In The Matter Of:

NEW JERSEY OFFSHORE WIND TRANSMISSION STAKEHOLDER MEETING

(MORNING SESSION)

November 12, 2019

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STATE OF NEW JERSEY
BOARD OF PUBLIC UTILITIES
TUESDAY, NOVEMBER 12, 2019

NEW JERSEY OFFSHORE WIND
TRANSMISSION
STAKEHOLDER MEETING
(MORNING SESSION)

BPU DOCKET #Q019010068

HELD AT:
TRENTON WAR MEMORIAL
ONE MEMORIAL DRIVE
TRENTON, NEW JERSEY
10:00 A.M.

BEFORE: SUZANNE PATNAUDE
SENIOR COUNSEL, BPU

BPU STAFF: CYNTHIA HOLLAND
JIM FERRIS
ABE SILVERMAN

PANEL 1 MEMBERS:

JANICE FULLER - ANBARIC
FRANCIS CHARTRAND - ATLANTIC SHORES
DAVID WALLACE - DAVID WALLACE & ASSOC.
MIKE TABRIZI - DNV-GL
ULRIK STRIDBAEK - ORSTED

PANEL 2 MEMBERS:

DOUG COPELAND - ATLANTIC SHORES
JOSH GANGE - BOEM
KIRSTY TOWNSEND - ORSTED
SUE GLATZ - PJM
JOHN DEMPSEY - PSE&G

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MS. PATNAUDE: Good morning. Pursuant to the Open Public Meetings Act, N.J.S.A. 10:4-6 et. seq., this stakeholder meeting was properly noticed by the New Jersey Board of Public Utilities' secretary Aida Comacho-Welch.

My name is Suzanne Patnaude, I am Senior Counsel at the New Jersey Board of Public Utilities, and I have been duly designated by the Board to serve as the presiding officer at this stakeholder meeting.

The purpose of this meeting is to discusses how New Jersey should plan its transmission system to accommodate the major role off-shore wind plays and will play in New Jersey's energy future. We appreciate your attendance at this meeting, especially given the weather.

The Clean Energy Act of 2018 L. 2018(c)17 Off-Shore Wind Economic Development Act, OWEDA, N.J.S.A 48:3-87(d)4 and N.J.S.A 48:3-87.1 to 87.2, and Executive Orders 8 and 26, require the BPU to implement certain green energy initiates to achieve 100 percent clean energy by 2050. To achieve these goals, the BPU has established an off-shore wind renewable energy certificate, or OREC, to incent the creation of new off-shore wind

facilities.

In June of 2019, the Board approved an 1100 megawatt, mw, off-shore wind generation project. The first of several expected qualifying off-shore wind projects eligible to receive ORECs. In preparation for future solicitations, the BPU staff is establishing the first of possibly a series of technical conference format meetings where interested stakeholders can provide comments on one or more off-shore wind transmission solutions that further state's off-shore wind ambitions in a cost-effective manner for New Jersey ratepayers. We asked interested individuals to self-nominate serve-on panels to discuss how to best meet the state's objectives.

As you can see, we have a court reporter. She's here to transcribe the panel and stakeholders' comments. In order to provide clarity and be courteous to the court reporter, I will insist that people not interrupt or speak over one another, identify themselves by name and organization for the record, and speak slowly, clearly, and loudly enough to be heard. There's actually a microphone right there in the front for people when they will be asking questions.

There may be additional technical conferences to further explore options, and written comments may be filed by -- oh, that date is wrong. We'll get back to you when you have to file the written comments. Stakeholders should be aware that for the purposes of the Open Public Records Act, these comments may be considered public documents. Stakeholders may identify information that they wish to keep confidential by submitting them in accordance with the confidentiality procedures set forth in N.J.A.C. 14:1-12.3. The BPU thanks all stakeholders that have already taken part in this process for the participation and comments.

The information and views presented by staff today do not necessarily represent the views of the New Jersey Board of Public Utilities, its commissioners, its staff, or the State of New Jersey. Staff comments do not provide a legal interpretation of any of New Jersey statutes, regulations, or policies. Nor, should they be taken as an indication or direction of any future decisions by the Board of Public Utilities.

The agenda for today will include a fifteen or twenty-minute break between the morning

session and the afternoon for restroom breaks, and there will be half an hour for lunch. I believe we're breaking at -- the bathroom break will be at 11:15 to 11:30, and the lunch break will be from 12:40 to 1:10. November 18th for the comments, the written comments.

Written comments are also encouraged and should address the questions posed by staff, and reference the associated question by number. Written comments must be submitted to Aida Comacho-Welch, Secretary, New Jersey Board of Public Utilities, 44 South Clinton Avenue, 9th Floor, Post Office Box 350, Trenton, New Jersey, 08625. Written comments may also be submitted electronically to OSW.stakeholder@bpu.nj.gov in PDF or Microsoft Word format. Written comments should be submitted by November 28th, 2019. Please note that these comments may be considered public documents for the purposes of the Open Public Records Act, N.J.S.A. 47:1(a)1, 2, 13. Stakeholders may identify they wish to keep confidential by submitting them in accordance with the confidentiality procedure set forth in N.J.A.C. 14:1-12.3.

As previously mentioned, the

transcript that will be produced from the stakeholder meeting shall be made part of the record in this matter, and shall be reviewed by all members of the Board. We believe we will have commissioners in attendance this morning. In fact, Commissioner Holden is already here. And, I apologize, I can either wear my glasses and see who's in the audience or I can read close up. Commissioner Solomon has also joined us. Okay.

With that we are going to start with our first panel. And, our first panel consists of -- getting the most up-to-date copy here -- we have Janice Fuller from Anbaric. Francis Chartrand from Atlantic Shores. David Wallace from David Wallace and Associates. Mike Tabrizi from DNV-GL. And, Ulrik Stridbaek from Orsted.

So, with that, why don't we start on the far end with Mr. Wallace.

MR. WALLACE: Good morning, ladies and gentlemen. And, thank you for having this conference and allowing the stakeholders to have some comments that, hopefully, will be pertinent to the installation and development of the off-shore wind energy, which is going to be a major process in the Atlantic Ocean off of New York/New Jersey.

My name is David Wallace. I represent the surf plan -- (Indiscernible) -- fisheries management plan, and the members of the industry who participate in that. The plan is based on one of the largest fisheries in the State of New Jersey, and it ranges from Virginia to the Canadian border. But, I also will speak on behalf of the bottom tending mobile gear fisheries, such as the troll fishery and what have you, who have their either dredges or scallop dredges or clam dredges or outer trolls on the bottom. The cables are going to be a very, very major problem for everyone. I have a lot of experience with telecommunications cables, Transatlantic, and then actually cables that run from the United States to the other states which also has caused us great grief in the past.

Most of the vessels that I am talking about are very large, as far as fishing vessels are concerned. They have about a 120 to 160 feet. They have a thousand or 2000 horsepower. They tow very large, heavy gear. And, in particular, the clam industry, clam dredges, cut into the bottom to wash out the clams. And, if there's anything in the way below the surface, the vessel either scoops

them up or it ends up being entangled in the gear. And, that's the reason that we are concerned about these power cables.

Unlike telecommunications cables, which start in New Jersey -- or end in New Jersey depending on which way you want to look at it -- they run in a relatively straight line off the continental shelf and go to Europe, or wherever they go. And, so, they're pretty easy to manage from the point of view that there's only -- they only install one at a time, and we are pretty sure we know where they are. And, we're made sure that the telecommunications folks bury them deep enough, monitor them on a continuous basis, under a law passed by the legislature of the State of New Jersey about twenty years ago, which I was a part of. And, we need to make sure that when these large cables are installed to connect the turbines and then to deliver the power to the shore, that they are not going to be a problem for the fishing industry. We do not want to be a problem for the power industry. So, we feel that there needs to be a great deal of consideration on how these things are installed so as to not put the fishing industry vessels at risk, or the cables themselves

at risk.

And, when we are willing to participate, we have not had good experience with the wind industry developing people. I've served on a couple of panels for Orsted up in New England, and we made a number of recommendations. Unfortunately, they were not considered because they cost money. And, we are just flabbergasted that a billion dollar project worries about just really minor things like burying the cables deep, so that having them come and go into and come out of the turbines as close as possible, and where they're not exposed to the surface where they could be easy to entangle our gear.

And, you know, we've been here for hundreds of years, and this is a brand new enterprise for the world and the United States. And so, we want to make sure that we are protected. When Governor Murphy took office and talked about sustainable energy, one thing he did say was that he was going to make sure that the fishing industry and the power, wind turbine, ocean industry would be able to co-exist. I was skeptical of that because of their power. I hope that he's right. But, we seem to always end up on the wrong side of

the long end of the stick.

So, thank you very much. And, happy to answer any questions.

MS. PATNAUDE: We're taking all of the questions after all of the panel have spoken. Thank you, Mr. Wallace.

And, next we have Ulrik Stridbaek from Orsted.

MR. STRIDBAEK: Thank you very much. Thank you for organizing this conference and for giving me and Orsted an opportunity to sit in this panel.

I am Ulrik Stridbaek. I'm in charge of the regulatory affairs in Orsted working out of Copenhagen. So, why am I here? Well, the BPU has asked for our experiences from Europe on the transmission issue. I will try to share those. But, also, by in this time and manner looking into new transmission models for off-shore wind in the future, I firmly believe that New Jersey is actually breaking new ground in trying to tread the path that is also being looked at in Europe. So, I think the experience is going flow both ways over the Atlantic in due course.

But, Orsted is the global leader in

developing off-shore wind. We cover Europe, and more than a third of all these off-shore wind farms outside of china. We pioneered the industry, and have experiences across several markets. And, when it comes to transmission, we have largely experienced two basic approaches in Europe. One, being where the developer is doing the transmission connection. This is what happens in the UK. And, one where the transmission is being developed by the transmission system operator, so the transmission company separately from the off-shore wind farm.

And, we are extremely excited about being here, having our off-shore wind project, ocean wind, and working together with New Jersey. I thought I would share some of the insights and the learnings from those two approaches. Those countries having been so kind to make the experiment, to being the laboratory for different approaches. For that, we actually asked scientists at the University of Berlin to look into those experiences, both from a qualitative and a qualitative approach. And, it was quite clear what they came to, and there are various public report, and very happy to share that. It's a

independent research institute, but we funded the project, I should say.

The quantitative analysis compared the transmission costs in the UK and in Germany. So, UK where the transmission was done by developers, and in Germany where transmission was done by the transmission system operator. And, generally they base it -- a similar amount of projects have been made, so there is a data foundation to make it empirical research. And, Germany also poses a very interesting example of having actually developed the shared grids in clusters of off-shore wind farms. So, having in the past a fairly small -- one, two, 300 megawatt wind farms clustered to better in terms of 900 megawatt.

