STATE OF NEW JERSEY
BOARD OF PUBLIC UTILITIES
MONDAY, SEPTEMBER 24, 2018

ENERGY MASTER PLAN
STAKEHOLDER MEETING

BUILDING A MODERN GRID

HELD AT:
MERCER COUNTY COMMUNITY COLLEGE
CONFERENCE CENTER AT MERCER
1200 OLD TRENTON ROAD
WEST WINDSOR, NEW JERSEY
10:00 A.M.

BEFORE:
MIKE WINKA - BPU

COMMITTEE MEMBERS:

BPU:
MICHAEL L. HORNSBY
GRACE STROM-POWER
SARAH BLUHM
ROSEANNA MILAN
JAMES BOYD
JOSEPH COSTA
CHRISTOPHER OPRYSK

DEP:
RUPA DESHMUKH
RAVI PATRAJU
JORGE REYES
CHRIS SALMI

EDA:
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MS. POWER: Good morning everyone. My name is Grace Power. I'm the Chief of Staff at the BPU. And, I'm the Chair of the Energy Master Plan committee.

Thank you for joining us today for our fourth stakeholder meeting. We have one more scheduled for this Friday, I believe, also here at Mercer County Community College. We have heard a lot of interest in actually holding additional stakeholder meetings in North Jersey and South Jersey. And, so, we are actively looking into whether we're going to add one to two additional meetings that would be on the general topic, before the comment period closes. So, stay tuned for that. Please make sure you signed up so that we have your e-mail address and we can keep you informed as to what we're doing. We also do update the website regularly.

So, as many of you know, the 2019 Energy Master Plan planning process kicked off when Governor Murphy signed Executive Order 28 in May. It directs the BPU to spearhead this process, which is an inter-agency process primarily. We have many representatives here from across the state. And, essentially, our committee is tasked with

developing a blueprint for the total conversion of the state's energy production profiles, 100 percent clean energy, by 2015. We are also actively looking to come up with exact specific proposals as to how this will be implemented over the next ten years.

Hopefully, many of you are familiar with our timeline. In June we held our kick-off meeting, at which time we split into five working groups. We are holding our stakeholder meetings now and in October. This winter we hope to have -- we wrote up a draft document that will be released to the public some time late winter/early spring, at which time we will have additional stakeholder and public comment period, and opportunities for you all to weigh in and be involved. And then in June of next year, we will deliver the final plan to the Governor.

A number of departments, as I mentioned, that are involved in the EMP, including BPU, DCA, EDA, DEP, Health Human Services, Transportation, Labor and Work Force Development, Treasury, and Transit.

I'd like to welcome Mike Winka up to introduce his team. Before I do so, I just want

to mention, the next meeting is this Friday at ten a.m. And, again, we may be adding one to two additional meetings. And, again, on behalf of President Fiordaliso and Governor Murphy, thank you so much for being a part of this process today. Mike?

MR. WINKA: Thank you, Grace. So, there's about fifty folks here. There's about forty folks that are signed up. So, if it's okay with you, we're going to sort of plow through without a break, if it's okay with the stenographer. See if we can get everybody through before lunchtime, and get everybody out back to work.

With that, I'm going to open it up to the folks on the committee to introduce themselves. And since we have a shortage of chairs up here, we have some folks on the committee that are sitting in the audience. So, why don't we do them first. Just speak up loud enough for folks to hear you.

MR. OPRYSK: I'm Christopher Oprysk. I'm an engineer with BPU.

MR. COSTA: Joe Costa with the Division of Reliability and Security at the BPU.

MR. HORNSBY: Mike Hornsby with the

BPU.

MR. WINKA: And we'll start with Sara on the end.

MS. BLUHM: Sarah Bluhm, BPU.

MS. MILAN: Roseanna Milan, BPU.

MR. REYES: George Reyes, Department of Environmental Protection.

MS. DESHMUKH: Rupa Deshmukh, DEP.

MR. SALMI: Chris Salmi, DEP.

MR. LIKE: Russ Like, Economic Development Authority.

MS. PATRAJU: Ravi Patraju, DEP.

MR. BOYD: James Boyd, BPU.

MR. WINKA: Mike Winka, BPU. And, so, as I said, there's forty folks that have signed up to speak. Typically we would set about a ten-minute time limit on speaking, but we're not going to enforce that strictly. But, keep your comments succinct. If you've commented before, just summarize your comments if they're new comments in regards to this issue, and just a couple of points on this issue.

So, the last three sessions, the Clean and Renewable Energy -- and, we are not the Clean and Reliable Transportation section, we are the

Build a Modern Grid -- but close, since you need transportation to build a modern grid to get from place to place. So, that section, the Clean and Reliable Transportation and Reducing Energy Consumption, those were all about helping us set the goals that we need to in the Energy Master Plan. And, the Energy Master Plan is planning for a ten-year horizon through 2030. We're close enough to 2020 to be 2030. This session, and the one that follows, that's going to be chaired by Cynthia Holland -- up there -- running the sustainable infrastructure. This section and the next one is all about how we deliver those goals to the customers, that you in your home and your businesses. And, this session specifically on building the modern grid is on the distribution energy systems. The interstate sort of structures, the things we regulate within the state -- although not just what we regulate at the Board of Public Utilities, and the Board of Public Utilities is the state energy office which is charged with delivering energy, security, and reliability and assurance. And, we do an energy assurance plan -- and Joe Costa is one of the folks that do that on at routine basis, along with the Energy Master

Plan.

So, these, the things that we're talking about today, building a modern grid on the distribution energy side. And, it's not just the electric grid that we're talking about. So, it's the distribution energy systems. How do we deliver electricity, natural gas, all the other fuels that are part of the distribution system within the State of New Jersey. On Friday you'll here from Cynthia on the transmission energy side, the interstate system, the things that are regulated more by FERC. So, today is the distribution side. On Friday you'll hear about the transportation side.

When you're addressing your comments in regards to the modern grid, there are the things we need to do to get to 2030, over the next ten years, and how we build out that grid. But, we should also be focused on the two long-term goals that are set. So, the Global Warming Response Act has a requirement that we get and 80 percent reduction in our greenhouse gas emission levels by 2050. By 2006 we were at 125. So, we have to get to 25 million metric tons. The other is, the goal the Governor has set in the Energy Master Plan

to get to a hundred percent clean energy by 2050. So, your comments should, how do we need to build this system for the next ten years, and how do we set up that modern grid to get us to those goals by 2050.

And with that, we'll start calling folks up. You can come up here, you can come up here and speak at the dais, you can speak at the microphone up there. You need to speak at one of the microphones. We're recording this, so you want to speak into the microphone so you get your comments on the record, in the recording. Your comments can be submitted in writing up through Friday, October 12th, close of business -- close of business five p.m. And, again, if you come up, hopefully you can summarize your comments. Be shorten than I am.

With that, we'll call the first speaker.

MS. POWER: And, I just want to thank Commission Dianne Solomon from the BPU who is joining us this morning. Welcome.

MR. BOYD: All right. We'll get this started. And, as Mike said, we're not going to get the hook to take you off after ten minutes, but I

will give you a warning of three minutes when you get there. Sometimes you loss track of the time, so we'll likely warn you or tell you about that.

And the way I'll do it is I'll announce three speakers, the first one coming up and the other two will be on deck, as they say.

So, first I'd like to welcome up Joe Accardo from PSE&G. Following that will be Imelda Foley, and following her would be Henry Gajda.

MS. LOPEZ: Good morning. I'm not Joe, but.

Good morning, everyone. My name is Danielle Lopez. I am speaking on behalf of Joseph Accardo for PSE&G today. I want to thank the BPU staff for the opportunity to provide thoughts and comments with respect to Governor Murphy's proposed 2019 Energy Master Plan, and today's Building a Modern Grid stakeholder meeting.

PSE&G is a 115-year old company that owns and operates 1,700 circuit miles of electric transmission and 22,000 circuit miles of electric distribution, in service of 2.2 million customers in the State of New Jersey. In addition, PSE&G owns and operates 58 miles of gas transmission, and 17,800 miles of the gas distribution mains, to

service 1.8 million customers.

Like our country's interstate highway system, electric and gas transmission and distribution infrastructure is essential to New Jersey's economic well-being and quality of life. It has helped power the industrial northeast for more than a century. Unfortunately, a significant portion of the New Jersey's transmission and distribution systems date back to the early 1900s, and needs to be replaced and upgraded to handle the increasing demand for clean and reliable power. In recent years, PSE&G has worked to replace, upgrade, modernize, and sometimes move parts of the grid to ensure our system can withstand extreme weather, and other threats. Even as our customers are using less gas and electricity, their reliance upon clean and reliable energy has never been greater. Our investments must be targeted and prudent. We must push back against the myth that investments in modern electric grids are not needed in periods when the demand for power is flat.

Recent events in North and South Carolina are all too painful reminders of Superstorm Sandy, which devastated our region and cost customers 775 million hours of lost

electricity. Since Superstorm Sandy, PSE&G has made significant infrastructure improvements, and has reduced unplanned transmission outages by over sixty percent. Watching our fellow citizens struggle with the affects of Hurricane Florence has yielded an appreciation for New Jersey's robust grid, and the need to continuously strengthen and modernize it. The high-voltage grid must also be storm-hardened and modernized for an environment that can be hostile to our electrified society.

The customer benefits are clear as we move forward into the 21st century, the electric grid must be upgraded to adapt a more distributed generation of energy storage. A shift in the electric generation mix, a move away from central generation, and a world that places a high premium on system resilience. Edge of grid technologies, like energy storage and electric vehicle infrastructure, are important complimentary pieces to that investment. The need for continued strong investment in building a modern grid requires investment in grid facilities as a first option rather than a last resort when it comes to meeting local and regional reliability needs. In virtually all instances, a robust modern grid will retain its

importance and vitality as a compliment to, and a facilitator or, technology and markets.

At PSE&G, our goal is to enable renewable energy resources to inter-connect while maintaining the reliability of the grid for all customers. As such, we continue to develop innovative tools to help the state achieve its goals, from the Solar Loan Program to the Solar4All Program, from creating a customer-friendly process enabling residential customers to install rooftop solar to providing generous solar limits for distribution circuits and substations. PSE&G has been a leader in the effort to accommodate residential, commercial, and large solar farms.

