves. I hope that answers that question.

MODERATOR: Got you, yeah. So another one for Bryan here. How much local and Rhode Island labor are you able to use?

BRYAN WILSON: We've been utilizing quite a bit of local labor. It's one of those interesting things, when we talk about the design of this project, it's long-term design project. Take, for instance, myself, I've been work on this since 2009. I've been working with dozens, if not hundreds of people, over the course of the last year six years with regards to the designing of this project. We've also done a lot of work with [indiscernible] point and [indiscernible], engaging with primarily union folks to do a lot of the localized construction work that can easily be done here.

We're also utilizing folks from Massachusetts, Rhode Island, and nearby on the actual installation offshore pile drivers. A very good friend of mine, his brother is working on the crane, one of the cranes on the 526. So we're trying to integrate as many local folks into the project as possible. But that being said, we're also relying very heavily on people from Louisiana and Houston and Europe to give us guidance and experience as we move forward and develop this core group of people that will then move on to the larger projects.

MODERATOR: Great. We've got maybe time for maybe just one more question, try to wrap up on time here. We've got, can the block wind presenters provide some perspective on small penetration in the supply chain. Bryan?

BRYAN WILSON: I'm sorry, I'm looking for that question.

MODERATOR: Oh, sure. Sure.

BRYAN WILSON: Can the block -- oh, block wind presenters. Okay, I'm sorry, I didn't understand that. Some perspective on small business penetration in the supply chain. That's a little beyond my purview. We have been engaged as the developer in this project with large and small companies. I'll tell you, for instance, during the development of this project, we utilized a whole range of engineering and archaeological, biological companies and so forth working out of the State of Rhode Island. Marine survey vessels coming from Connecticut. PAL Archaeology Laboratories did most of our historical resource analysis. Small businesses have been essential to this project.

That being said, we have also engaged with much larger companies. We have a joint venture between Weeks and Manson, as they are the folks that are actually installing right now. Those are two very large companies that came together to pool their resources to work on this project in hope that it will lead to more work for all of them. So I think in terms of getting business penetration into the supply chain, it's built on a small scale and a large scale.

MODERATOR: Great. I think we're going go ahead and wrap things up here, since we hit the hour here. I Wang to thank Aaron and Bryan for providing their valuable updates and being able to participate today. I also want to thank our attendees for listening in, and we are sorry that we can't get to everyone's questions. We have quite a few left, and terrific that everyone is interested and wants to know more. Please feel free to e-mail us about any kind of questions that you have, and we'd be happy to follow up. So we look forward to having you on future webinars, and have a great day.

BRYAN WILSON: Thank you very much, folks.

MODERATOR: Thanks.