And, the first comment to be made here on those experiences is that an off-shore wind farm today is at least 900 megawatts, fitting to the equipment that you make transmission system with. So, the reasoning for clustering, the reasoning for sharing, is very, very different from when Germany started this.

Secondly, they look into the costs from selling off the transmission grids in the UK, and public information about building the

transmission systems in Germany. And, the conclusions and results are very, very clear. The British transmission, off-shore transmission, on a conservative way and a conservative assessment, costs at least thirty percent less than in Germany. That corresponds to ten, eleven dollars per megawatt hour for the entire project. So, fifty million US dollars for a good one gigawatt project per year. And, the availability of the transmission is higher in the UK. So, very, very clear evidence.

Now we are seeing that Denmark is changing over. They are letting the developer -- they are going to let the developer develop the project, the transmission project, in their next tender. So, there is a -- (Indiscernible) -- here, and we are confident that New Jersey will look into and take those experiences away. Especially the very high value and the synergies of building, or at least allowing to build the off-shore wind farm, the off-shore wind transmission connection, together. Losing that out, or hindering that, you risk losing very, very significant synergies.

That said, looking forward -- I will

complete my statement -- looking forward, we also do think, we do see with the discussions here in the United States and in Europe, that there is a need to rethink and have another look at the transmission systems. There is a need to develop the high-voltage DC equipment technology, and integrate and link systems in a better way. And, we firmly believe that this will happen in Europe, as well. And, we look forward to continuing to work together with New Jersey in sharing and developing these models.

Thank you very much for the opportunity.

MS. PATNAUDE: Thank you. We're going to take Janice next, Janice Fuller from Anbaric, because she volunteered her computer for everybody else to use. So, her presentation is on here. Jan, you want to come up?

MS. FULLER: Thanks, everyone. Thank you everyone. Thank you to the Board of Public Utilities, the commissioners, for having us today.

I think we all recognize as New Jersey starts on this path towards an energy revolution, the importance of really stopping and thinking of transmission as what a critical component that this

is to ensuring that the state can successfully reach the governor's clean energy goals, making sure that we get this right from the beginning is necessary, of course, for that.

I'm assuming you can see on the screen the presentation? Thank you. So, what is planned transmission? Obviously, there's a few different ways to think about that. But, at its basic component it is figuring out and discussing and determining what transmission should look like in concert with what your future energy needs are. And there are discussions that can be had, obviously, about who built that transmission. But, also, what needs to come first is the conversation about that that transmission should look like for it to meet the energy needs that we have planned for the short, near, and long term.

Well, a lot of what we've heard about already, and I think we'll hear about as we go forward, the purpose of this panel to talk about how other jurisdictions have approached this. And, I think a lot of what we'll hear about is what has happened in Europe. But, I think we can also look right hear in the United States of some examples of transmission planning and successes and failures

that we've seen.

I'm sure most in this room are familiar with the CREZ project in Texas. This is probably one of the most successful examples of planned transmission. Because of the approach that was taken in Texas -- and, of course, this is on-shore wind, but there are lessons that we can learn from that. We have seen the highest amount of installed wind capacity in the country. We're approaching 25 gigawatts. That has led to 25,000 jobs, 46 billion in capital investment, and 307 million each year, each year, in land owner payments and state and local taxes.

So, much of the conversation, obviously, that is happening with off-shore wind and this bridging industry is the economic development that will come with it. And, how can the states who are competing in the space maximize the economic development that is centered in our state, and make sure that those jobs are created here and stay here. And, we can look at planned transmission, a thoughtful process for planned transmission, as a way to ensure that that happens in a successful way. And CREZ, the Texas project, clearly presents us with a tremendous opportunity

there.

We can contrast that with what happened in Maine earlier in this decade. They set a target of 28,000 megawatts. At this point approximately now we're only at 46 percent of that goal. 923 megawatts. Five major wind farms were cancelled due to transmission constraints and interconnection delays. And, there's a ten-year delay on addressing the bottle neck. That is due to the transmission infrastructure not being looked at and planned, and those problems and questions addressed and answered before they moved forward with their process. So, you can juxtapose these two projects right here in the state as we begin to learn and design what will work for New Jersey.

And, here is just a chart that shows the capacity today for what's going on in Texas. In 2000 they were at 116 megawatts. And, they are on track by 2020 to exceed 25,000 megawatts. I think was also is to be learned from this in terms of efficiency of energy delivery, they are down to point five percent wind curtailment at this point in that project. So, as we look not only towards how to bring it to shore, but the most efficient way to bring it to shore and connect to our grid,

again, we can look back at the examples in Texas.

We've heard some from Germany, we also hear about the failure of Germany in terms of transmission planning of the reason why we should continue to proceed as we have been with transmission and generation being bundled together. And, while there are many options, there's models that we can look at. And, I think the biggest thing that we should learn is New Jersey should look at all the successes and failures around the state, around the country, and around the world and take from that all of the successes that we can and combine what will be best for New Jersey. As we look at Germany, and moving forward from the early part of the century as we approach this decade and going forward, as they began to plan transmission we see these projects coming in on time, under budget, and moving forward to the point where we're going to be approaching subsidy less transmission projects and wind projects in Europe.

And, now, when you look to the New Jersey, the concerns that we heard brought up by the fishery community, the concerns that we're going to hear from our friends from the environmental community, we understand that while

we have a vast ocean off of our coast, there are tremendous obstacles that we face in terms of shipping, fishing, environmentally sensitive areas previously a place where there could be used as -- (Indiscernible). And, we need to figure out a way to bring all of this power to shore, but be respectful of all those industries and all of those concerns. And stopping now to have a conversation like we're having today where we can bring all those concerns to light, and come up with a plan moving forward, will allow us to address all of those constituency concerns before we proceed with the plan, and give the state the most options that they possibly have in terms of how they proceed with procuring transmission and generation in the future.

And, the side that you see here before you is the shift of potential vision. One of many that I'm sure you will see before you today, and throughout this proces with other stakeholder conversations. But, the governor has a goal 3,500 megawatts currently stated, with two more procurements happening next year and in two years following that. But, for those of us, I'm sure everyone in this room who are on the call at the

Rocky Mountain Institute a few weeks ago, where they talked about the integrated energy plan and recommendations for how to achieve clean energy goals for the future, they recommended that the State of New Jersey look to something much more aggressive, more in the neighborhood of 11,000 megawatts. So, putting us 2,000 over, even over the very aggressive goal that's coming out from New York right now. So, if we were to think that the state is going to pursue something in the neighborhood of 11,000, you look at the image that you have on the right, and if we went with a generator lead line model, we see all of those cables that could potentially be coming from the potential wind leased areas into the shore. And, those of us who have studied the on-shore grid know that there are not nearly that many points of interconnection that are available to take this amount of power from these wind farms.

So, then, you look at the image that is on the left, and this is just one scenario that could be put forth in terms of a planned transmission that looks more like a grid. So, we can maximize points of interconnection. Many of us are studying some of them, have applications in,

are moving through that process. Right? So, you look at the points of interconnection. Those that can take the amount of power with the least amount of upgrades, and recognizing that the more expensive the upgrades the more expensive the cost will be for the ratepayer in the long-term. And, figure out a way that we can plan the transmission so you can come up with a grid, bundle the lines that are coming together, form a backbone grade or some other structure so that you are minimizing the disruption to the ocean floor, the disruption to the shipping channels, the disruption to the fishery community; but, you're also maximizing the efficiency of how you bring that power to shore.

So, just looking at those images on the right and the left, those are the kinds of questions that we have before us as New Jersey moves forward in this space. And, we, from Anbaric, are jus proud to be part of this conversation and discuss some of the ideas of how New Jersey can approach bringing this power to shore.

So, thank you all.

MS. PATNAUDE: Thank you, Janice. We appreciate Janice's technical assistance with the

computer.

And, next we have Francis Chartrand, and he is from Atlantic Shores. Thank you.

MR. CHARTRAND: Good morning, everyone. My name is Francis Chartrand. I'm from Atlantic Shore. Atlantic Shore is a partnership, a joint venture between EDF Renewables and Shell. I'm glad to be here this morning because transmission is definitely a key to the success of off-shore wind in New Jersey. So, that would be a first reason. And, the second reason why I am happy to be here is there is currently a snow storm where I come from.

I'll briefly discuss the European off-shore wind transmission at first. I'll discuss, as well, one case of US involved success. And, the third point I'll finish with will be the New Jersey transmission situation and COP options.

So, first of all, and what we see and what we have in Europe is 18 gigawatts so far of involved and connected off-shore wind. That's a good number. This is mainly in Denmark, Germany, Europe, and United Kingdom. And, there's another 70 gigawatts estimated by 2028. So, these are large numbers, and also tells that it can be done.

A TSO to ensure the on-shore and the off-shore grid developments are coordinated. Maybe Ulrik could give more feedback on that later on.

Each country has created its own transmission strategy based on the factors and choices. So, I think that's important. It's not a one situation for everyone, so it's different, different design and different ownership. And, that comment comes from one of my colleague from the UK, all European system implemented to date have good and bad points. So, there's obviously both. That everything involved rather than being planned from experience, so nothing -- no -- (Indiscernible) -- planned so far.

Another speaker from the NYPA off-shore wind report that was issued last August. What I like about that figure is you get to see the evolution of the different transmission efforts in Europe. I'll focus mainly on the grid design and the grid ownership. So, in terms of ownership you can that Netherlands was initially on the developer base, and they moved towards a TSO, transmission asset ownership. UK was initially a deadlocker, and they moved to separate entity, the off tow as they call. So, this way they were able to develop

8 gigawatt so far. And, there's also, there's Denmark that moved from developer at the beginning when they were a smaller project close to shore, and they are now moving toward a TSO.

In terms of network, so this would the HVDC solution for Germany. So, they are the only one that came out with that design so far. One explanation would be the grid bottle neck that they had, and also the cable landing was quite challenging, they had some environmental constraints. So, HVDC was a good solution for this. And, it's always a TSO that developed this.

This is the report I was mentioning before. So, I took a look at it and got some interesting points. Just wanted to share the main takeaways from that study. So, the first one is that the most effective path to low- cost grid power is through a scale and healthy competition. Second item, second takeaway, is model and views is dependent on variety physical and non-physical factors, including geography. Third one is visible, so the long-term grid banning on-shore and off-shore is important. It removes barriers to entry, improve coordination, and lower the cost. And, the last one, which might be a bit less

applicable here, but it's cross border for -- (Indiscernible) -- how countries leverage planned transmission and cross structure -- (Indiscernible) -- and gaining -- (Indiscernible) -- of scale. However, you can see that as maybe a cross ISOs that could be applicable.