With that said, it also must be recognized that some areas in southern and central New Jersey has experienced tremendous growth in the adoption of renewable energy. Particularly solar, that has tested the limits on individual electric circuits. Part of building a modern grid will be planning for and developing new tools to equip the grid, and accommodate a large amount of renewables. PSE&G's recent Energy Strong II filing represents the next step in PSE&G's efforts to strengthen the utility's gas and electric systems to withstand

storms, improve reliability, and significantly enhance resiliency. Through hardening stations and circuits, and increasing system automation, the Energy II Program will improve reliability and enhance resiliency. In addition, by building a secure distributed communication network and new operational tools, PSE&G is working to modernize the system to not only increase resiliency, but also implementing the fundamental tools to safely and reliably integrate new clean and renewable generation sources.

Building a modern grid gives us the optionality to adapt to whatever the future holds. And, a modern and resilient transmission and distribution system, will be among the most valuable assets we have. Distributed generation resources, energy storage, and other new technologies will not eliminate the need for a modern electric grid. Rather, these resources and technologies will depend more than ever on the grid for their economic justification and deployment. A modern grid will depend on continued investment, both in the distribution system and transmission system. A core element of the next generation grid is a reliable and resilient transmission network.

Transmission is and continues to be the backbone of our electric system. And, the ability of the modern grid to respond to dynamic needs of the customer is predicated on the efficient and reliable flow of power through high-voltage network.

PSE&G has actively upgraded and reinforced its transmission system over the last several years. Our investments have included large and challenging extra high-voltage transmission projects covering hundreds of miles in the mostly densely populated areas in the nation. Energy storage also offers some of the most promising benefits for modernizing the electric grid. It enables higher levels and better integration of renewable energy onto the electric grid, and provides resiliency for critical infrastructure, and enables electric lines to handle greater capacity during peak electric use.

As we know, the Governor has set a target of 600 megawatts of energy storage in the state by 2021. And, 2,000 megawatts of energy storage by 2030. PSE&G is taking up this challenge and investigating ways to more efficiently and effectively integrate energy

storage into its infrastructure, to provide resiliency and maintain reliability as the amount of grid-connected solar increases. PSE&G's Solar4All Program currently has three megawatts in the pilot program that integrates solar with other battery technologies to provide reliability and resiliency for critical facilities during prolonged outages.

PSE&G is also developing a new program to increase the amount of energy storage capacity on PSE&G's electric distribution grid. Continued investment in our system is required if we are to meet the challenges of an electrifying economy. Installing modern digital technologies, deploying and serving more distributed resources, enhancing regional and inter-regional energy markets, lowering electric prices for consumers, and strengthening the grid against physical, cyber and natural disruptions.

PSE&G is ready to meet those challenges, and looks forward to working with the BPU in that process. Thank you for the opportunity.

MR. BOYD: Slight change of order. We'd like to welcome up Henry Gajda. Followed by

Gabrielle Figueroa, and Doug O'Malley.

MR. GAJDA: Hi. My name is Henry Gajda. I'm with the New Jersey League of Conservation Voters. Thank you for the opportunity to speak here today on this important issue of Building a Modern Grid. I'll keep these comments fairly brief. We submitted comments, and will continue to do so.

So, as you all know, our grid has evolved from a centralized system into one that is more like a web. This evolution has been influenced by the transition from centralized energy resources like huge coal-fired power plants to a distributed energy resources, like wind farms and solar arrays. Running it smoothly requires new and advanced lines, as well as increased coordination among generators, transmission and distribution system grid manager, and consumers. And, the EMP should explore really every avenue, including increased transparency and collaborative measures to make sure that they have a functioning grid.

Understanding grid dynamics is essential to future electricity growth. And the EMP should be forecasting and energy projecting to

ensure that we really know and have a really great empirical basis for load shaping, and the variables that will impact load shaping. From this information, demand response programs and public education initiatives should encourage non-peak load time us. With the influence of electrical vehicles growing in society, charging and other power-intensive activities should be encouraged during non-peak hours, like overnight, to reduce grid stress and keep energy costs low by preventing peakers from coming on line. And, to also provide a basis for regional reliability and storage needs.

Infrastructure investment and improvement is also essential to maintain a reliable grid. It is important to continue strengthening the system of wires, transformers, and substations that move power around our state. In addition, we should also explore every avenue to ensure that we do so, while also taking in the anticipated impacts of climate change, just to increase the reliability of our electric grid; and, also, maintain functioning during times of extreme stress.

And then lastly. Any new fossil fuel infrastructure investments, such as compressor

stations or new pipelines, should be discouraged to ensure that we also do meet the Global Warming Response Act goals. And, also, just really facilitate and thrust New Jersey into a clean energy future. Thank you.

MS. BLUHM: And, if you have remarks that you can leave with the stenographer, she would appreciate that.

MR. GAJDA: Sure. Sorry.

MS. POWER: I'd also like to welcome BPU commissioners Bob Gordon and Upendra Chivukula. Thank you for joining us.

And, yes, to echo Sara's comments. I'm also a fast talker. But, if you could slow down just a little bit it really does help our stenographer, as well.

MR. BOYD: Now I'd like to welcome up Gabrielle Figueroa. Followed by Doug O'Malley. And after that, Evan Bixby from Pine Gate Renewables.

MS. FIGUEROA: Good morning. My name is Gabrielle Figueroa. I am with the law firm of Bevan, Mosca & Giuditta, and I'm here today on behalf of the Retail Energy Supply Association, or RESA. It's a coalition of the retail suppliers

that offer a diversity of natural gas and electric products to residential, commercial, and industrial customers in New Jersey, and throughout the country.

I'm going to just briefly address some of the technology ideas from the stakeholder notice. Particularly advance metering infrastructure, or AMI. It does look like AMI is presumed in these comments and in this process, which RESA thinks is a very positive thing. New Jersey right now is 48th in the country in terms of AMI deployment. This is according to the Energy Information Administration. This is based on 2016 data published in 2017. And, the two states that are behind New Jersey are Rhode Island and New York, both of which have recently adopted AMI initiatives. So, we're in the dust right now.

There are amazing benefits to AMI, and we would encourage the Board to maybe to be a little bit more -- to be quicker than some of the proposals for say six years. We believe that AMI can be deployed in the state in three years. There are amazing benefits to AMI deployment. Customers who lose power -- and we've seen this in Superstorm Sandy and in other recent situations --

those customers, while they should always contact the utility to tell them that their power is out -- if they don't, the utility is going to get a notice from that advanced metering infrastructure, and they'll already know and they can better target restoration efforts.

Adoption of AMI increases customer privacy by eliminating the need for on-site meter readers, and lowers utility's operational costs. And the data can help the customers to better target energy efficiency measures, and take advantage of other energy efficiency offers in the Office of Clean Energy program. For example, the data can let the customer know that their refrigerator is not running well, and the customer can take advantage of some of the energy efficiency rebates that the state offers. Get a better refrigerator. Reduce their load and reduce the state's load overall. We do believe that AMI should be on an opt-out basis to ensure maximum participation.

The last thing I will address is the data from the meters. The data does not belong to the utility, it does not belong to their supply. It's the customer's data. If the customer uses a

supplier or is part of the government the energy aggregation program, the supplier and the aggregator should have access to that data to better design programs or help customers manage their power. And part of the customer's consent to sign up with a supplier should include access to that data. But, it is the opinion and the position of the Retail Energy Supply Association that that customer, that the data belongs to the customer.

RESA will be filing more detailed written comments on this and other topics. Thank you.

MR. WINKA: Thank you.

MR. BOYD: Next we'd like to welcome Doug O'Malley. Followed by Evan Bixby. And followed by George Hay III. Doug?

Okay. So, we'll move on to Mr. Bixby. Evan Bixby? All right. George Hay? Okay. Well, I'm going to read the next three. So, we'll do Clark Bruno. Mr. Bruno? Edward Hutchinson.

We'll go back to anybody. We'll re-read the list at the end in case somebody -- Okay. Doug, would you like --

MR. O'MALLEY: How's that for timing?

MR. BOYD: Perfect.

MR. O'MALLEY: Good morning. My name is Doug O'Malley. I'm the Director of Environment New Jersey. We represent more than 20,000 citizen members across the state. And, maybe this is the first time where I wish the hearing was at the State House versus here. But, glad to be here on time. And, obviously, thank you to the entire committee to continuing to hold these set of hearings. Obviously, today the focus is on the electric grid.

This morning Environment New Jersey released a report of documenting the growth of renewable energy and the growth of renewables across the country, including here in New Jersey. Looking at the growth from 2007 up to 2017. And, as you might imagine, the growth of the solar sector in New Jersey was off the charts. And that's because of this historical work of the Office of Clean Energy upon this program.

I wanted to emphasis much more on something that this hearing, obviously, focuses on. And, that's energy storage. New Jersey was ranked as 20th for energy storage, with one megawatt into 2017. Clearly, the Board has been immersed in the

issue of energy storage, for multiple years at this point. And there's even a pilot program to work to develop energy storage projects around the state. Obviously, those projects for the most part did not come to fruition. We have, through the Clean Energy Bill that was passed this may, mandated for New Jersey to have 2000 megawatts energy storage by 2030, and to have 600 megawatts in the early 2020s. So, obviously, this is going to be another thing that's on the court's docket.

That being said. When we think of the growth of renewables, both in the solar sector and the, obviously, the progress we've seen with solicitations on off-shore wind, New Jersey is poised to become the national leader in off-shore wind. And, we also have to think of this as the Murphy administration works to make New Jersey to be a clean renewable energy leader, that we also have the leadership on energy storage. And, obviously, the portions of the legislation that will move forward in energy storage are really the first step. And, I think looking at the other areas that we rank New Jersey in from 2007 to 2017, it's clear that the inertia and the lack of funding and the lack of policy focus from the top during

the Christie administration, made New Jersey -- we were not leaders, we were obviously laggers. Some things, obviously, the administration was holding us back and rolling us back from climate action -- RGGI being the best example, as well as off-shore wind. Clearly, there's going to be a wholesale change. And, I think energy storage is one of the aspects that the Governor, when he was campaigning, announced his climate vision on Earth Day 2017. He had a broad agenda, but he was also very specific on energy storage. Obviously, those goals are reflected in the Clean Energy Bill, and will clearly be part of the Board's action moving forward.

I think it is imperative when we look at energy storage, we also need to have the funding that's dedicated to make these projects work. This is, I think, another great example of where using the Clean Energy Fund for its intended purpose, and having a hundred percent of its funds dedicated towards clean renewable energy projects can pay dividends. Because these are, obviously, very aggressive goals, and we need to ensure that the funding is not being siphoned off for, you know, obviously, important projects -- New Jersey

Transit, or perhaps less important, but not relevant projects like the funding for the state's electric bill.