As Janice was mentioning, we do have a success story here in the U.S., so this is the Texas CREZ. So, the energy was located western part of Texas, while the load was on the east side. So, there was definitely some constraint in terms of transmission line to bring the energy to the load. So, the Texas legislature in 2005 asked the public utility commission of Texas and the ERCOT to design the CREZ, so, the competitive renewable energy zone. And, they loved the transmission plan. The PUC identifies five CREZ in 2007, and ERCOT again to develop a transmission atomization study.

In terms of off-shore wind here or power load we can do to that for the CREZ is we have the bond, we have the lease. So, this job is already done. So, what's missing is basically a transmission plan. The PUC selected a scenario that would come out at 18.5 gigawatt of wind at a

cost of 6.8 billion dollars, and consortium was initiated in 2010 and completed in 2014. So, the implementation of the CREZ helped overcoming curtailment in transmission, as well. Which is something we need to keep in mind, their system upgrade -- (Indiscernible) -- but, eventually as more and more wind come in, curtailment will become an issue.

For the New Jersey transmission situation, so we do have some on-shore coastal grid. While the grid is not planned to receive the new generation, so this is known fact, we would require significant amount of upgrades to deliver the energy from the on-shore grid towards the load, which is more north. And, to safely do it. As I mentioned before, the congestion and curtailment should also be assessed. And, we need to include other resources, so it's great off-shore wind but there's also in the queue there is a lot of solar, there's a lot of on-shore renewables, there's storage, as well. So, that needs to be taken into account.

So, as stated here, this situation is similar to the CREZ, collective planning, a lot of or very large amount of wind energy to be delivered

from -- (Indiscernible) -- generation through shared facilities. State target is to have 3.5 gigawatt in service by 2030. So that's fast, so time is the essence. We need to work with options that are available now. So, if we want this to happen, it's really important that this be considered.

Coast lines and available point of interconnection, POIs, are limited, and their access are very challenging. So, lessons learned from Europe could also be looked at, especially for the next phase.

Last one, so, what the option for New Jersey transmission. So, we have the business-as-usual interconnection process for radial line. So, that's going to come up with reasonable upgrades for the first project, but they will ramp up quickly as more and more projects in the queue. There is I-risk on both the ratepayers in terms of cost for system upgrades, but also on the developers -- for timing, for example. It doesn't provide a coordinate approach to integrate other renewables energy. And, also on the good side, however, it does provide more flexibility, more control to the developer. Especially for the

first comers.

Thedic roam approach (Phonetic), so this would allow and this does exist, it can be used. It will offer a coordinated approach with other state goals. So, that's quite important. Transmission plan selected would optimize the system upgrade and increase reliability and reduce congestion and curtailment. Again, if you do that on a case-by-case, you might see the overall picture. But, if you do a coordinate approach, you could include that in your evaluation.

Time line is unknown, so that might be challenging. Time line to perform the study and everything. However, study could piggyback on other current queue position, planned upgrades, so the current projects could move on, continue, and the study could consider the upgrades that are really planned or getting planned for the current queue position.

So, based on European experience and other projects U.S., such as the CREZ project in Texas, the on-shore system required to connect the off-shore wind, must be planned. So, this is our position, this is our point of view. It must be planned and coordinated through the state agreement

approach. This should be a first priority to reduce the cost at the risks for the ratepayers and the developers, and to optimize the transmission asset. Thank you.

MS. PATNAUDE: Thank you. And, next up we have Mike Tabrizi from DNV-GL.

MR. TABRIZI: Hello. My name is Mike Tabrizi from DNV-GL. Just a quick introduction of myself. I've been with DNV-GL about eleven years, and I lead power system advisor practice within North America.

There was a lot of discussion made, which was great, and I wish we had more time to go through all this details. Before going through that, just a very quick introduction about what DNV-GL does. DNV-GL is a largest independent advisor in the renewable industry in the world. We have been involved in more than 97 percent of the off-shore project across the globe. German project, UK project, Danish project. And, we started, basically, being involved in U.S. project, as well. We have been in the shipping and the port industry for 150 years. Power grid, electrical engineering and planning for the grid for 85 years. Off-shore oil and gas, 45. And,

also, wind energy more than 30 years.

So, all the great stories that was mentioned before by Ulrik, by Janice, Francis, for UK, for Germany, for Danish, for CREZ, in fact we -- and especially my team -- has been heavily involved in all of these project for the last ten to twelve years. So, there was a lot of discussion that could be made, and that hopefully that time allows us to go through the details here.

Just European experience, as part of -- we have been involved in both Nordsee at the northeast off-shore development. We have been working with the TSOs, or the transmission system operators for 40 Hertz and also TenneT to plan our system. And, which basically includes a planning for the on-shore, as well as the off-shore grid. During that practice, which was all from 2015 to 2019, we looked at various scenarios under the on-shore, as well as the off-shore. For the off-shore we did not limit ourself to the dedicated genti line scenario. We also looked at a lot of other possible scenario in which we could have a bit of a stronger connection using these hand-based -- technologies.

We looked at radial connections, split

connection, backbone connection, as well as the grid connection. But, which is, each one of them that I'm going to discuss that they have their own benefit and cost. But, the question is how those benefit could outweigh the cost. So, discussion that was made that these project needs to be built by the developers, or basically become one with the generation or the TSOs, yes, we have had success stories, we have had failure stories. But, the conclusion comes out to be what is benefit to cost. That is the main objective here that, I guess, we need to focus on.

During those processes for the particular looking at project, we look at a lot of studies, and basically we try to evaluate the system, the grid on-shore and off-shore from a different perspective. We focus on the scenario will be for the future scenario of market modeling, which is kind of different from a U.S. to --(Indiscernible) -- that the grid compliance under American FERC, obviously European has different grid codes. But, the basic, the fundamental are kind of the same similar market modeling. And, then, we focus on the power system modeling itself. And, then, either from the basic and ready detail

costs benefit analysis to see which option on the on-shore and off-shore outweighs the costs.

Another example that we have been working, which is which is an ongoing project is a project called "promotion", which is the basic European white project. We look at the connection and work out the issue, there's a solution. Right? I mean, there is a discussion in a European regulators that all of the off-shore wind could go up to 99 gigawatts. And the question is, is the AC network sufficient enough to meet that requirement. So, that's why, you know, we started looking at the -- (Indiscernible) -- technology -- (Indiscernible) -- reliability and also decrease the cost.

Now, in the summary, what was the lesson learned doing all the work that we did on the off-shore and on-shore in the broken market. The first one is we need to have holistic approach -- argument that we need to go with the off-shore dedicated resources, or we need to compromise transmission with the generation, or we need to basically socialize the cost. But, each scenario is different, each country is different, each grid is different. What needs to be done is basically doing a detailed commitment to cost

ratio. So, I don't think at this state we can make a general statement by saying that obviously one of the option is going to outweigh the other one.

The other key was basically components standardization. Because we are looking for long-term strategies and aggressive target for the off-shore. Now, in this off-shore business there is going to be a lot of vendors and technology venders going to be involved. But, the question is, how this components will work together. If you start, basically enlist that holistic approach and thinking that how this component, HDVC component, AC component, the turbines -- how the -- (Indiscernible) -- system is going to work together, so that's other area that need to be really, really focused at.

And then lessons are learned was basically optimization using energy storage. Yes, renewable and off-shore they have a lot of averages. So, there is no doubt about it. But, without having a optimized transmission and storage solution, most likely we not be able to maximize the benefit of the off-shore. So, the question is where and how we should be able to use the storage to basically maximize the benefit, and how that

comes to the picture.

Other experience. Everybody talked about the CREZ. We have been involved as exclusive consultant for all the utilities that have been involved in the CREZ development. There are non-utilities. That the whole idea started 2005 by regulators, in 2008 PUCT basically approved the idea and the environment or was constructed by end of 2015. And, yes, that is success story, there's no doubt. It was a very successful story. And, in fact that was a socialized transmission. So, ERCOT is one of the territories in which the transmission cost is not going to be pertinent on the developer. So, basically, it's truly social, and the economy analysis needs to be done to be able to justify the transmission.

Now, yes, it was success. But, it is also some lesson learned. The main issue takes us today is amount of wind that more than doubled for last six years. The amount of solar got more than thirty times for last seven years. But there still there is a lot fulfillment issue. So, that means even though there was a lot of investment made to the Texas region, to the -- (Indiscernible) -- to the panhandle area, but the developers, they will

not be able to maximize their investment. And ratepayers, they are not able to basically take advantage of this free resources, even though free resources out there, but the transmission is not designed well enough to be able transfer all the energy without a significant fulfillment.

So, this is just a high-voltage picture of the all the CREZ project, or basically transmission lines. It is about 2,400 miles of the high-voltage transmission. Which basically was comprised of nine cumbent and incumbent transmission providers.

(Whereupon there is a discussion off the record.)

MR. TABRIZI: So, why this happen? Why the success story that we had for the CREZ, but you see there are a lot of fulfillment. And the reason is when the system was designed, not all the criteria was basically to the account. We are involved in a lot of discussion with the utilities and -- (Indiscernible) -- in the northeast, and I heard a lot of discussion about the transmission operate. And, when I ask them what do you mean by transmission operate, they talk about the transmission terminal -- (Indiscernible) -- but

from a CREZ standpoint and a CREZ experience for last ten years that we have been heavily involved, I can tell you that if you are going for aggressive targets for the off-shore wind, terminal overload is your lease concern, it's not going to be your first concern. A lot of other concern that going to play a major role in the design of the transmission. There's grid strength, all these inverter-based resources that are going replace the conventional units. That's a market. That's how market is going to lay out. So, what's going to happen to the grid strength? We are going to use a lot of inverter-based controllers with the -- (Indiscernible) -- controllers to the system, how all those controllers is going to attract with each other. Another major issue that has caused a lot of problem in the past and continues to cause problem even today.

-- (Indiscernible) -- into the grid stability. Even though terminal overload is there, if we have a line in the current -- (Indiscernible) -- that even though the line is rated for 2000 MVA, for very close to 2000 MVA, but that transmission line cannot carry more than thousand MVA today. Why? Because of the stability issue. So terminal

overload could be one of the issue, but it's not all of them. What's going to happen to the reserve requirements? That's also another issue, the issue that instead -- (Indiscernible) -- they need to take a look at. Probably not all the stakeholders is going to care about grid, I mean grid resiliency and reserve requirements. That's the sole duty of the ISOs -- (Indiscernible). And transmission congestion and curtailment is, I mean, you can connect whatever generation that you might have in the grid. But, the question is how much actually is going to be transferred to the ratepayers? How much of those is going to be utilized by the grids?

So, these are topics that I believe need to talk about. And, I don't know how much time allows, but I hope that we can have a great discussion here. Thank you for your time.

MS. PATNAUDE: Thank you very much. We're going to open the question and answer portion of this.

I would like to acknowledge that a number other BPU folks have entered the room. The glare is a little difficult to see people, but thankfully some folks are sitting in the front row.

In addition to Commissioner Holden and Commissioner Solomon, we have, I believe, Rob Glover, who is Commissioner Holden's aide. We have Stephanie Forest who is here with Commissioner Solomon. And, Beth Christian who is Commissioner Gordon's aide. And, if there's anybody I missed it's because I can't see you from here.

We have several staffers at the table. We have Abe Silverman, who is General Counsel. We have Jim Ferris, who is in charge of a number of the clean energy initiatives at the BPU. We have Cynthia Holland who is our transmission guru with FERC issues. And, I know Grace Strong-Power, who is Chief of Staff, was here earlier. And, Kelly Moie who is Deputy Director of the Division of Clean Energy.

So, with that, can we start with some staff questions for the panel?

MR. SILVERMAN: Yeah. Well, thank you all very much. I'll start with a clarifying question. This for Ulrik. You mentioned that the German and the English system, that the networks sort of the centrally planned system is more expensive. Is that comparing apples to apples, though? Because, I take it that the other system

is nothing but radial lines. And, how did you deal with sort of numerous potential landings that weren't coordinated? Is there a way to avoid that under a sort of developer integrated transmission planning process?

MR. STRIDBAEK: Thank you for that question. And, I was sitting here and I was regretting that I hadn't brought slides to nicely and clearly illustrate my points. First of all, coming back to Francis, also, and to the apples for apples. There are differences in these systems. There are big differences, also, between Denmark and Germany and the Netherlands, for example. And, how Denmark is actually going back to allowing the developer to do this.

But, the scientists in Berlin, they actually did go a very long way in really trying to compare apples with apples. Maybe it's granny smith with some other; but it's not apples and pears. And it's, you know, variations for interpretation of that study indeed, but it is frankly very clear. And the synergies from doing off-shore wind and transmission together are huge. The bridge system is very far from perfect, I will say. Many, many, many mistakes to avoid there, as

well. But, the synergies are very clear.

And, indeed, on-shore, the UK and Germany have different challenges, no doubt. And, some of the German challenges have spread into the ocean, and their choice of the solution there, are clearly enough.

So, I think for New Jersey different lessons to be learned there. But, the key one is don't at least allow for creating those synergies, because that's what matters for ratepayers. That's the thirty percent, at least. So, thanks.

MR. SILVERMAN: So, then, just let me follow up real quick. Is your vision, then, that every off-shore wind farm would have sort of its own generator lead line and its own land fall? And, is there a way to have a sort of integrated model, but to avoid having, sort of, you know -- well, and Janice's picture was wonderful, eleven versus three interconnection points.

MR. STRIDBAEK: So, I think absolutely believe that both in Europe and the U.S. we will need to figure out more intelligent ways of using the landing points intelligently, allowing for -- as you said, allowing for off-shore transmission, becoming also a strengthening on the on-shore

capability. These kinds of things, that's what we need to develop. We don't have the answer how to do that.

I know for sure that you here in the U.S., you are very, very good at creating incentives. We are a little bit behind with that often in Europe.

MS. PATNAUDE: Do we have any other questions from -- Jim?

MR. FERRIS: This is for everyone, I think. So, Europe clearly has chosen several different models. And, I'm wondering if there are any specific factors or conditions, site conditions, total capacity, regional capacity, a number of projects, that tend to drive -- (Indiscernible).

MS. CHARTRAND: Well, maybe, for example, UK, they have a huge amount of coastal shore lines. So, that makes it much easier to access the grid and have multiple point of interconnection. As if you go to, I believe, Netherlands and Germany, it's much more restricted. So, you're correct, it's a big factors into this -- (Indiscernible).

MR. TABRIZI: So, system

characteristics under the policy's generation is -- (Indiscernible) -- another important factor is how the market operate. Is it are we having the same market structure, market -- (Indiscernible) -- convert to European market? This is also another area that needs to be looked at.

So, and one point to the previous question. I, personally, I don't have any one opinion on that off-shore transmission should be built by the states or by the TSOs, or by the resource entity. But, my only concern is whatever way we figure out, the question is how we make sure that the off-shore transmission is planned to accommodate the entire mandate, and not only the specific project. To me, that's a key area that we need take a look at and need to consider regardless of who is going to build what.

MS. HOLLAND: Thank you. I did have a couple of questions just to, I guess, round this out. I really appreciate the different presentations regarding the CREZ. One of the things that I wanted to touch on is we had asked a couple of questions about the concerns about -- (Indiscernible) -- and I was curious to what extent any of the panelists wanted to comment on that. Or

not.

All right. Well, then, with regard to the environmental concerns that were raised with regards to fishery, I was curious if there were any lessons learned from European models and experiences there. Because certainly the fishing industry and environmental concerns were presented in Europe, as well.

MR. STRIDBAEK: I'm happy to try to answer that. So, in all the oceans we are active in there is also fishing going on, a lot of fishing activity. And, we have, I think, good dialogue with the fishing community, and developed different solutions. Of course, both the fishing methods and at least what the fishing is focused on is very, very different from place to place. So, having heavy equipment at the bottom of the ocean is, of course, a different type of challenge than we have, for example, in Denmark. So, this is an area where we will have to find solutions together, no doubt.

MS. PATNAUDE: Anyone else?

MR. FERRIS: Just one specific follow-up question for David. You mentioned telecommunications cabling. Is that a model that

we should be looking at?

MR. WALLACE: The fishing industry, the telecommunications industry, and the DEP spent eighteen months meeting once a month for the whole period of time, dealing with all the issues that each of the participants needed to be able to accomplish their operation. And, so, I think that if -- there are a number of similarities, and, so, therefore, I think if you looked at the legislation and contact the folks at DEP that participated twenty years ago, they could shed light on how compromises could be made where everyone gets to do what they have to do without having very large extra capital expenses or operating expenses. And, it worked very well, because where we used to have a lot of conflict with the telecommunication cables -- which we didn't want and they didn't want -- once we designed the systems properly, that essentially went away. Except when we had large storms that washed out the cables. And, one of the things that we ran into there was we would then notify the telecommunications folks -- cable ABC at such and such coordinate is on the surface and you need to do something about it. And, they cost billions of dollars, so it's not like these were

just cheap little things that they throw away. And, generally huge amounts of revenue for a second. But, what we found, none of them had a budget for going out on an emergency manner and re-burying their cable. And, so, one of the things that everybody should do is have a sludge fund for those kinds of eventualities, because sooner or later it's going to happen. And, when we -- there's some high-voltage in a telecommunications cable, but it's not going to light up a steel ship. If we penetrated a power cable, a live power cable, we could have a serious problem because we are hooked to the ship through a steel cable to the gear on the bottom. And, so, we need to make sure that safety is a factor.

MR. FERRIS: Thank you.

MS. FULLER: While it's not -- you asked previously about lessons from Europe and also fishery -- (Indiscernible) -- it's not that -- I think one of thing -- very recently I traveled to the gulf region, and while it's a very different industry, I think there are some parallels and synergies that we could learn from how the oil and gas industry has built their relationships with the fishing community there, in terms of their advanced

planning and how it is a very cooperative relationship that the energy industry and the commercial and recreational fishing industry in the gulf has developed over the last few decades that I think is something that we could look to as we proceed with energy development here.

MR. SILVERMAN: Francis, you -- first of all, I think you mentioned time line unknown for the third-party developed systems -- so how do we deal with that? Is it like sequencing these items, and the commercial risk associated with the cable not being available, say, like Orsted or Atlantic Shores, how would you address those commercial realities that make it -- and sequence it in a way that minimizes risk for all parties, also to having to organize off-shore backbone?

MS. CHARTRAND: Thank you. That's a very good question. If we look at CREZ, it took over ten years for the whole thing to be done. And, I think that was a success. I mean, I don't think it was too long. I think that's reasonable.

One way that I personally see that this could be done is to go through phases. And, that was also mentioned in previous stakeholder meetings. So, we can continue with the first

project we having a stand-alone connection, but what's important is to take into account the upgrade that would be done for both project, and include that in a more global approach, more on-shore study approach. So, this way the first project get to continue with a stand-alone radial connection. But, what my presentation was focusing is mainly on the on-shore upgrades instead of everybody -- (Indiscernible) -- and, it's to really let them do their first study. But, the overall planning will include those upgrades so at the end it can be brought back to a more global planning.

MR. TABRIZI: If I may. Well, I mean, that's a great question. And, not that I know the answer to it. But, that was one of the main challenges that what happen to Europe. And, I wish I could show my slide and I was not able to. But, depending on the congregation on the off-shower -- and now I'm talking about the off-shore -- we need to have that long-term -- (Indiscernible) -- we cannot solve the problem on pieces as long as we have that long-term road map, and take into account what technologies could be placed. Because there are a lot of technology out that in fact are not compatible to each other.

And, so, I mean not that I know the perfect answer for it. But, to me that is a great question and a great challenge.

MS. PATNAUDE: At this time I'd like to take some audience questions. We don't have a lot of time. But, if you could come up to the podium in the center and identify yourself and the entity that you represent, that would be great.

MR. TIDDLE: Jeff Tiddle, New Jersey Sierra Club.

I was wondering in Europe and some of the other projects that you've looked at in the off-shore backbone versus having once you land on shore to have to build new power lines to bring it to market. So, one of the things that we see in New Jersey, at least the Sierra Club's perspective, is if the lines from off shore come in down, let's say, Atlantic City or below, Cape May with the project off of it, that grid there is fairly old and would have to rebuild or you'd be building a new power line to bring it to market to the Pinelands to South Jersey, or up the Parkway.

And, so, I wondered if Europe has been experienced on which works more cost effectively to try to bring in a backbone or bring it on shore and

then have to build a new structure on shore?

MR. STRIDBAEK: Try to answer that. So, again, maybe Germany and a country like Denmark or UK has opposite ends of that. And, by the way, there is only one almost example of a backbone, and that is a project where off-shore wind farms connected both to Denmark and Germany. And, it hasn't been really built yet, it's under construction. So, a very, very thin experience.

But, largely in a country like Denmark there has been quite foresighted transmission planning and transmission construction over several decades. And, the transmission operator there has managed to stay ahead of the curve, and being able to absorb the power and take it to load centers. And, I believe so in the UK, as well. Whereas in Germany, that has not been possible. It hasn't happened.

So, very much agree with the comment that on the on-shore transmission you really have to think ahead and have at least a long-term plan. So, that's one thing.

The second thing is the mood, I believe, in Europe now is that certainly for us in the industry is that we went through the maceration

or almost through the maceration of off-shore wind. Now we are ready, and we need to accelerate. Because if we are going to have electricity to transport electricity into heating into the industry, we will have to build up a lot more and a lot faster. And, that cannot be done, we believe, without having some form of development of a backbone service system where you start to connect countries while connecting off-shore wind.