Also, when we're thinking of modernizing the grid, clearly we can't just focus on storage. And some of the lowest hanging fruit continues to be the lack of rollout to smart meters in this state. And, we've had, obviously, some progress through Rockland Electric. But, this is another area where the rest of the country has moved forward, and New Jersey hasn't. And when we're thinking of creating demand response programs, or we're thinking of creating resiliency programs, right now it's still very much imperative upon you when the lights go out to call your utility. Utilities should not be dependent upon that happening.

And, obviously, there are many benefits of smart meters. They obviously have a cost, without a doubt. And the ratepayer is right to question what is the ultimate value of smart meters? I think the ultimate value can be seen from other states. And, ultimately looking at modernizing our electric grid, we cannot continue to rely on a essentially a 19th century technology.

We need to be following the lead of other states.

And, finally, I just wanted to talk about something that was a huge focus, clearly, at last Thursday's hearing. And, that's the growth of electric vehicles. And, this is another area where, you know, New Jersey is not alone in this. There are many members of the zero-emission vehicle compact that don't have enough electric vehicle chargers on the road and enough electric vehicles on the road. But as we plan to hit the clean car mandate, we also need to figure out what the impact of having more electric cars, not only on the road, but in homes and charging. And, effectively, electric cars are batteries on wheels. And, so, how can we plan for electric cars? How can we use demand response pricing, and time of use pricing? And, how can we ensure that we're not only planning for electric cars, but we're depending upon the growth in the electric vehicle sector to help with battery storage and grid resiliency? That's kind of, I think, the untold story of the electric vehicle sector. And, there also is, obviously, we have to plan for the electric to be able to handle more of these on the grid.

So, I'll conclude my comments with

that. And, obviously, we'll be submitting more detailed comments by the deadline. Thank you very much.

MR. BOYD: Thank you. Next, Ryan Storke. No? Dr. Gearoid Foley. And following, Rich Gannon. Pamela Frank. Bryan Rubio. Tony Simmons. Ibrahima Kalle. Mark Bellin. Ian Michael. Brian Vayda. Barbara Blumenthal. Jams Thomas. Kevin Hernandez. Bernadette McPherson.

MR. WINKA: Just to be clear. These are folks that signed up and asked to speak at this section, so it's not an old list. It is the list that people check themselves saying "I do want to speak at this section". So, probably some confusion about where that check mark was on the website.

MR. BOYD: We'll keep going until we get the next one on deck, at least.

Walter Wilson. Julia Bovey. Nicole Sitaraman. So, you'll be next Ms. Sitaraman.

MS. FOLEY: Let me set the record straight. I'm not a doctor. But thank you anyway. I appreciate it.

Appreciate the opportunity to address the committee. I'm here from the Department of

Energy's combined heat and power technical assistance partnership. DOE CHP TAP works with end-users and policy makers to assist in transforming the market for CHP waste heat to power and district energy technologies throughout the United States.

Combined heat and power technologies hold enormous potential to improve the nation's energy security and resiliency, and reduce greenhouse gas emissions. CHP supports our move to a clean energy economy and the creation of green jobs. The Department of Energy has long championed CHP technologies to harness the full power of CHP to help the nation meet its energy goals.

CHP is part of a community-based hybrid microgrid including renewables and battery storage, represents a cost-effective means of providing resilient base load power and thermal energy for the local community, including critical infrastructure in an accessible way for all.

The advancement of CHP is part of the US Department of Energy's Office of Clean Energy and Renewable Energy, DERE, as part of their mission to create a sustainable American leadership in the transition to a strong and prosperous

America powered by domestic, affordable, and secure energy for the industrial, manufacturing, federal, institutional, commercial, and multi-family sectors.

Combined heat and power does address a number of issues so relative to modernizing the grid. And, in response to some of the questions posed, 3, 4 and 5, which address "how does a modern grid address, adopt, or respond to climate change? Fuel diversity and renewable energy within the modern grids, and integrated distribution planning". A modern grid can benefit significantly from the application of CHP, which provides local dispatchable resilience. It is fossil fuel, but it is a very clean form of fossil fuel energy as we move towards a hundred percent renewable future providing a short term here and now solution. It can also be fueled with bio-fuels, so in the future it can support the fully renewable grid. And, it's very cost-effective. It is one of the main go-to alternative for delivery of bulk power on the grid in a clean and sustainable manner.

In relation to State Policy Question Number 7. State policy supporting a modern grid to increase resiliency and reliability, and fight

climate change. Again, here, inclusion of combined heat and power as we move towards this hundred percent renewable future, provides the local resiliency to dispatchability of a natural gas or bio-fueled fired generator provides the keystone for local microgrids base load energy delivery. It also provides spending reserve, ancillary services, that we normally rely on the grid; so fire support, frequency support, et cetera, can be embodied in the CHP plan. It's a powerful assist in a hybrid microgrid.

And, as we move towards the future -- and this is part of DOE's vision -- from the CHP, we look at hybrids CHP plans, which are CHP batteries and PV combined at a local area providing resiliency to multiple facilities in a clean and sustainable and reliable manner. The CHP component, again, understanding it's a fossil fuel, but it provides the cost-effectiveness component right now that's driving some of these microgrids. And, it is also compatible with the existing grid. So, again, as we move forward and the discussion moving from very large distant resources of energy to distributed energy resources, we believe that, again, in the short term as we move forwards toward

the goals here, that the combined heat and power offers a lot of benefits towards helping develop the modern grid. Thank you.

MR. BOYD: Thank you. Next, Ed Potosnak. Joanne Pannone. Armando Tamargo. Duncan Cambell. Susan Dorward. Brian Kauffman. Brian, you'll be on deck. Thank you.

MS. SITARAMAN: Hi. Good morning. My name is Nicole Sitaraman. And, I'm a Senior Manager of public policy at Sunrun. And, I work on the company's legislative and regulatory initiatives in the mid-atlantic region. So, certainly New Jersey, also Pennsylvania, Maryland, Delaware, and the District of Columbia.

I'm really appreciative for another opportunity to share our thoughts with you all. We participated in the first session on Clean and Renewable Energy. And, actually, this session I believe is actually the most important session. Because, really, we're at a place where we, all stakeholders, have the ability to decide what we want a modern grid to actually look like, and who we want it to really service.

I also just want to acknowledge my former colleague, Danielle. We both served in the

DC Office of the People's Council. So, we're consumer advocates at heart. So, it's great to see her here.

So, Sunrun is the largest residential solar and storage company in the U.S. And, we have about 200,000 customers in 23 states, D.C., and Puerto Rico. We've been spending a lot of time, our team, in Puerto Rico working with stakeholders on rebuilding the grid, in a more customer centric fashion, after Hurricane Maria and severe weather events.

We have a great interest in working with stakeholders to map out the future of distribution system planning, DER, Department Energy Resources programs, and rate design, that will facilitate greater customer adoption of solar and storage. And, will make sure that those resources benefit all ratepayers. So, while we are very customer centric, we really need all customers because we believe that these resources will benefit all consumers on a grander scale.

So, when we're talking about a modern grid, what we really focus on is how do we define that. And, there are many approaches to modernizing a grid. But, from our perspective, a

modern grid is not -- should not be focused on kind of more expensive gold-plated, same old versions, of what we currently are working with in terms of our infrastructure, that we've been working with for several decades -- in fact, a hundred years. This is an opportunity to explore ways to really re-design our electricity delivery system. And, we believe that decentralization is a really key component. And, also focus on customer-sited resources like solar and battery storage. Which we believe should be the anchors of any grid modernization proceeding.

I also want to highlight another kind of cornerstone principal that we would encourage stakeholders in this process to think through. But, we really want to make sure that grid modernization moving forward encourages competition, rather than inhibits competition. So, we want to make sure that all market players have an opportunity to serve customers and to partner with the utilities, to ensure that our grid is reliable and resilient. We acknowledge and indeed respect greatly, the utilities have an enormous responsibility to maintain grid reliability. And, we believe this is a critical opportunity to

explore ways that utilities can partner with DER providers to enable customers to help in the grid resiliency effort.

One important approach to that would be a focus on non-wires alternatives. So, there are -- across the country there are -- utilities are coming in with a great deal of requests for return on investments and resources for build-out of infrastructure that may not be necessary. And that, of course, from our view, requires greater emphasis on identifying locations in local grids, statewide grids, that could benefit or really could really provide at a lesser cost customer-sited solutions to enable grid reliability. So, non-wires alternatives we think can provide benefits to distribution planning, including the ability to defer and avoid unnecessary ratepayer-funded utility capital expenditures, like poles and wires. And, also, the benefit that from a larger client perspective, would be a reduction in peak demand.

The Solar Energy Industry Association recently published a white paper, which I would refer you to, that talks about non-wires alternatives. And, they say that non-wire

solutions will be a key part of holding down utility system costs in the future, which will lead to significant ratepayer savings. As utilities are required to make the public more of their system planning and expected investments in emphasis, DER providers will be able to offer solutions to meet utility needs that may otherwise be met through additional distribution grid infrastructure investments at a fraction of the cost. This will ultimately result in savings for ratepayers as utilities are able to contract with DER provider for more cost-effective solutions, and policy makers can develop tariffs that support DER to offset or relieve grid needs.

And, that leads to my final point. And, some of my team members in other jurisdictions -- specifically New England and New York -- are exploring a concept or a new tariff arrangement called "bring your own device". And, we would encourage in this proceeding or moving forward that that kind of structure be explored here. So, basically, it's a tariff that enables customers to purchase battery storage from whoever they want, and allow the utilities to have access to that resource at their property so that they can

pull from basically that battery during times of high peak demand. So that it benefits ratepayers on kind of an aggregated basis, reduces cost overall, and the customers get a benefit on their bill. And it doesn't kind of interfere with net metering at all, it's separate from that. So, it's something that we're going to provide greater comments on by October 12th. We're going to really explore that. And, also, talk about more about Puerto Rico. But, we think it's a really innovative great idea that New Jersey could benefit from.

So, thank you very much. And, I look forward to continue to participate in this process.

MR. WINKA: I just want to take one moment to agree with you a hundred percent that this session is the most important. And, also, as you raised the issue on competition. The next session on Friday, behind run by Cynthia Hollands, is where we'll get into that energy competition. As the Board, we're very much in agreement about energy competition. So, thanks.

MR. BOYD: All right. Mr. Kauffman. Followed by Matthew Davey. No? Okay.

Scott Yappen. Alexa Henao. Jaci

Trzaska. Sally Gellert. Bruce Burcat. James McDermott. Dean Evans. Vince Faherty.