So, this will happen. But, we don't have a model in Europe either. This is entirely new, as well. And balancing incentives, planning requirements, and capturing the synergies, it's --

MR. TIDDLE: I guess, because a concern here is, you know, that if you end up having to build a backbone on land instead, that it may also have a lot of environmental impacts or worsen costs, too.

MS. FULLER: I think the question really highlights the biggest point. Right? That we should think about answering these questions ahead of time. We know where, roughly, the power will come from. We know roughly where the power needs to go. And, to answer those questions ahead of time so that if the on-shore grid -- the

upgrades of the on-shore grid can be maximized in terms of their efficiency so you're not building one cable and then five years later have to install another one. And, answer those questions now instead of down the road.

MR. TIDDLE: I guess the other point, I don't think it's being done yet in Europe. But, on of the things versus a private company coming in doing the transmission. Have the wind companies themselves thought about having a consortium to do it themselves, versus another company create their own? Is there any movement like that in Europe, or no?

MR. TABRIZI: I mean, my information in that regard would not be great. But, I think there was effort, but it just didn't go anywhere. And, just a quick add on each to your previous question, I agree, we got a really clean experience when it come to off-shore network, the only one is Germany, Danish, Denmark.

But, that being said, our analysis shows that sometimes only focusing on the cost, it doesn't give you the whole picture. There has to be trade off between the cost and reliability. And, one of the main issues when it comes to

off-shore is the concept that we -- (Indiscernible) -- to the point of failure. That if one failure happens in one of the equipment, are you going to lose the entire off-shore? So, that's why sometimes we need to look at off-shore network and we can trade off the cost. Which will be more? The cost, or the reliability of the off-shore?

MR. TIDDLE: Also, I guess the other factor should be the environmental impacts versus off-shore and on-shore if you have to build --

MS. PATNAUDE: Thank you. We're going to take one more question, and then we're going to take our break.

And, I would like to note for the record that Commissioner Gordon has joined us.

Do we have another question from the audience? Then I guess we're going to take our break.

There are restrooms on this floor. If you're looking for a quick coffee, if you go out the door to the right, down the street, then make a left, there's a Starbucks on that block.

MS. HOLLAND: I just wanted to say thank you to all the panelists.

MS. PATNAUDE: Yes. Right. Thank you

very much.

(Whereupon a short recess was held.)

MS. PATNAUDE: So, Panel 2 is off-shore wind transmission framework. And, we're going to let Josh Gange first, because his presentation is already in the computer. He is with BOEM.

Josh?

MR. GANGE: Thank you. And, people can see the presentation. Correct? Excellent. I just wanted to make sure.

As she mentioned, I'm Josh Gange with the Bureau of Ocean Energy Management. We are the federal agency tasked with managing renewable energy on the outer-continental shelf. So, the off-shore wind or transmission projects we're talking about today -- at least on the ocean side of things. The main land side of things, please, don't ask me any questions.

So, don't worry, I'm not going to read you this slide. This is the general federal regulatory framework for the renewable energy system. Basically, what it says, is that the Secretary of the Interior is tasked with providing leases, easements or other legal instruments to

provide for renewable energy development in a responsible manner on the outer-continental shelf. In fact, no one can develop renewable energy without one of these legal instruments.

So, again, all of our leases that we provide to off-shore wind developers, the lessees, once they have that, the regulations actually provide for one or more easements to a transmission connection point on land for a full enjoyment of the lease. So, that is a non-competitive process at this point. So, what happens is they would say here's our preferred connection points, and then a lot of survey work and consultations go into determining whether that's appropriate. And, they negotiate the right to connect to the grid with the state utility or other entity involved.

In the case where you where you would have a third-party working to do a transmission project, the instrument involved there would be right-of-way grant. And, I'll go into that a little bit more.

So, all of our processes require a competitive process, unless it's determined that there are not -- there's not competitive interest. And, so, what that means is, when a developer says

I'd like to do, put a, let's says a regional backbone system out on the OCS, we first have to go out and say are there others interested in doing this. And, that goes out in the federal register, and a request for competitive interest. We get comments back, and then try to make that determination whether there is competitive interest. If there is, it will typically go to an auction process for the right to that grant.

Once the grant is issued or -- well, actually, I should step back -- BOEM then look to determine whether it's in the public interest to issue that grant. If it's determined that it is, that grant would be issued to the entity, which will then kick off a number of NEPA related environmental processes and consultations. And allows the developer to propose a project in the form of a general activities plan, or a gap -- which involves even more environmental and consultative processes.

So, a little bit of the details on what a right-of-way is. The grant holder is first qualified by BOEM, so you have to then first come to us and be legally, technically, and financially qualified to both hold a lease and develop the

project you're proposing. So, there's a little bit of a process there. If a right-of-way is issued, it's two hundred feet in width centered on the cable. Greater widths can be added to along the length of that cable for safety or other environmental needs that has been demonstrated after survey work.

The grant does not prevent the granting of other rights by the United States. This is not necessarily an exclusive grant, so other cables could cross the grant, other cables could run in parallel to the grant. This could go through or around leases. Leases could be kind of cohabitating, depending. And, also, any activities we authorize can't unreasonably interfere with other approved activities or existing operations. And, also, any grant that we're issuing, the holder would agree that any other user may use or occupy any part of the right-of-way that's not actually used. So, typically what we would see is someone would say we want to put it in this general area, but then they have to go out and do quite a lot of survey work to determine the exact route. Once the right-of-way is issued, hopefully that's narrowed down and they'll give back sort of the unused

portions.

And, it should also be noted that BOEM does require financial assurance for any projects for decommissioning. So, the developer is responsible for return the sea bed to its original condition at the conclusion of the projects.

So, that is the general regulatory framework for a right-of-way grant, which would be a third-party transmission system on the outer-continental shelf.

I'm going to try and keep it brief because I figured questions are more important than me talking about the regulatory code, unless you want to do that later, come find me. Thank you.

MS. PATNAUDE: Thank you. Next up we have Doug Copeland from Atlantic Shores.

MR. COPELAND: Good morning everyone. My name is Doug Copeland. I'm the development manager for Atlantic Shores off-shore wind. We are a fifty-fifty joint venture with EDF Renewables, where I've been for ten and a half years; and, Shell New Energies. We picked up the northern New Jersey lease last December. And, submitted and OREC this last year. And, are excited for the future solicitations. But, really here today to

talk about transmission, as you all are, as well.

And, inside of Atlantic Shore, one of my main roles is our interconnection strategy. And, so, been looking at all the different opportunities for us to connect here into the state, both radial lines but also thinking about transmission in the future. And, I think sort of the main thing that you heard from Francis, who spoke earlier from Atlantic Shores -- and that I will echo again today -- is we really prefer a solution where the state takes a big lead in all of this. Even though New Jersey is part of PJM, we'd like to see New Jersey really kind of take that lead on its own, with close coordination with TOs. They know this areas better than anyone else, as far as transmission; and, we'd like to see them play a very active role in that overall planning.

And, initially, it's about bringing the transmission to the beach. It will be on us as developers to get to the beach, but that if the transmission lines can come directly to the shore from wherever the points of interconnection are on land, we can get them to the shore from the projects. And, I think that kind of the key with all this is as the state is thinking about where

these transmission lines are going to go, two critical things; one, is that we don't want the transmission line from one project to basically prevent another project from getting to shore, or make it extremely difficult. And, part of that can happen because, well, you just don't cross the cables. Right? You have a lot of work that goes into armoring them up to make sure that they're protected. And, ensuring that that occurs in areas that aren't' going to have a really negative impact on fishermen, because any commercial fishermen are not going to be able to fish near an area where a cable is crossing.

We just want to make sure that all that kind of overall planning, which is in some ways kind of step two, once you figure out what the big plan is going to be, is take into account going on, just because you are going to have multiple radial lines, especially with the early projects. And, we just really want to see some close coordination with all of that.

So, I look forward to the panel. Thank you.

MS. PATNAUDE: Next up we have -- I'm going to start at the far end of the table with, I

believe, Kirsty Townsend from Orsted.

MS. TOWNSEND: Hi. You'll by tell by my accent that I'm British with a Scottish name, Kirsty. But, I'm pretty good at responding to that now. I work for Orsted. I've worked for Orsted for eight, nine years, but in the off-shore wind industry for ten, fifteen, which to be in the industry is quite a long time. I've been working on the U.S. project for sort of six months/twelve months. And, my experience comes from Europe. I guess from the panel earlier, the key point I would say on touching on this is the whole European system is really different. The way that we assign wind projects in the UK, for example, is just completely different to how you do it in the U.S. Although, there were lessons learned there, I would just be a bit cognizant to really focus in on New Jersey's issues, what you develop will not be what we see in any of those markets in Europe.

So, starting, I guess, from the beginning. Your existing transmission development framework and the radial lines will get you your 3.5 gigawatts. You kind of don't need to do anything more. Where it gets interesting is if those targets considerably exceeded. If New

Jersey really increases it's three and a half gigawatts. Janice mentioned a number of eleven. Or, if New Jersey sees itself as the state to green coastal power to inlet states all the way through to neighboring states, then your system constraints, your on-shore system constraint is how you get that power to load becomes the key issue that needs to be resolved.

We've been working really hard in New Jersey with ocean wind and the future bid project, which a lot of work goes into on how to get that power to shore. And it's tough. Just getting one cable landing is really challenging, and it's complicated on the permitting. This is a baby industry, and we're developing it as we go. So, just again, to keep in mind whatever we do there let's not slow it down, or find a way of allowing the industry to continue to develop while the sort of wider, broader plans come into place.

So, stepping back. Even that world where you've got that bigger target, that grander ambition, if we're talking about shared assets, traditionally the value of those shared transmission infrastructure projects comes from clustering. But, now, either as we've seen from

Germany, that was when we were dealing the 3.6 megawatt turbines and 400 megawatt projects. And, that's just kind of old news. The U.S. has come into this right at the beginning, you would go straight into the big projects, the eight hundred plus, one gigawatt plus. And, that's where you need to start and continue to build forward.

So, actually, the value of shared transmission of planning isn't from shared export cables. It actually, we think, will come from supporting that on-shore system. Supporting and resolving the constraints that you have from getting supply to load. On-shore congestion, avoiding expensive operating costs, or politically prohibitive upgrade costs on shore. Or, avoiding really sensitive environmental areas. Your off-shore transmission planning could be the tool to do that. The same goes with landing points and that interconnection of how to do it from that.

So, I guess, the recommendation would be to look at, with a broader ambition, thermally and stability-wise where are the top spots in New Jersey? Where are the key points? What is the key issues that you want to solve? And, then, as far as I can tell, the U.S. has got the best incentive

mechanisms in the world. So, use that model, use that competitive prowess. Use the existing regulation you have, adopt your public policy planning process with PJM, and put that out to market to competitively solve those specific issues in those key phases.

The one thing I would say, which I'm going to say because I mostly represent the developers, but it really is true, is that keep the option open to maintain those synergies between the development of the generation and transmission assets. Particularly during the next five or so years when we're meeting those initial targets, and we're already struggling enough. The synergies come from all sorts of areas, not just the sort of coordination effort and the overhead and procurement and the actual electrical interfaces. So, although I like the vision of a full coordinated system, it would make our lives easier in some senses, as well. We've got to do that knowing the technical constraints and the ambition and the real issues that New Jersey want to solve.

If any of you guys have questions on the UK's update system and the problems there -- it's probably not for this panel -- but, I'm more

than happy to explain in detail the pros and cons and the trials and tribulations that the UK has experienced. Thank you.

MS. PATNAUDE: And, next up we have Sue Glatz from PJM.

MS. GLATZ: Good morning, everyone. I'm Sue Glatz with PJM. Thank you for the opportunity, really, to join into this discussion about off-shore wind. So, we're happy to contribute to this, and really welcome this opportunity to talk about the transmission impacts. And, certainly since New Jersey, as well as the other states along the coast are a part of PJM; and, so, this is going to have a significant impact on our process. And, so, happy to share some of our perspectives on transmission planning with respect to integrating renewables.

So, just kind of start just a little bit of a background. I just want just give you some sense of our understanding of what we see happening with renewables across the PJM grid. So, what I have up here is some data that shows some of the targets for various PJM states. And, some of them are fairly ambitious or aggressive, I guess I would say. And, this was actually prepared just

earlier in the year, but we did update two of the numbers because Maryland, Ohio there was some recent changes. Even though it says -- September 29th, so that reflects some changes. And, I think a key point here is to recognize that these goals that the different states set, they are dynamic, they are changing. And, so, really are a planning process. We need to be able to respond and react to the dynamic nature of the goals that are out there.

So, the next slide about off-shore winds, let's talk about what's actually happening in the wind development. And, what I have illustrated up here shows the time framing between 2005 out to almost 2030 -- not quite. And, showing what's been developed and what's in service. And, looking towards the future, what are the targets that are out there. And, this is cumulative, so this represents all the PJM states, not just New Jersey. But, you can see the targets are increasing quite a bit from where they were. So, we have through 2018 roughly about --- not quite yet ten thousand megawatts of wind generation. But, looking out to the next ten years of development, that looks like you're going to be

over 35,000. And, of course that's -- because while it's across PJM, we know that with the off-shore wind it's only in a few states, really, that you're going to see that type of development.

So, a couple of takeaways is that to date the RPS targets this type of development. Really has been happening just through the PJM markets, so the markets been able to respond and meet these targets to date. Now, the question is with what's in the queue and what these targets are going out there, things to thing about for New Jersey really is the type of framework through our interconnection queue. Is that really going to be sufficient going forward once the number of megawatts really starts to substantially increase? And, so, one of the things that we would recommend for the industry, really, is start to think about in New Jersey, as well as the neighboring states, is what do they see as the ultimate build out and the framework of our interconnection queue? Is that going to be sufficient to meet what those future targets are. That's one of the things that we would encourage some thought about.

So, since this is about transmission framework, what I want to talk about now is what

are the options day for developing renewables and to fill our off-shore wind? So, There's really two paths. There's the interconnection queue, which is what really is supporting all the renewable generation today that is coming into the PJM system. And, the other option I think you've already heard mentioned about, and that is what call our state agreement approach. And, that is the avenue that was really developed and envisioned to address public policy needs.

So, let me first talk about the interconnection queue. So, those seven or eight thousand megawatts of off-shore wind, they came through the PJM's queue. And, we expect this is still going to be part of the process going forward. So, what is the queue? It's a rights-based process. So, essentially, the first in line has the first access or the rights to use the grid capability on the system. And, when you get through studying for the process and you pay for any upgrades to accommodate your generation injection into the system, then those rights, those injection rights or interconnection rights are preserve for your project.

And, this applies for merchant

transmission, also. Our queue accommodates merchant transmission that may want to interconnect between PJM and neighboring RTOs, as well. And, one other comment in terms of the generation queue. That project, they're responsible for all the costs to interconnect it. So, that's not only the actual direct connection type work, the substations and so forth just to bring in the project, connect it to the grid; but, also if there's any impact to the grid, that it creates any overloads on the system or any reliability violations. Then they would be responsible to pay for whatever transmission upgrades or expansion to accommodate that generation.

So, that's the interconnection queue path, and that's largely what has been occurring to date to interconnect the renewables.

Another option is the state agreement program. And, as mentioned, so, this was a process that was laid out when the auto one thousand was developed. And, this was the path that states, that identified what their public policy needs are. And, then, that would allow PJM to study those particular policy needs or ultimate outcomes that they're seeking to achieve for the

public policy such as integrating renewables. And, with that analysis we could identify the upgrades. And, then, that would be funded by the states to do those upgrades. And, that could be one state, it could be multiple states. So, it's not limited.

The key message there, though, is the state would identify that policy, and they would have a lot more control over not only what types of, you know, determine what those upgrades would be, but also who would be responsible to construct that transmission. So, a little bit more -- they're paying for it, so they have more control over that. And, through that, then those rights would be preserved through that policy.

So, those are the two approaches that could be taken for the future development of the off-shore wind. Things to think about that we would encourage New Jersey, as well as all the others stakeholders in this industry, is to think about what do you see as your ultimate build out? And, I think others have also brought to that point. Because recognizing, you know, what's your long-term goal. And you want to try to be able -- you can more consciously make decisions about how

much investment you want to make today versus the future. How much flexibility, what trade-offs are you willing to take in the sense of maybe minimizing impacts to some of the landing points of the substations that you would interconnect with. Or, even minimizing the amount of upgrades to have to go back and revisit transmission lines that you've already upgraded for one project, versus maybe a more coordinated plan, or recognizing that the timing of when these actual upgrades would be needed. So, it's not to say that one is better or not; but, it's more about being able to consciously decide how much flexibility you want to accommodate your future build out. And, so, you would take control of that planning.

And, I guess again, it's really about trying to maintain some flexibility so that, also, you don't lock yourself in to early into one path. And, I guess one last thing that I would share is that while there may be various options in terms of radial or network, and talk about the off-shore grid; but, I would say there really needs to be a lot of thought about the on-shore grid because there are only so many available substations today, there's only so many lines today. And, so,

regardless of whether you do radial or network, and what you do off-shore, eventually it's going to rely on the on-shore grid to really reach customers.

And, so, with that, I will turn it over to the next speaker.

MS. PATNAUDE: Thank. And, now we have John Dempsey from PSE&G.

MR. DEMPSEY: Thank you all very much for having me today. It's good to be here representing PSE&G on this panel.

I'll just start off by saying that PSE's objective in participating today is really to help identify the lowest cost solution for New Jersey ratepayers. With that, I think our perspective here is that while radial lead lines certainly may be effective for the initial stages, we do view there being a couple of challenges to the radial method being the most cost-efficient going forward. Those challenges have largely been discussed already. I'll jus touch on them briefly.

The first is the interconnection queue process, and the second is just the constructability piece. On the queue process,

specifically, right now developers are incented to file multiple interconnection requests. This is really for two reasons. One is to really make sure they don't put all their eggs in one basket, let's just say, for interconnection spots. As Sue just said, there's only a few places to interconnect, and they want to make sure that -- you know, they don't know what those upgrades are going to be until a couple of years down the line, and they want to spread some of that risk out.

The second reason, though, is -- let's also be honest -- when they have more than one interconnection requests in, then later entrants to the market aren't able to access those same stations just because they would be behind them in the queue. So, I don't think the existing queue process works for really anyone here. Obviously on the state side, when you're selecting a project without knowing what the upgrades are there are some uncertainties there, as well.

As Sue indicated, PJM can't really just adjust the rules. They are universal to every generation resource in every state that's trying to enter the grids. So, again, it's not something that can be fixed easily. I'll also

just say -- and I think it was mentioned at the start -- that congested queues also can inhibit other renewable development. When you look at portions of New Jersey that have land for a lot of solar, it's mostly in the central and southern part of the state. Which is, obviously, where a lot of the off-shore wind will be impacting. And, when you have -- I think Sue, you mentioned 8,000 megawatts in the queue, you know, if you're a solar developer that's trying to put 200 megawatts on that grid, there could be some downstream implications. It could be harder for you to figure out where to go, given all the activity on, really, a relatively few number of circuits that are higher voltage. And, by that I mean above 230 kV.

On the constructability side -- I don't need to go into it -- they're all bad options along the coast. There's no good option, it's just what's the least bad. So, while I think there are certainly ways to get in there for a handful of projects -- and I'll also just note, and anyone's that's followed renewables in the United States over the past decade -- local permitting for transmission has been a challenge for renewable projects, whether it's these merchant transmission

projects in the north, or whether it's even state-sponsored renewable projects in New England trying to bring renewable down via long transmission lines. So, it shouldn't be taken for granted, the challenges associated permitting transmission in New Jersey.

One of the questions in the notice -- and I'll try to keep this pretty brief here -- one of the questions in the notices was about joint planning authority between New York and New Jersey, or I think it was a regional was the way the question was posed. I think electrically it makes a lot of sense. Certainly there could be some efficiencies in trying to combine some of these investments. I think politically, from a regulatory perspective, it would be incredibly challenged. And, PSE&G knows that, along with the BPU and others in this room that have been involved in some of those seams issues with our neighbors to the northeast.

I will say, as Sue mentioned, the PJM tariff on public policy process -- I think she summed it up well -- it seems like it gives the states a fairly wide latitude to determine the types of projects they want to do. And, also, to

identify the people to implement them. And, Sue can answer more about this; but, my understanding is the rules are sort of up to the state. So, what the process looks like, how long any sort of planning process goes, I feel like those decisions can be made jointly with PJM. But, Sue can answer that.

Final thing is if there is some sort of a third-party transmission approach, however it may be executed, a couple of things on that. I feel like there's obviously a lot of lessons learned over in Germany. I think it would be not very difficult for us to speak with the German transmission owner that owns some of those things, and some of those market participants, to really get behind the, I'd say, the higher level to understand what the real issues were; and, how to design protections in the tariff for the developers, to make sure that if they build a project there's going to be a transmission line there to serve it.