Okay. Gaylord Olson, you'll be on deck, sir.

MR. KAUFFMAN: Great to be here. My name is Bryan Kauffman. I'm with the Enel Group. And, thank you to Michael Winke and the EMP team, as well as Commissioner Chivukula, Gordon, and Solomon, for being here and hosting.

Who is the Enel Group? I just want to say a few words about that. So, you might be more familiar with a brand called EnerNOC, that offers demand response. So, we were acquired last year. And, as of next week we will no longer be known as EnerNOC. We'll be Enel X. The Enel Group is a global energy company headquartered in Rome, and has 72 million customers. We are the wires company in many countries. And, actually, we operate in thirty countries here in the U.S. We have this company EnerNOC providing demand response, demand energy, which does a lot of customer-sited solar and storage. And, a company based out of California called E-Motorworks that works on integration of electric vehicles into the grid. We also have a company called Enel Green Power

North America. Which operates over 5,000 megawatts of hydro, solar, wind, and other renewable power here in North America.

So, first off, thank you very much for hosting this. Isn't this a humbling event? Thinking about 2030, 2050. I would say a wedding, like I hope we're all here for your 50th anniversary and, you know, I feel a little bit like that. But, it's great to be here and talking about these issues.

My comments will kind of focus on some of the same issues that the prior folks have talked about. Danielle, Nicole, and Doug, I think hit on a lot of points that we think is really essential for developing a modern grid. And, let me just start off with those, and think about the path forward.

So, the first element we'd like to talk about is a clean peak standard. And, we definitely would recommend considering that in addition to the states renewable portfolio standard. A clean peak standard, such as the one that was recently passed up in Massachusetts, helps to ensure that as renewable penetration grows, that an associated amount of storage and curtailment

activity can also be encouraged to come on line. And, that's really essential to seeing that peak time of the day when the grid is stressed the most, that renewable energy is supplying that, and really helps flatten the grid. And, it's really so important that -- you know, in a lot of states they're considering this because they don't think it's possible to meet a goal such as a hundred percent clean energy without something like this.

The second major topic is financial incentives for storage. As others talked about, New Jersey just has passed a goal by January 1st, 2021 -- so just about two years from now -- 600 megawatts. And as you heard from some other folks, a year ago we only had one or two megawatts on line here. Obviously, that's a huge gap. And I would encourage the EMP team to really think about that as a high priority to get those incentives, whatever is really needed to meet that goal. And I'll talk about interconnection is also a key issue.

The third big topic -- and some other folks also talked about this -- is non-wires solutions. So, nearby states like New York and District of Columbia have experience with this

process. And, a key goal for a non-wire solution program is to really consider all alternatives to distribution upgrades, and conduct third-party analysis to assess if a more affordable alternative can exist in a form of a non-wire solution such as DER, including demand response, energy efficiency, energy storage, and solar.

The next big topic I'd like to talk about is demand response. And, in AB3723 that was passed in May, the state put forward goals around peak shaving, which is a form of demand response. And, I think what a lot of states have seen is good modernization relies on customers, customer engagement. And, demand response is really the gateway drug to a lot of differently types of customer engagement. And, we would definitely recommend prioritizing that. And, I think even AB3723 calls on the BPU to really set a lot of goals by mid-2019. So, I encourage you to focus on that issue.

The next big topic is maximizing DERs to support resiliency. And, I think others have really gone into a lot of details there about how useful on-site fuel in the form of clean renewable fuel, such as solar backed up with storage can be.

And, you know, if we think about Hurricane Sandy, just imagine if more customers had back-up power on site that was storm proof, and was also clean.

The next big topic, which I think really is important for all of this to happen, is rate structures. And, we're partners with utilities in many states, and we see them as those who can really get these programs off the ground. Especially DER and other customer-sited solutions. So, we really see that utilities, though, need to be incentivized to help develop the a grid that allows those resources to come on line. And, if that didn't take in -- you know, focused on, then often, even if you pour a lot of resources into a lot of different solutions, the utility is really there to be supportive, or they're the one who understands that there's risk to the grid and really slow down a lot of processes. So, we see that utility incentivization is really key.

And, also -- echoing Sunrun -- competition. Companies like ours really only operate in states where there's competition. And, we see that competition is essential to bring solutions to customers. But, it's also important for customers to have access to solutions that are

the most affordable. And, obviously, thinking ten years, thirty years down the line, New Jersey is thinking a lot more than just energy. You're thinking about how you retain companies here in the state. And, that's really also gets at what are the cost of doing business. And one of the big cost to all business is energy. So, having competition really is a key part of that.

And, I'm getting to the end here. But, the next part, you know, to focus on an interconnection. Because that is something that in so many states is an impediment to any type of modern grid. And, we see some states that have really taken a lead, like California, driving down the times to inter-connect behind meter solar down to a week. And that, obviously, can be done. And a lot of states have made progress, like New Jersey on that with solar. I think there's probably more that can be done on solar, as well as, as we think about storage and other EVs that are interconnected that are going to be functioning both with load and generation at different times of day. There really should be a lot of focus on interconnection. And, like we talked about, setting ambitious goals and having some elements competing with those.

Interconnection is one of those areas where unless that's taken really as a focus area, it can be very difficult to reaching these important goals for the state.

And, I'll just say finally, EV charging infrastructure. We are a proponent of modernizing the grid so EVs can easily come on line and provide different levels of service, both to the utility and also to wholesale grid operators like PJM. And, that also relies on coordination. And I think a lot can really be done at the state level, because at the end of the day these are mostly state interconnections, and state has the authority.

So, thank you very much for giving me this opportunity. And, October 12th we will definitely be submitting more comments. Appreciate any feedback.

MR. WINKA: Great. And, just on the interconnection issue. We've been a winner of freeing the grid a number of times. And Mr. Hunter, who's sitting in the back there, runs probably the best interconnection work group in the country dealing with all those thorny issues that get in between those gray issues on regulation to

interconnection. And, I would suggest you participate in the interconnection work group.

MR. BOYD: Mr. Olson. Followed by John Reichman.

MR. OLSON: Hello. My name is Gaylord Olson. Originally I was intending to be just a listener at this event. But, I realized I did have a few things about discussion points 4 and 6. Four being, "How does the state plan for fuel diversity and renewable energy within a modern grid?" And, 6 is, "In what ways can a modern grid meet the Global Warming Response Act 2050 greenhouse gas emissions reduction requirements and the governor's goal of achieving one hundred percent clean energy by 2050".

So, I'm assuming one hundred percent clean energy means avoiding all fossil fuel. So, we've heard a bit about energy storage. And, that is a big issue to get to one hundred percent clean energy.

Now, I'd like to bring to your attention that energy is not measured in megawatts. Energy is measured in megawatt hours. Power is measured in megawatts. And, so, we need to keep that in mind. Now, this is a mistake that is very

frequently made. People start talking about energy and energy storage, and they say so many megawatts. That's like apples and oranges, sort of, that is. You need to know how many megawatt hours it might be. Now, on that thing, if you look at Wikipedia, you'll find that the largest form of energy storage for the grids worldwide happens to be pumped hydro-electricity. And, I'll just give you the quote. "Pump storage is the largest capacity form of grid energy storage available. And, as of 2017, the U.S. Department of Energy, global energy storage database reports that pump storage hydro accounts foe over 95 percent of all active storage installation worldwide". Over 95 percent. And, so, batteries have to fit into the little bits between 95 and a hundred. A few percent for batteries. I will submit to you that it's probably going to remain that way for a long time into the future. We're going to have to rely on pumped hydro-electricity for almost all of our grid scale storage.

Now, along that same line. Most people assume that there's been very active study of this, and so we're running out of places where we can do pumped hydro. And, believe that's really

not true. And, I mentioned this at a previous meeting, but I'll just bring it up again here. There are three places, happen to be in Germany, where there are pumped hydro installations without a dam. Most people assume you have to have a dam, and you have to have two reservoirs -- a low-level reservoir and a high-level reservoir. So, you pump water under the lowest level to the high one, that stores the energy. You let the water come back down to the lower reservoir, and the energy comes back. So, you might say that's a sufficient condition to have it function. But, it's not a necessary condition. You do not need to have a so-called reservoir at the bottom. You only need a source of water at the bottom. That source of water could be an active flowing river, such as the Delaware River, such as the Hudson River.

So, the fact is you do not need to build a dam to disturb the environment in terms of fish or anything else. You can have the continuous flowing river there at the bottom, and you pump water up to a reservoir at the top of the hill. Now, there if you don't have a lake -- and believe it or not, there are some places where you actually already have a lake. Along the Appalachia trail in

northwestern New Jersey there's a place called Sunfish Pond. And Sunfish Pond is a thousand feet up from the Delaware River. So, if anybody wanted to, they could convert that into a very large energy storage facility. Now, the environment people probably would not want that. But, of course, you can excavate artificial reservoirs elsewhere other than changing anything about the existing natural pond.

So, what I'm saying is, if you can look into the far enough -- into the future far enough, I think we can envision that we can have multiple pump storage hydro facilities along the Delaware and Hudson River. This might require some additional transmission lines to come from those sites down to the cities, like Philadelphia and New York. But, I'd like to at least put this out there as a possibility.

And, I did submit something in writing on this same subject. If you want to look it up right now, there is quite a bit on the internet. If you go to the New Jersey Sierra Club latest newsletter and look on Page 13, there's a more extensive description of that than what I'm giving you here today.

One additional little fact, which I did a calculation of a few weeks ago. If you look at the energy that's stored in the largest pumped hydro facility in the United States -- which happens to be in Virginia, it's call Bath County pumped hydro -- you look at the quantity of energy stored in the water at the high level at that location, and you compare it to the energy and all of the batteries in all of the Nissan LEAFs -- -now, the Nissan LEAF is the biggest selling plugged-in car in the world today -- if you compare the energy stored in that one pumped hydro facility with all of the energy and all of the batteries in all of the Nissan LEAF in the world today, it's about four times more energy in that one pumped hydro location.

So, I would say we don't need to rely on batteries for grid scale energy storage. And, I'd be happy to discuss this with anybody else who may be interested.

MR. BOYD: Thank you, sir. Next we have John Reichman. Followed by Matt Davey. Matt, you here?

Okay. Ashley-Lynn Chrzaszcz. Would you like to speak?

MS. CHRZASZCZ: Yes.

MR. BOYD: Okay. You'll be next. Thank you.

MR. REICHMAN: Good morning, everyone. Thank you for hosting this important event. My name is John Reichman. I'm the Chairman of the Environmental Committee of Bluewave New Jersey. Bluewave is a grassroots organization that's been involved in many federal and state issues since 2005, including environmental issues.

When you're deciding on this Master Plan, I think you need to keep three principles in mind. The first is your decisions must take into account the most important stakeholders in this process. And none of them are in this room. They are our children and our grandchildren. So, I don't see too many minors out there. But, what you decide may not have that much of an impact on an old geezer like me. But, it's going to have enormous impact on my children, and my grandchildren.

Second principle I think to keep in mind is that climate change is an obvious existential threat. And, how we combat climate change is the biggest economic and moral issue of

our time.

And, the third principle that I'd like you to keep in mind, which sort of leads ineluctably from the first two principles, is that there needs to be a complete ban on new fossil fuel infrastructure. That includes a new gas plant in the Meadowlands. That includes all of the various pipelines that are being proposed all over the state. Now, I think it's debatable whether any of these projects make economic sense. Particularly if is you're really -- if you have a real goal of one hundred percent renewable energy by 2015. Because that would mean that all of this infrastructure would be abandoned well before the end of its useful life. But, let assume just for the sake of argument, that there is a short-term benefit to any of this new fossil fuel infrastructure. What I ask is that you channel Nancy Reagan and just say no. And, there is certain analogy really between fossil fuels and drugs. It's obviously not a perfect one. But think about it. I mean, drugs give you that short-term high. They give you a short-term benefit. But they will kill you in the long term. And, the same is true of fossil fuels.

So, now is the time to step up. There are cities such as Portland that has done this. There are countries that have done this. And, now it's time for us to be the first state to just say no to fossil fuels. Thank you.

MR. BOYD: Ms. Chrzaszcz. Evan Berger, you'll be next.

MS. CHRZASZCZ: My name is Ashley-Lynn Chrzaszcz. And, I'm an associate at Gabel Associates. And, I am here today to testify on behalf of the independent energy producers of New Jersey, referred to as IEPNJ. And, we appreciate the opportunity to present our views.

So, IEPNJ is a not-for-profit trade association that represents New Jersey's generators of electric power. IEPNJ members own or operate approximately seventy percent of the electricity generation capacity in the state. Members include companies that sell electricity into the wholesale market for sale with the state's utilities, which in turn sell that power to New Jersey homes and businesses.

As such, members of IEPNJ are active participants of the region's wholesale power market, and have a continuing interest in assuring

that there are adequate supplies of electricity to fuel the region's growth in and environmentally and economically sound manner.

IEPNJ's members have been on the forefront of the dramatic changes that continue to transform the power business. And since 1992, IEPNJ is directly involved in shaping of the laws and policies that affect New Jersey's power industry, and has been an active contributor in the state's Energy Master Plan process over the years.

We support New Jersey's direction to creating a clear, more environmentally advanced energy industry throughout the consumption, transportation, and production chain. The power generation industry is a vital component of this chain, and generators are committed to continuous improvements in the efficiency, reliability, and environmental performance of its plans. In this regard, the one factor we wish to emphasis is that the most efficient way for New Jersey to achieve its goals is to rely on competitive markets and let them work. Competition forces market participants to respond to competitive pressure by improving efficiency, which in turn reduces costs and improves environmental quality.

New Jersey's generation fleet has evolved and improved significantly over the years for this process. New Jersey's power generators are currently one ever the cleanest fleets in the United States. And, we recommend that you continue to work in fostering the competitive energy marketplace. The Energy Master Plan should clearly indicate that it will continue to rely on a competitive market design to achieve these goals for New Jersey.

IEPNJ looks forward to continuing the work with New Jersey to provide the policies that encourage the development of generation resources needed to meet New Jersey's demand for power. In addition, we are always available to serve as a resource of information as you think through important issues.

Thank you for the opportunity to submit these comments.

MR. WINKA: Thank you

MR. BOYD: Thank you. Mr. Berger. Followed by -- is Willett Kempton here. Thank you, you'll been next.

MR. BERGER: Pleasure to be here this morning -- I believe still -- with this great

panel. So, my name is Evan Berger. I work with CALMAC. CALMAC is based here in Fair Lawn, New Jersey. We were founded in 1947 in Englewood. And, we've been manufacturing thermal energy storage pod, so ice storage, for over forty years since 1978. Last year we were acquired by a large company called Ingersoll Rand. So, now I work for the train company which is one of the firms that comprises Ingersoll Rand. They also have a large facility here in Trenton, so they have 190 kw solar. I was told to say this. But, it's actually my first year at the new company. It hasn't been that bad. It's a large conglomerate. It's a very big, well-run organization and hard a driving culture that I appreciate.

So, we still manufacture here in Fair Lawn, New Jersey. And, we've manufactured over a gigawatt of thermal energy storage that's been installed in sixty countries worldwide. We've got projects such as -- we just put in a second project at Rockefeller Center. Installation project at LaGuardia airport right now. Have done a lot of work in New York City. Here in New Jersey we've done a large thermal energy storage project at Rutgers. A number of projects in Perth Amboy.

School districts. And around the state. So, it's a real pleasure to be here.

What I wanted to talk about just briefly, which the laudable thing that you folks are doing with the Energy Master Plan, and how that sort of ties in with the new energy storage mandates or the new energy storage legislation, that has a very commendable and very aggressive goal. So, the first and foremost things that we do in the thermal energy storage and the energy storage business is integrate the clean renewable resources, particularly those intermittent resources like wind and solar. Without storage you can't have a real opportunity to make that grid scale component to drive even fifty percent, let alone a hundred percent of your power. And, so, that's the number one thing that we do.

Our thermal storage, or ice storage, essentially it's energy that is stored in the form of ice. So, we manufacture large tanks here in Fair Lawn. It's a modular system. And the idea is that you run on a large air conditioner called a chiller that makes ice at night. During the day you're basically letting that ice melt to create coolant that you then distribute throughout the

buildings. So, the idea it's kind of energy arbitrage, making ice at nights and then melting it during the day when prices are a whole lot more expensive because of the realtime price market, as well as reduction of demand charges. And, the benefits that we have over battery storage is that -- battery storage has got some real benefits, as well, as the ability to provide not just for cooling but for everything else -- but, on the plus side for us we are about a third of the cost, and we last two to four times as long for a very long duration, a battery that has an eight-hour discharge. So, one of the ways you would sort of think of us -- and this is something that we do in a virtual capacity all over the country, specifically in Texas right now is where we're essentially sopping up the wind, wind power peaks at night. And, so, the energy prices in Texas, which is a regulated competitive energy market just like New Jersey, with a lot of wind in the western part of the state, drives the prices to near zero at night. Enabling our customer to basically buy almost free electricity at night for use later during that day, helping to integrate that resource, drive up the price from below zero to

slightly above it on a must-run resource. And, enabling that to come into the grid.

So, when you're looking at energy storage, I think thermal energy storage has to be a large part of that solution. Right now we've been able to, you know, of significant success here in New Jersey without any incentives or rebates whatsoever. In other states, such as New York City or New York where there's a large demand management program an up-front incentive from utility, and previously from the state -- and places like California or Florida. FPL has a large -- Florida Power and Light -- has a large thermal energy storage program. It's relatively modest in scale compared to some of the stuff that batter companies and fuel cell firms have received, but it's enough to drive over twenty megawatts and over nearly 200 megawatt hours of storage into that grid over the last ten years or so.

So, we would recommend that those sorts of incentives, modest as they may be, can really drive a market. And, can really accelerate the adoption of a really crucial thermal storage and other energy storage technologies of all sorts across this state. So, when it comes to how you

would incentivize a storage, what I would really recommend to you folks is just a few things. The first I would say provide as clear a market signal as possible. As I mentioned, schools, hospitals, the institutional sector -- outside of New York where it's the large office building, the Goldman Sachs, the Credit Suisse's and all these big skyscrapers. Outside of those handful of large metropolitan areas, it's schools and hospitals and institutional clients that drive our business. And, they'd be the first one to tell you that they're not a very sophisticated audience from an energy perspective. That's not the business that they're in. They're in the business of serving their clientele, their students and those who come seeking help.

So, what we found is that a clear incentive that they can calculate themselves and understand at a very gut level is very important in terms of driving the adoption of this stuff. Not just for the most sophisticated, but for all customers, your everyday folks. It's so important to have these be transparent and either prescriptive or known in advance. And, it's very important that the incentives, any kind of

incentive that you're using, could drive market adoption be regularly available.

We are a big fan of the non-wires alternatives, non-wire solutions that have been discussed earlier. We've done certain projects with them in the past. What I would caution is that -- and, they're very -- let me just say that they're very useful if you got an acute need. If you have a distribution substation or some other feeder line that has a real problem, nuclear plant comes or dramatic growth, it can be a very successful way to really hone in on that. And, great reductions there. The problem is, with those sorts of approaches, is that it really kind of drives your everyday customers out of the market. If you are a school district that is constrained by your buying capacity; or, when you're going to be developing a school if, if it's not a regularly available incentive it's very hard for you to take advantage of that. Same is true for hospitals. Same is true for most non-class A office customers. So, it kind of creates a bit of a -- you know, some distortion in the market. So, I would definitely take that good thought in terms of how to create an incentive structure for all the technologies that

you're looking to accelerate, that enables all customer types to play a big role.

So, that's pretty much it for me. I really appreciate the chance to speak with this panel. And, we will be delivering to you some more detailed comments before the 12th. Thank you very much.

MR. WINKA: Thank you.

MR. BOYD: Mr. Kempton. Followed by Noel Christmas.

MR. KEMPTON: Good morning. My name is Willett Kempton. I'm a professor at the University of Delaware. I heard the instruction that we should minimize things that will repeat in previous sessions. So, I'll just summarize. There's a written version which I'll be circulating.

So, in Executive Order 28 and subsequent legislation, Governor Murphy and the New Jersey legislature have tasked the Board of Public Utilities with recommending how to meet the state' energy storage goal of 600 megawatts by 2021, and 2000 megawatts by 2030. We explain here how electric vehicles can help reach this goal at a lower cost than relying solely on stationary

storage, whether battery for pump storage, or in other mechanisms.

So, just very briefly. Our group, The University of Delaware EV Research and Development Group has developed -- well, invented and then developed the use of vehicles to support the grid so that it's being controlled. In other words, grid integrated vehicles you can charge at slower or faster rates, or maybe discharge, also. As well as vehicle-to-grid that is putting power from the vehicle onto the grid. So, that's something we've been working on for twenty years -- surprisingly enough. And, it's now being licensed to corporate entities and being used to generate revenue.