I also think if there is some sort of third-party transmission solution, developers should have time to incorporate what that solution is into their bids. So, their efficiencies, for

example, if you can eliminate an off-shore collector station that goes from 66 to 230, but that 66 could be fed directly into a converter station, you can save the cost of that 230 step-up station if you're an off-shore wind developer. So, it's important that the developers don't propose a project without knowing kind of what their transmission solution is. This may result in some delays to actually executing some of these -- putting out some of these generation RFPs. I don't think we're talking about year-long delays. I think we're talking about a few months.

Finally -- and, I'd be curious, Josh -- this is an idea I cooked up in my head, and I'd like to get your perspective on it. But, my thought is that if there are third-party transmission participants like the TOs, it would be helpful if the developers were in some way obligated to allow the TO to access portions of their BOEM lease area, and allowed to utilize their right-of-way grant. And, I can envision the BPU allowing this or making this a requirement in some sort of procurement so that the transmission owner does not need to independently go through the BOEM process, the rules of which I think are fairly

uncertain at least, as we saw in the Anbaric proceedings earlier in the year. So, it's just an idea. Again, I might have my lawyers look at that. So, I guess we're getting quoted here, so maybe I have to own it. But, that's it. I look forward to your questions.

MS. PATNAUDE: Thank you. I'd welcome staff back to the stage and see if they have any questions first.

MR. SILVERMAN: Just one housekeeping, though. We will be asking all the panelists to make their presentations available, by the way, and publish those on the website. So, we would very much appreciate that.

I was really struck by that last comment. And, talking about how would we best use sort of limited rights-of-way, landing spots, and how do we coordinate that. Is that something where if we were to adopt a radial system, can we? Can we under the BOEM rules let other people use it? You seem to say it wasn't necessarily prohibited from doing that. And, then, from thinking about it from a cost perspective, okay, so, Developer A has put a lot of money into building the radial line, if we then allow other

people to use it at some point in the future, is that something -- how would the cost responsibility work? How would outage risk work? So, basically, is it legal, and who pays for it.

MR. GANGE: I'll take the first part of that. You know, our goal, sort of leasing that right-of-way instruments are not necessarily exclusive. So, provided that it's demonstrated that something can be a cohabitated area, or a cable crossing agreement is put in place and is demonstrated to be safe and isn't unreasonably interfering with another leaseholder's rights, that is something that could be examined. I don't know that I could say that it would automatically be granted, because there would be some analysis that would have to go into that. But, yes, there is a -- when we grant a lease or a right-of-away it is not an exclusive lease.

And, the, for the sort of cost issues, I'll turn that over to --

MR. COPELAND: I need to jump in a little bit on the cost. The devil's in the details about where the transition occurs. Right? So, if you had an underground vault shore side that a project, when you run from the water and then from

there went onto the grid. And, that vault became a part of Exelon system. Right? Because you're in Exelon East territory --

MR. DEMPSEY: Sorry. PSE&G --

(Whereupon there is a discussion off the record.)

MR. COPELAND: So, with that comes the scenario where you could either have a smart on shore facility that could accommodate multiple projects. And, that you could have an efficiency where maybe the first project builds extra ducts, or some way of getting from, you know, a quarter mile off shore to that duct. Now I'm getting in the weeds here. But, the issue is that costs money. And that when we are in a highly competitive process, and then we at Atlantic Shores would be bidding against someone else. If we were to add some 20 million dollars or 50 million dollars -- whatever that cost is to our project -- how does that get counted for us if that's the value. Or it, quite clearly, would be counted against us, because not it's just an increase in our CapX.

And, so, that's really the -- I think part of the issue for the BPU to decide is would

you like these things included into a project that aren't part of that project; and, if so, how does that project not get deemed for it. Because it's definitely more efficient if you're going to run one cable to shore, that you run one or two or three more conduits in that general area, you cap them, and it allows for much less impact later on. But, how does a project not get penalized for good planning.

MR. SILVERMAN: I would say, that is -- I feel like we have our first topic for your reply comments to address. Because I think the way you just phrased that is a wonderful thing. We'd love to see people's ideas about that.

MS. TOWNSEND: So, just to build on that. The ducting is one. You can also add additional spots off-shore for circuit breakers that allow flexibility to connect to the other wind farms, giving you that future option to have multiple existing farms off shore. So, you could open that flexible system, maybe as an interim for a much grander longer-term plan to keep your options open in a interim period. And, then, again, it's ducting landing and interconnection, and it's also reliability. So, using an example

from some of our projects in the UK, reliability has become a concern, similarly you try to bring the power down into congested areas from supply to load. And, actually, they're using high-quality battery storage integrated into the wind farm to provide that additional stability to the whole area.

So, again, that's just three different types of ways. I'm sure with the innovation from the tech teams there could be more that give you those solutions until you've got a grander plan in place.

MR. DEMPSEY: Are we talking about bringing that duct bedding off shore by some hundred meters, or are you talking about on shore?

MR. COPELAND: So, I'm envisioning that you have -- the way I was describing it is you have multiple ducts off shore, maybe a kilometer or depending on the depth of how close you can get to shore with your -- (Indiscernible) -- vessel. And, then, you would directional drill from an on-shore location out to that point. Then you can cap them, they would be buried, they would be marked on the other buoy, on whatever appropriate safety measures are there -- this is going to be a place

that future projects can come into. That's just one idea of picking up. The other one, you could have, you know, a larger cable that's carrying from a substation that's, in essence, under built for future so you have just one larger cable. Which is I think like the UK system, which I think has had some problems. Our UK guys tell me that's not what you want to do. But, I think that that's what I was suggesting.

MR. FERRIS: I'd like to explore that timing issue. Josh, how long does it take to grant right-of-way; and, then, from the developer perspective, where in the development process do you start to need some certainty as to transmission solution?

MR. GANGE: Yeah. On the timing it's from, I guess, issuing the grant to construction, is at least a couple of years. Because what would happen is if we have an unsolicitor request it has to go through that competitive process that I mentioned earlier. And, at that point, you know, there's mandated notice and comment periods, there's analysis that has to go into whether it's the right time and place to put something like that from environmental and -- (Indiscernible) -- for

other purposes, navigation, DOD, et cetera. And, once that is issued there's a lot of survey work, more detailed survey work goes into the development of the general activities plan which would kick off the EIS.

So, it will require some advanced planning certainly. I think provided everything goes well, it is a shorter process than the construction of a wind farm. So, there would be space to sort of fit those together, I think.

The problem is that developers want sort of certainty when it happens. And, as a federal agency, we can't mandate the use of a third-party line if you're talking about transmission in the State of New Jersey. So, that could be a place that you guys can really explore is whether or not you want to mandate specific uses at certain times. Obviously, that requires those to be built, so perhaps that increases certainty. I don't want to put that on you guys.

MR. FERRIS: Let me just follow up on that. So, that's two years from grant to construction?

MR. GANGE: Well, from grant to construction. Yes. Then per the regs they're

required to, once the grant is issued, within a year they are required to submit the general activities plan. So, from that point on then you have the general EIS process that would be undertaken. And, realistically, that's probably two years at minimum because of the necessary consultations that go into that.

MR. COPELAND: Can't you roll that into a project's overall COD planning?

MR. GANGE: So, you could if you had -- so, if this was proposed as part of a wind farm project where they have easements, that could be rolled into the COD. Yes. I was thinking more in the terms of having extra capacity via an independent system.

MR. COPELAND: So, that you could compress the time line if it was coordinated ahead of time?

MR. GANGE: Absolutely. Yeah. If you have a developer on board that was a leasee, or more than one leasees that wanted, to say, connect their projects, you know, there's room for that sort of analysis within the COD stage.

MR. FERRIS: And, how about from the developer perspective?

MR. COPELAND: So, right now, for us with our few positions in PJM and other ISOs, the interconnection process is not on the critical path. And, by that I mean is that that's not going prevent us from meeting -- (Indiscernible) -- on schedule -- that is more of a function of proper surveys, permits, and the whole COD process. It's the critical component to the process, I don't mean to push it down the list in any way.

But, the timing of the overall PJM studies, the expected time for on-shore upgrades, and the associated build out is all within the schedule that we have been proposing and are feasible in the future. And, I think the risk is that if it gets taken out of our hands, then it's not something we can account, so then you have this horrible scenario where some developer wins 800 megawatts in New Jersey with the COD of 2027, and the line isn't built in time. That's the German scenario, and I think that's the one that nobody wants to repeat.

But, I think it also comes down to financing and the issues around that. And, how we make sure that when you think about project commands that you take in basically risks and add

to them -- (Indiscernible) -- when you think about someone else being responsible for how to get your line to shore. So, that's where you run into the scenario where how much is the state willing to bet on this? You know? Would you preemptively build an off-shore line or a substation? Is that cost something that the ratepayers can bear? But, to take that risk with ratepayer dollars before a project is there or fully permitted, that's really the question that comes back -- from us back to you.

MS. TOWNSEND: -- (Indiscernible) -- the question, as well. We take into account the connection point being interconnected from the layout stage. That's really, really early on, but it makes a big difference -- (Indiscernible) -- about the integration synergies. They're not in my head, but we see them, we realize them in all of our projects. It doesn't mean you can't do it another way, but that is what we experience today. And we see this from an early -- (Indiscernible) -- transmission is the longest lead time of our projects. So, to procure transmission -- it's different, though, between AC and DC, which maybe we'll here about in technical Panel 3. But

particularly the DC is your longest lead time. And even for AC, you have to get in early, and with some really smart things with procurement and agreements and design which might shorten that. But, at the end of the day you have to know and you have to get your transmission line before you can progress with the projects. Timing of when changes come in to take that into account.

And, then, just to put some numbers on it, from my colleagues in Germany, it cost the German ratepayers one billion euros from one year of delay -- (Indiscernible) They have a system where they take the cost of delays and they put them on to the German ratepayers. It's quite easy to see where those costs went. But, that's not to say that if you experience delays here, if you incentivize that appropriately. But, that's some of the numbers around the delays to interconnection process in terms of that.

MR. GANGE: -- (Indiscernible) -- from the federal perspective is that in the COD process we utilize typically a -- (Indiscernible) -- so there is a little bit of variability for proposing multiple line options in the earlier stage. Once they get down to the facilities -- (Indiscernible)

-- that pretty much has to be determined. But, during the early stages of the project proposal, there is a little bit of flexibility.

MS. HOLLAND: Thank you. I did have a couple of questions myself. So, I know the prior panel and this panel there was a strong indication that we really need to know the end goal and then work from there.

And, what I'm particularly intrigued about, as was kind of discussed, is that, you know, is it just the New Jersey objective; or, is the fact that we are part of the PJM region, is that the end goal? Because, obviously, our sister state commissions and some of the other states along the Atlantic coast have their own objectives. Is that the end goal that we need to be looking at from a PJM regional-wise perspective?

And, then, of course, given New Jersey's unique geographical location, we're actually on the border with another region, if you will, which is the State of New York. And, New York obviously has very aggressive objectives, as does New England. So, is that the end goal that we're planning the transmission grid for?