So, for example. For commercial projects right now, in Denmark earning $1,500.00 per EV per year. Similar projects in the Netherlands and France. A UD project 2013 to 2016 used BMW vehicles, and earned $1,200.00 per year per vehicle. In a new UD Nuve project -- Nuve is a company that we licensed here in technology, too. The new UD Nuve project has a total capacity of one megawatt, which we're currently working on an interconnection process with PJM. And, that's in Delaware, so we can't interconnect in self because

legislation has been passed to facilitate this. At the end I'll suggest some things that New Jersey will need to do to be able to have these kinds of capabilities.

So, how much does a V2G cost in comparison to stationary batteries. So, let's assume the strongest and most expensive case the car discharge as well as charge, it has control systems. So, you compare a stationary battery systems, at the end of 2017 the cost was about $850.00 per kilowatt for utility scale, and $1,500.00 per kilowatt for a residential scale. Cost of dropping, but it's likely that they will not be economically viable without subsidy for some time. By comparison, EV Group estimates that adding bidirectional capabilities to an EV charger will add in the range of 200 to $500.00 per vehicle. And an additional $200.00 of equipment for doing the controls -- talking to PJM or whoever the grid entity is. So, if you take a 6.6 kilowatt Nissan LEAF, that's $700.00 for one EV, taking the high figures there considerably; or, $106.00 per kilowatt for bidirectional storage from the EV. So a total $815.00 a kilowatt for fixed storage; $106.00 per kilowatt for EVs doing the

same thing.

So, how much can you do with this? Is this a small resource or is it large? New Jersey has set a goal of 330,000 zero-emission vehicles. So, we just take that as a bench mark without making a statement about whether that is low or high, or whatever. So, the state's goal of 600 and 2000 megawatts, how do those two compare. At 6.6 kilowatts per EV, 330,000 UVs would be 2,178 megawatts of storage. More than enough to meet even the 2030 storage goal. So, this is a really big storage resource. And, it's really low cost. Although not all EVs will have V2G capabilities, and those that do will not be connected all the time, this example illustration, this example calculation, illustrates that the EVs could be a significant component to meet New Jersey's storage goals. It's in the same order. It's not one-tenth to 100 or something.

So, I'll skip down to policy recommendations. You know, we've been working on this in multiple states and in multiple countries. So, we have a pretty good idea what's needed to be able to do it. And, of course, the system was not set up to do this kind of thing, so some rules

don't quite match. So, grid integrated vehicles and vehicle-to-grid power face regulatory barriers that prohibit market penetration. So, we list policy actions here needed so that New Jersey can capitalize on the benefits to support the state's transition toward a clean energy economy. And, that's both to encourage EVs, and also to encourage a modern, cleaner grid by having low-cost storage as part of that.

So, I won't go into each in detail. I did go into more detail at the previous testimony. And, there's a written handout. So allow for interconnection of grid-integrated vehicle systems using the industry that is the automotive industry safety standard created by Society of Automotive Engineers, that' SAE J3072. If you want safety from an electric vehicle plugging into the grid, let's look at what the automotive industry has created for this purpose. This is a draft -- it's a proposed bill in State of Delaware right now. This is a new standard that just came out like two years ago. So, that's Item 1, look at the standard.

Second. Allow for retail credit for export in utility tariffs. So, we've got credit

for solar, but we don't have credit for storage in the low voltage end of the system. So, again, we have some more detail on that. But, that's a very important thing if you just -- every time you store energy you push it back on the grid, you get zero for that which -- you can't make money because you're moving it back and forth, back and forth. You have to get some kind of credit when you push it back onto the grid. It doesn't have to be more credit than what everybody else gets, it doesn't have to be more than you bought it for. There has to be some credit explicitly in there for export.

Third. Raise the fast-track interconnection limit from 10 to 25 kilowatts as recommended by the Interstate Renewable Energy Counsel, IREC. So, that's already out there. Some states are doing it. New Jersey has not done that yet. That makes it possible to use the full power of a car without artificially limiting it 10 to ten kilowatts because of the type of interconnection limits that we have now.

And, fourth. Allow grid integrated vehicles to compete on an even playing field with transmission-connected storage in wholesale markets. So, this is a response to FERC Order

841, which PJM will be evaluating. The state, the BPU, could ask utilities to evaluate this Order, and is it feasible. FERC allows for, possibly, utilities that would want to do it, it's smart accounting. So, if they do it, that's great. If they don't do it, then we need to have the things I mentioned earlier; the retail credit for exports. You have to do one or the other, or you kill their business. You take energy and you pay for it, push it out, you get nothing. So, the idea is you're moving back and forth, so you have to get credit when you push it out.

The then fifth, and last recommendation is kind of simple. And, that is, explicitly include grid integrated vehicles in the New Jersey definition of storage. Just to be really clear, that's part of the whole picture.

Okay. In conclusion. V2G is a triple opportunity. It provides storage, cleans up transportation by providing a second remedy stream to the vehicle owner, and lowers ratepayer costs. Because, if you're providing services out into the distribution grid you don't have to put in as much infrastructure. So, it provides storage, cleans up transportation, and lowers ratepayer cost. But

unless the policy actions described above are implements, the BPU will effectively block this valuable resource from use in the State of New Jersey.

Thanks very much. Glad to take questions later.

MR. BOYD: And, Mr. Christmas. Followed by Jonathan Lu. Jonathan, you'll be next.

MR. CHRISTMAS: Good afternoon. Thank you for letting me come before you today. I know you look at that paper and thought that name was false, but that is my name. Noel Christmas. I can't hide from anybody with that name, so I have to make sure I do things right.

Again, thank you for letting me come before you today. As I said, my name I Noel Christmas. I represent 3,500 members in the utility industry. I am the president of the Utility Workers Union of America, Local 601, representing 1200 members for Public Service Electric & Gas Company. And, I am the Chairman of the State Council of the Utility Workers Union, representing workers at New Jersey American Water, United Water, Elizabethtown Gas Company, Bergen County Sewerage Authority, Stamford Township Water

Authority, Berkeley Township Water Authority, Kelly Construction, and J.D. Coley Construction. And I also represent a small group that works for New Jersey Transit.

Specifically for today's hearings I will address the issues basically dealing with the technology pieces of today's discussion on Building a Modern Grid. As for the general principle, we are for modernizing the grid and its infrastructure and its resiliency. But, only to the extent of upgrading its infrastructure to the point that we are more resilient and prepared to handle the ever-increasing presence of more powerful storms, and making sure the public is safe. But, we have 500 jobs -- meter readers, field collectors, field service operations, billing and payment centers, customer service call centers and walk-in centers, new constructions, gas and water contractors, and gas and utility street workers.

I will not take up much of your time with my testimony here today to talk to you about the important role that we play in our state, in our communities. Utility companies provide good middle-class jobs to all communities, especially in those communities where many are looking for an

opportunity to improve their lives to have a decent living. What is being proposed will permanently destroy the diversity of those jobs, along with utility safety presence we provide in all communities. Those opportunities will no longer exist for me. And, I'm specifically talking smart meters.

Now, as these utility companies, corporations, and manufacturers will paint a rosey picture of all the blind customer spin they will put on about some of their false projections and propaganda on grid modernization, specifically smart meters -- a catchy phrase, but it does not pass the smell test. Remember, it is almost always, and I mean always, about money and profits when it comes to smart meters. It's never about the safety of the public.

Now, to briefly get into the details backed up by some of the facts. The field jobs that I represent perform important emergency duties. Not just the duties that I described earlier. We are the boots on the ground. We are the ones that go into homes, see dangers, report them, and have them corrected. I'm here to tell you what corporations and utility companies, such

as PSE&G, and manufacturers won't tell you. We are the ones who save lives before it even happens. When meters are tampered with, we are the ones that report it and have it corrected. We are the ones who hear meters buzzing and have to shut down the house until it's fixed, stopping many potential fires that you never even hear about. We are the ones that see landlords taking advantage of tenants, jumping into electric meters. We are the ones doing Superstorm Sandy and Hurricane Irene, who answer the bell for police and firefighters and many emergency personnel who did not have the means or the staff to provide the protection to the public needed from downed power lines, cracked utility poles, wires being pulled down, and potential major gas leaks that could have occurred.

Technology does have its place in our society. Cell-phones, internet, social media, access to information -- many other safe avenues. But, not at the expense of lives of human-beings. We are talking about gas and electric. Elements if not checked, inspected, and corrected, people die. I have a board here in front of you. We report hundreds of these on a daily basis. I only printed up a few. I have stacks in my office. Gas meters

taped, that our meter reader found. Shut down the gas, called up, told the landlord he had to have this corrected before the gas could be restored. Electric meters tampered. Boxes broken into. All these things, if we're not there, does not get reported. Those are the things you don't hear that happens every single day.

I have members that wanted to come with me here today. I said no, you have to be in the field, I'll take care of it, don't worry about it, it's not that type of forum. I will speak for us. All right. That's the kind of work that we do out there that people do not understand. And, that you will not hear anybody talk about smart meters -- or gives a proposal on smart meters -- mention that. The proponents of smart meters have not written any proposal on how to provide safety to the public. They don't tell you that batteries overheat in smart meters and cause fires. They don't tell you about all those hidden dangers that I brought up. And as far as savings to the customer, there has been no evidence of any customer savings where smart meters have been installed. In fact, it's been quite the opposite. The analog meters that we have now have life

expectancies of about fifteen years. That's when they get changed. When you start dealing with smart meters and modernization and internet, now all of a sudden they have to upgrade every couple of years. And who's going to pay for that? The customers, the public. That's who's going to pay for it.

This year the State of Massachusetts got it right. After a four-year investigation their Department of Public Utilities came to the conclusion that the business case revealed weaknesses for advance metering functionality. Regulators said that the evidence support a utility investments in grid technologies like advanced distribution management system, some sort of automation, and volt optimization, as opposed to automated metering infrastructure. Regulators approve of other modernization investments in addition to that, just nothing customer facing. While the BPU did not take the decision lightly, they declined and customer-facing investments at this time. Kentucky regulators came to a similar conclusion this year, also. And, North Carolina is now questioning the same. Wherefore like I mentioned earlier, we are for grid modernization

and upgrades. But anything customer-facing would be a tragic, costly mistake. Not mater what those who seek to profit from it tell you.

No one seems to be able to answer this question. PSE&G has won the reliability award in our region for sixteen years in a row. Beating out states that have smart meters. And, we don't have them. How is that possible? Everybody who told you smart meters said they would have a more reliable system, more modernization of a grade. How come they're not winning those reliability awards? How come their power outages are still longer than ours? Nobody seems to answer that question. One thing I can tell you. Also, PSE&G's rates are equal or similar to those who have smart meters -- or, even less. So, anybody who's telling you about smart meters, all they want is access to the data so they can make money on that data, and also change the technology and charge the customers whenever they see fit.

Thank you for your time. I appreciate it. Have a nice day.

MR. BOYD: Thank you. Next, Jonathan Lu. Followed by Jeanne Fox.

MR. LU: Hello everyone. It's

Jonathan Lu. It's hard to see. Yeah. Good morning. My name is Jonathan Lu. I am the founder and the leader of the Princeton Student Climate Initiative, which is a group of student researchers working with schools across the state to take effective action on climate change.

First, thank you all for holding these stakeholder meetings on the Energy Master Plan. These set an inspiring example fore me as a young person on democratic decision-making. And, we also applaud Governor Murphy on his recent efforts to rejoin RGGI, and set strong clean energy goals.

Before I begin, I just want to note that we hope to work together with every one of the stakeholders in this room. You can find me afterwards. We have a policy proposal today, but we see it has complimentary to the other policies that are being suggested. Especially because it produces money, it generates funding. We don't have the one solution, but we think we have a good part of the plan.

For the past year, we have been working with state assemblyman Andrew Swicker on a proposal for a carbon pricing proposal that covers all sorts of emissions in New Jersey. Which

compliments RGGI, which focused solely on the electric sector. We have written a 94-page white paper, and will be presenting our research at the first international carbon pricing conference in New Delhi. Our proposal will protect low-income households and energy- intensive businesses, while investing in crucial energy infrastructure and grid modernization. We also recently held our 130-person state quarter forum on New Jersey climate policy, convening representative from across business, governments, utility, environmental justice sectors. And, we look forward to submitting our report on those prospectives through this process, as well.

So, as a millennial I see climate change as the biggest challenge facing my generation. And I once despaired that we would never muster the political will to take effective action on climate change. Especially with the partisan gridlock in Congress, pretty much throughout the time that I've been growing up. But, then I learned about carbon pricing as a simple, effective, and politically feasible approach. Simply put, carbon pricing makes it more expensive to pollute, and gives an incentive

to switch to cleaner energy and to have energy efficiency. And, it sets a clear, long-term market price signal that everyone can calculate several years into the future for all economic actors, whether you're a business or a household. It's technology neutral, and it can generate revenue for investments, again, in things like a more reliable and modern grid, and renewable energy. When I say politically feasible, I mean that 73 percent of adults in New Jersey support a carbon tax on fossil fuels from a study of just this year. And, leaders from both sides of the aisle -- our senator, Corey Booker, two Republicans such as our former governor, Christine Todd Whitman. Both environmental groups and fossil fuel companies support this.

We have been researching our carbon pricing policy that works legally, economically, and politically for New Jersey. What is most exiting is the potential to generate funding. So, if we set a $30.00 CO2 price, which is about 27 cents on the gallon; and, we set aside 20 percent for investments, this would generate about 700 million dollars a year for investments in things like modernizing our grids, electric vehicle

charging infrastructure, renewable energy, and public transit. Just to put this in context. The total revenue -- the total yearly funding from RGGI options, for all RGGI states in 2016, was only 400 million. So, if we set a strong carbon price, we can really have the kind of scale of investments that we need in order to get a head start, and be first on this. At the same time you can delegate the rest of the revenue to protect households from the rise in energy costs.

One thing that I noted. Environmental justice in low-income communities, these are communities that are experiencing disproportionate impact from climate change and the effects of air pollution, who may not have the means to testify at hearings like this today. We can take action to protect them in particular. Dedicating a specific amount to investments in their communities, and to reduce pollution. This is a common idea. It's an integral part of proposals in Washington State, I1631, and the New York Climate and Community Investment Act. For example, if you dedicated 30 percent -- I said 20 percent of -- I said about 700 million dollars. Dedicate 30 percent of that into these communities, that gets you about 210 million

dollars each year for these investments.

Another question I don't think was brought up was about natural gas leak detection and mitigation. You can incentivize companies to stop these leaks, again, with a price on greenhouse gas emissions. We believe the government should assume a worse leakage rate for pipelines until companies can install effective reviews, leak detection systems. The price will then give them an incentive to monitor and reduce their leakage from future emissions. And, that's all I have today. Thank you all very kindly.

MR. BOYD: Thank you, Mr. Lu. Following Ms. Fox we'll have Doug Davis. You'll be next, sir.

MS. FOX: Thank you for having this, and all the other hearings. I couldn't help -- I didn't sign up to speak, but I saw there's three commissioners here, so I want to say something.

So, I'm Jeanne Fox, and I'm representing myself. I have a long history in regulation, the state and federal government. I first want to thank the three commissioner, Solomon, Chivukula, and Gordon for being here. This is an important hearing. And, it's really

good that you and your aids are here. I also want to thank the hard-working public servants, of which I've always been one, and I love you guys. And, i wanted to thank the Governor for having the Energy Master Plan be what it's supposed to be, which is participation by all the necessary, relevant departments, and not just the BPU. While the BPU is responsible and chairs it, you guys have to be in the game. And I'm really thrilled that the Governor has all the cabinet officers who are involved involved in this.

This is a real exciting time for you all, the commissioners, to start the new energy future for New Jersey. We need to get there. We've been thinking about it, talking about it, working on it every once in a while. But this is the really great opportunity to plan this and do it right.

I want to talk about a couple of things. One is off-shore wind. Now, I congratulate you for putting out the RFPs. That's a good first step. I see off-shore wind as a replacement for nuclear power plants as base load generation. The two nuclear plants will be going off in the 2040s. I expect to be around when

they're still going off -- and they can, because they're just so big, they'll be out there. It's very windy up there and high, and the new turbines for Europe are pretty incredible.

And, what I want to talk about, though, is the backbone transmission line. We have been talking about this for fifteen years. At one point in time we had chairs of the commissions of Delaware, D.C., Maryland and Jersey going to pursue that with PJM. Unfortunately, that was a number of years ago. And now it's a whole different thing. But, I think the backbone transmission line is clearly needed. And should be a competitive process in RFP. There are at least two who are interested in doing that. And it really should be part of your off-shore wind study. I don't know if it is or not, but it really needs to be.

There's a lot of reason for the transmission line, which will be part of the PJM grid system, it be treated like the PJM transmission lines are treated. And, the reasons are really it's windier in certain parts. So, you talk about Virginia up to northern New Jersey. It's windier in some parts than in other parts at

different times, that line will take that electricity where it's needed. I know that Europe -- not Great Britain, but the rest of Europe, Germany I know, put out an RP separately for transmission, treat it as part of the grid system -- as I think we should do, separately from the off-shore wind that they have for those developers. It should be a normal part of PJM's grid. I also note that the OREC -- which is really not a good for it, but anyway -- the OREC is paid for by every ratepayer in the state of New Jersey, including those in north Jersey where it's most congested and the electricity is the most costly. That we have a backbone transmission line, and then they can see some of the benefits for which they're paying. We don't have a backbone transmission line, most of the initial wind will be in south Jersey, where the electricity is less costly. And, if you have a backbone transmission line, those who are paying for the electricity in north Jersey can get some of that benefit. It will help cut the congestion cost, which is the most costly electricity that we have in the state.

I also note there's a group called the Power Buoy. We gave them some money in the first

decade of this century to do some research. And, they're located off of Great Britain. I think they're also of the northwestern United States. We couldn't have them here independently. They're maybe fifteen, twenty feet above the water line, and then they go down below and they use the power of the water -- which the ocean has a lot. It's not effective individually separately here. It is where there's no outer continental shelf. Like off of Great Britain, and off of northwester United States. However -- and, it would have at least ten, twelve years ago talking to that company. Those power buoys would also be very effective hooked up to the backbone transmission line. It would make them then cost-effective. They are not cost-effective if they're out there by them. So, there are a lot of reasons. It be less cost in the long-term. Off-shore wind will be hopefully a developing industry over the next thirty years, with more going out and more going on it, so long term it's more efficient, more cost-efficient. And, I urge you to put that as part of your Energy Master Plan study, and to consider it in your timetable for every two years or every eighteen months when you develop the RFP for off-shore wind

developers. You also factor into that timetable the backbone transmission line, so people have certainty about when the bid is going to be and that they will have -- developers will have the backbone transmission line to hook into in the future. They will not be doing their own transmission. Honestly, your initial RFP, maybe the next one or two after that, you have to figure out how that works. But, in the long term we definitely need that. And, I suggest and urge you to factor it in.

Secondly, regarding solar. New Jersey, obviously we know, is the most densely populated state, we have over 90,000 PV installations in the state now. And, there are some developers who want to do big solar farms, build them in South Jersey where the land is cheap. The distribution lines are rural binds, and the land costs a lot less so you can make more money. As you all know, New Jerseyans, we vote all the time for open space preservation and farmland preservation. I suggest in our state -- and this is not place for most cases solar farms. I can see a solar farm if it's used locally by that farm for their situation, or somebody who's a neighbor.

But you don't want to have places down in south Jersey -- I don't know how many now -- but, where you cannot put solar on your roof because they have these darn big solar farms there taking up the distribution line. That should not be allowed. We have plenty of roofs, we have plenty of parking lots. Cost a little more to do that, it's a more costly part of the state. But, that's where the people and the use for electricity is. So, I urge you to look at that, and really have it geared towards rooftops, parking lots, brown fields. Not landfills, it's too costly -- unless the owner wants to eat up the additional cost.

Thirdly. Alternatives transmission -- alternatives. Same thing. Couple of people have talked about that. We were going to start to do that back when Mitchell Weiner was the director of the Energy Division, with that PSE&G line coming into Roseland line. We didn't have time to do that kind of study at that point in time, so it went in, it was needed. We need to work with other states. A lot of going on in other states. California ISO. Independent system operator is doing the study now. The final report will be done in November. Looking at transmission to alternatives for the

whole independent operator of California. Also, New York and some other states have been working on this. We need a strong BPU policy now in this Energy Master Plan that has as a policy, a Board policy, alternative transmission, and non-wire alternatives need to be looked at first before the transmission line is built. You do not want stranded costs for the next four years. And, we know that that will in fact happen if you put them in unnecessarily. So, I urge you to look at that. Customers clearly want DER, and that's clear with what's going on now. So, we have extreme weather like Sandy, and climate change is getting worse and worse and worse. If we stopped everything now, we still have increasing extreme weather in the next twenty years. So, this is getting worse. Which means that customers know that. Commercial, industrial facilities and owners know that. There's also the addition of physical or cyber terrorism. And, I note that the Defense Department is very much into building microgrids. They've been doing that since the 90s, at least, when I was a VP they were working on that because they understand the concerns.