MS. GLATZ: So, there's pros and cons.

And, ideally it would be good if you could know the full development. And, so, that would allow you to consider where there's synergies, because you may find if you ignore state boundaries you look at the electrical grid, there may be more optimal locations in order to bring that off-shore generation.

And, of course, obviously, there's complications. The more parties you have to coordinate with, you introduce more challenges. And, that could introduce more delays just in terms of trying to reach some consensus position on where should the cost be, because the cost allocation with the rights that you would achieve with that. That's never an easy discussion. So, the fewer parties you work with, obviously you probably have more opportunity to get some agreement.

So, it's a trade off. You know? Do you have to do it? No. You don't. It's just that there may be more opportunities to get -- to recognize where is that optimal point or multiple points to bring in more generation. So, it's certainly worth looking at, at least to envision it, whether or not you might ultimately do that. But, again, you would have that -- once you have

that knowledge, then you can make a more knowledgeable decision about is it worth looking beyond just the State of New Jersey, and even more so just beyond even the PJM RTO.

MR. DEMPSEY: Yeah. And, one thing I'll just add is that New Jersey has a pretty robust 500 kV system. It's fifty miles inland. Absorbing ten thousand megawatts on the 500 kV -- (Indiscernible) -- the issue, the planners are here to correct me. I'm fairly certain that's the case. So, really the issue then becomes sort of for us, the PJM has a system that's so big that absorbing it is also an issue because of the 500 kV backbone that's on land. So, I think the value may be more for other states that don't have such robust connections, trying to get to our existing system. Unless us need to build out, let's say that coastal kind of off-shore piece or even reinforced system, because if the 500 kV were brought closer to the beach a lot of problems would go away, in my view. So, that's my perspective. Sue can correct me.

MR. COPELAND: I know as a developer, absolutely agree bring 500 kV as close to the beach as you can. But, the other thing to keep in mind is that each state has these specific requirements

about where you're supposed to land. So, New York said tell them it's JFK, New Jersey said in New Jersey, Maryland said it's the -- (Indiscernible) -- which actually is the legal definition, so it's parts of Delaware but not all of it. And, so, you end up with these kind of funny constructs because New Jersey, yes, you had a more robust 500 kV grid that was closer to the coast you could bring power from here and then get it to New York. But, in the New York process you get penalized for that at a pretty high rate, along with the policy risks that goes with that.

And, so, that's where the struggle becomes one of having state policies change. Because it would be a lot easier to get power into Maryland from New Jersey, then trying to go with a 138 kV -- (Indiscernible) -- design based to handle like Ocean City during the summer. That Ocean City, not this Ocean City.

And, so, with that you got this kind of bizarro scenario that maybe the technical construct, you could have AC/DC line that comes into New Jersey from off-shore projects and then exports into New York. How does that count? Right? Because you've landed in New Jersey, but if

it's got a shunt that runs right over to New York and lands -- (Indiscernible) -- have you violated the New York rules? Have you -- have you gone through -- you know, you have these interstate commerce, you have all these sort of things that come into play that there's actual technical solutions to all of them. Those are actually fairly straightforward. It's the political ones that become the tougher ones.

MS. HOLLAND: Also, in terms of bringing the project and interconnecting with the 500 kV system -- not wanting to talk about Panel 3 which is more technical -- but, in terms of the framework, what would your recommendations be for developers coordinating with you? For example, you mentioned that, you know, there's opportunities here to coordinate with the transmission owners. But, what are your specific recommendations about that? And, with regard to the 500 kV system, how would that work?

MR. COPELAND: So, my first recommendation would be to have the TOs work collectively. There's four of them, should be able to figure this out to say where are the most stable locations on the grid to handle -- just pick

a number, say ten thousand megawatts, and then to think about that. And, so, that you then understand the on-shore capabilities of the system. And, then, you figure out how best to bring those key locations closer to the beach using the existing rights-of-way. That would be kind of my first thing. Because we can get to our points of interconnection. It's a heck of a lot simpler if those points of interconnection came to us.

MR. SILVERMAN: So, if I could just ask a real quick question. I hear most folks saying that you think we should be working on the on-shore portion and not on the off-shore portion. Is that -- or let me ask it a different way. Would you have us spending our efforts on the on-shore portion or the off-shore portion of a shared grid?

MS. TOWNSEND: I think the way I would see it is your on-shore system is your biggest value to getting supply to the load. You're doing something you've never done before. You're getting variable power, coastal two load, and PJM and your RTOs should be able to with combined effort articulate where those issues are. That's your first challenge. Prescribing the off-shore

solution is a close but a secondary challenge to that. And, you've got more flexibility where the industry is. You don't need to prescribe that solution right now. So, fix the key challenge on shore. That will tell you and guide us all on how best to interconnect to that. And, that will automatically start to carve out a clear plan of how to then bring that power in in the best way for the New Jersey ratepayer, and the other stakeholder groups we heard from.

MS. GLATZ: I'll just echo the comment again about the grid. Yes. There is a 500 kV grid and it's fairly robust, but it does not go to the beach. That is true. And, in terms of for a smaller amount of generation, you can bring it on at a lower voltage. And, that may work to a certain point, but eventually -- and this is really getting to the point of trying to look into the future, because if you do have a vision that is substantially more, it would behoove you to do that analysis now to figure out what might that vision be, and how much would we have to expand at the higher voltage. And, would we have to bring that closer to the shore. What reinforcements would be needed so that whatever generation is out there can

access that. Because that is going to be very expensive, and that could become potentially a hurdle for getting more off-shore wind development.

MR. COPELAND: I just want to echo that. -- (Indiscernible) -- used car four different tires on it, different sizes, different manufacturers. And, instead of sort of choosing the tire that was the newest and buying three that matched that, just got four new ones. And, I think New Jersey is at a place where we can step back and existing projects can keep going. But, as you're planning forward, you get to pick those four new tires. You get to work with the TOs, work with the developers, work with other stakeholders, and be thinking about what happens after that first three and half gigawatts. Because we can do that, I think everyone has said that. But, it's going forward, and if you've really looked at that on-shore system it will help identify what the off-shore system will look like.

MR. DEMPSEY: So, my thoughts there are I think I understand and agree with most of what you're saying, Abe. I think the off-shore piece shouldn't be totally discounted. I think there's a few reasons. One is there's only a

handful of companies that actually execute this sort of couple. There's a couple of OEMs, there's a handful of cable companies. We're all largely working with the same people. I wouldn't say that I have the same amount of knowledge, or anybody of the developers have the same amount of knowledge, but it's not like it's an impossibility.

I think when you look at the first panel, some of the fishing concerns. And, I do think there's value perhaps outside of simply the cost of some of the other externalities around fishing, but also permitting. So, I mentioned it before, I think we're all saying it's easy to get 3,500 megawatts. There's zero megawatts now. Right? So, I don't know that permitting is going to be as much of a lay up on that side either.

And, then, I think lastly on the cost efficiency side. I know they're contemplating two thousand megawatt platforms that are DC in Europe. Those are a substantial cost. You do wonder at some point there is probably a tipping point with the cost efficiency piece. So, I'm not suggesting that it is absolutely mission critical to get the first project or two on there. But, I also don't think it's -- it's not something that's worth

examining.

MR. SILVERMAN: Josh, thanks. Because I thought we solved all the problems before you spoke.

MS. PATNAUDE: I'd like to get some audience questions at this time. We have about twelve minutes left.

MR. TABRIZI: Mike Tabrizi. Just a question for Sue of PJM. You talked about two different approaches for the transmission planning, interconnection queue or the state policy. In your view, or in PJM's view, given the aggressive target and the mandates here, which of these two could be more efficient or more optimal in the long term? Does PJM have any view on that?

MS. GLATZ: Do we have an opinion? I don't know that I would say we have one that says yes, one's better or worse, or preferred. But, rather, there's a number of factors to be considered. And, there's certainly some that could be some potential advantages. And, I think several people talked about some of those in terms of using more effective, cost-effective, to bring the grid closer to the shore.

A lot of this would really require

some analysis to do that. And, certainly PJM is available to perform those studies. And, I think just an aspect that if we were going to do any real extensive analysis, of course we would have to make that transparent to all stakeholders so others would be able to weigh in as to whether or not that one approach is more effective than the others.

There's certainly, like I said, pros and cons. It's also a question of what the state would like to accomplish in terms of maybe, you know, cost is obviously, as we all talked about, trying to do something sort of cost-effective. But, there maybe other factors in terms of minimizing impacts, minimizing revisiting stations.

And, so, I can't speak for all of the things that New Jersey wants to accomplish. But, I can say that probably the best way to do that would be to really do those kinds of studies. And, they would have to take all those in effect.

MR. TABRIZI: And, my last question from anybody from the staff from the panel. I heard that everybody was talking about the existing stations on shore. Now, I'm not familiar with the permitting challenges in the area, but are you open to the use of stations if that is more optimal from

a cost standpoint?

MR. SILVERMAN: I don't know that you're allowed to ask us questions. That's a great question. Frankly, I don't know that we necessarily have a view. I think we can all be open to any of the various solutions, depending what's permittable and what's going to be the least cost solution. But, I turn it over to the panel, if you all have views on whether we're better looking at sort of upgrading existing stations, or building something from scratch.

MR. DEMPSEY: I think it would probably be a mix of both. But, if you're talking about a much higher voltage along the coast line, it would likely require a new station, or the expansion of one that would be akin to just building a new one.

MS. GLATZ: Eventually you're going to have to get to the grid, so whether you need one or -- you know, it's going to be very specific to the sites, where you're bringing the power in to in terms of what's available, not only electrically but also in terms of the physical area what's possible to do there.

MR. COPELAND: And, I think the other

part that goes into that analysis is is it better to -- by better, I mean is it better for the ratepayer to upgrade a substation that's further inland, and bring the wires closer to the shore so that you connect to those wires as opposed to a whole substation. That would be part of the analysis with the TOs, as well.

MS. PATNAUDE: Any additional questions from audience members?

MR. SILVERMAN: I think we're ready for a lunch break.

(Whereupon the luncheon recess was held at 12:33 p.m.)

(Whereupon the morning session is concluded.)

C E R T I F I C A T E

I, CHRISTINA RESTUCCIA, a Court Reporter of the State of New Jersey, authorized to administer oaths pursuant to R.S.41:2-2, do hereby CERTIFY that the foregoing is a true and accurate transcript of the testimony that was taken stenographically by and before me at the time, place and on the date herein before set forth.

I DO FURTHER CERTIFY that I am neither a relative nor employee nor attorney nor counsel of any of the parties to this action, and that I am not financially interested in the action.

Christina Restuccia

Notary Public of the State of New Jersey
My Commission expires November 14, 2021

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