The Solar PV, people have it. But we

have Sandy, a lot of people thought well, I have my solar. Well, you don't, because you have to disconnect it from the system for safety to the workers, for the distribution company. What we need is smart inverters. So I was out for six days with my -- solar system burnt, didn't have a smart inverter, makes sense. There are ways now to do that. It's doable. There's a lot of the engineering types. I know that. But Maryland I think has been working on a study on smart inverters. At least that will allow me the day after, when it's sunny after Sandy, that I can have electricity then. Obviously, customers want energy storage, either commercial/industrial or residential. Because then when we have the extreme weather events will and are increasing -- they'll be able to be up and running after the storm further on a little mini grid, at least when they have the sun. And if they have storage then they can have it for a wile longer.

On microgrids, we need -- my recommendation is a vision of small microgrids for any community, any municipality of any size where their emergency management system, the fire department, the police department, and probably

some kind of community center, can be on this microgrid. With probably initially having to be combined heat and power. But, as I think most of you know, Princeton University during Sandy didn't lose any of their little critters in their test labs because they have a microgrid. And they went off the system, and they actually monetized that system when there isn't an outage, so it worked well. N.Y.U. lost all the little critters in their labs because they didn't have back up. Rutgers lost some, didn't lose others. Well, it's more than that. We have a lot of industries who are doing innovation technology stuff here. We need the energy storage to go with our DER, as well. And, I think that you're doing the study on that sometime as required. But I think that's really important.

Finally, redesigning our electricity system. Michael and I have been talking about this for twenty-five years. There is -- and, I suggest you use his brain, because it's really good on that stuff. Obviously we all want reliability, we want resiliency, and we want it at least cost. I know having done environmental for ten years in between my other stuff, my BPU stuff, most people don't get

these costs. They don't understand that ratepayers -- be it commercial, industrial, businesses, large energy users, or residential -- can't afford it. We have high rates. It's not as high as they have been, but it's still going to be high. Especially with all the improvements that we're going through. So, we really need to re-design this. And this is the Energy Master Plan they started doing. Look at what California is doing, look at what Maryland has discussed, what New York has done. They've made mistakes in some areas, all of these; but, they're working on it. Work with those entities. We need the smart generation distribution systems, microphasers and stuff, the union guy was talking about. We need two-way communication. The electric distribution company should be able to turn on and turn off for demand response or peak shading. My appliances in my home -- and I'm not there, I don't want to know anything about it, just have my refrigerator or whatever it is, like we do with air conditioning cycling -- we've been doing that for 25 years -- they can control it, the EDC control it, these smart appliances. And you also need, obviously, the two-way communication. One minute? Okay, Mike.

And, the final thing I'd like to talk about is modernization of the DER. I think that it's been worked on here and there, but how to monetize that. Aggregation selling into the PJM system for monetization, but also I think an aggregation obviously helps with that. But avoiding costs are a way of doing that. If somehow you can monetize that. And, I know the Rocky Mountain institute is working on that with some group. Thank you.

(Whereupon a short recess was held.)

MR. BOYD: All right. Mr. Davis.

MR. DAVIS: Hi. My first time attending one of these -- I say I guess my first time as an adult participating in anything political other than voting. So, very interesting and a wonderful opportunity. Excited about the Governor's new initiative. I think what was funny as we were chatting before, is this whole idea of how all these agencies are connected. I'd like to think the same thing for the modern grid. I've always been interested in energy. I started my career and moved to New Jersey with -- the train company was my first employer. I lived here ever since. It's interesting to see how the state's

stranformed. It's interesting to see how wonderful the state is with offering incentives and encouragement in different industries that might benefit the citizens.

I'd say one message would be, again, echoing what's happening here, is I think we can all get behind the idea of a microgrid. Certainly an easy transition to a future grid. I actually work currently for a manufacturer based in California that makes combined heat/power micro-turbines. And they're commonly applied to microgrid applications. I think, you know, in living in the state since I have it's interesting to see how portable takes have taken off. There's probably a lot more room for growth for that type of solar power, wind power, certainly is coming on board and excited to see these changes. I'd say, you know, the next few years it's fairly obvious that storage is going to take off and play a very significant role, as well. And, again, I always remind myself we shouldn't being picking winners or losers, we should be looking at these systems in the abstract.

So, storage also includes thermal storage. You know, solar portable takes also can

be solar thermal powered. There's a lot of ways to transfer energy. And combined heat/power is certainly part of a modern microgrid, and can also be a clean form of using combined heat/power technology to further our grid, to add resiliency, to use waste products which is biomass which are ample in the State of New Jersey. I think collaboration is the key for us to move forward as a state. I think learning from nearby states is also a wonderful opportunity. Not to do everything yourself, but look to others who are leading, such as the State of Maryland. The State of Pennsylvania certainly is doing a lot to break down historical barriers to the adoption of technology.

In my mind, the best thing we can do here today is to agree not necessarily on what the future's going to look like -- I think if we knew that we wouldn't need to be here today -- but, rather, we should be agreeing on what barriers are still existing from the old legacy that Thomas Edison gave us a hundred years ago of how we create power. As an observer, also the construction industry, I'd like to encourage people to really understand that the people that are developing and revitalizing -- I live in West New York, New Jersey

myself, and in the twenty years I've been there the neighborhood has gone from the dark coast to the gold coast. And I look at how people have decided to come back to that part of Hudson County and redevelop it. And are these incentives or programs that the state is offering being a part of it, and I'm sorry to say no. I look at most of the redevelopment that's gone on in New Jersey, at least where I live has been largely residential, it's been largely developer-based opportunities for making money as opposed to are we really building a modern grid or a resilient or a truly energy saving project. So, I think somehow or another the BPU, with its leadership, needs to kind of engage that audience and make it easy to do these programs, to make it easy to take incentives and put them to use. As opposed to creating incentive programs that might not actually effect the market.

I will look to our neighbor across the river in New York. And it took them a long time, but it's almost shocking to watch how almost every developer now in New York City is taking advantage of the programs. No one's building a new residential structure in New York City without first taking advantage of the free boilers. And

they're not free boilers. In New York City my firm has done a good job of promoting combined heat/power and solar, and some other things. And they're all building these technologies into the buildings because they realize it's to their economic benefit, and they're easy to access.

One of my friends in Philadelphia, I asked him for advice on why isn't New Jersey putting in more of this stuff that I'm trying to provide. And, he summarized that thought very eloquently, which is, the engineers -- and, again, everyone probably here might be an engineer, doesn't mean you're practicing -- but we make it overly complicated. And, the other advice that he said was, well, nobody is going to get fired for buying power from the local gas or electric company. So, as we look at microgrids we really have to figure out a way to be easy to do business with as a state, and eliminate barriers.

And that's it for me. I really appreciate the chance to be here. I did notice today we're on Facebook, so maybe in the future we can do Facebook Live.

MR. BOYD: All right. Dr. Jubilee, Prisar Brown. Followed by Mr. Ogden. And next

after that will be David Giordano.

DR. JUBLEE: Good morning, everyone. Thank you for this opportunity to speak. So, my name is Jublee. I'm from Rutgers University. I just recently graduated with a PhD in mechanical engineer. A couple of years ago Commissioner Chivukula, he came and visited our lab and saw the research we were doing towards energy. So, today I want to talk about -- forgive my clothing style, I drove my motorcycle here so I'm wearing jeans.

So, today I want to talk about three important things. As we go towards a hundred percent renewable energy reliance. So, one is the internet of things, and using electric vehicles for effective demand response. Second one, is planning optimal capacity mix. Third topic is solving poor quality shifts.

So, the first one, utilizing internet of things and electric vehicles for effective demand response. So, electric vehicles have been growing at ten times the rate in the past four years, and they're expected to grow at fourteen times the rate in the next few years. And, they're going to hold a major share of cars on road. And electric trucks, which are used in the

transportation industry, are also growing very fast. And, they're going to completely replace gas and diesel trucks in the very near times. So, they need a lot of current for charging. So, many of the speakers that are talking about using the -- so we don't have a lot of demand at nighttime, so, we can charge these electric vehicles up to 95, but each electric car using the fast charging can use up to fifty times the power needed for to charge a house or use in a house. So, the house uses like two kilowatts, an electric car needs about fifty kilowatts or a hundred kilowatts. So, if you have ten cars in a small neighborhood, it's going to fail the microgrid very fast. So, we need to plan for things like that. So, while I was doing research from Rutgers I took a course called Energy Systems where I did a simulation of a microgrid using electric vehicles, where the electric cars talk with the microgrid and they come to an optimal demand response time. So, if the car needs energy and the person needs to travel somewhere, the grid will transport energy to the car. And if the person, the car owner, doesn't need to travel anywhere and there's no sun or there's no wind, then the battery can discharge back to the electric

grid. So, it's just called V2G system. So, we need to come up with those internet of thing, technologies, to have a communication between electric vehicles and the microgrid. So, we need to build systems like that.

So, the second topic is planning optimal capacity mix. So, planning is very important when we're trying to make these quick changes to the grid system and using, utilizing renewable energy systems. And I read a research paper which, a couple of years ago, which studied the PJM grid for like twenty years. I did a lot of data analysis on how much wind power do we need, how much solar power do we need, how much storage do we need. So, without planning we will not know how we need to distribute those resources. And, it also depends on the climating conditions of states. So, for New Jersey I want to stress the point that we need to do some data analysis of historical data that's available from the New Jersey or PJM grid, and determine the solar power, the wind energy, and the storage needs of the state.

The third topic that I want to talk about is solving poor quality issues, which is one

of the biggest issues with renewable energy because when the cloud goes away the sun comes out, the energy from the solar panels quickly ramps up and we are faced with poor quality issues like the voltage goes about the standard value that's set for the frequency changes. So, recently I read an article written by the wise president of Fasolar, Dr. Morteria. He said that we need to come up with new agreements, power purchase agreements, to solve these issues because power-producing people they don't want to lose energy. So, the way to solve these power quality issues is we need to raise some energy. Right? So that when it's ramping up we can raise some energy so the voltage still remains within the standards. If we lose energy, the power producers would lose money, so they don't want to do it. So, the government needs to come up with certain changes to their agreements so that they're still paid for that energy that they're losing so that we can still maintain the right power quality.

So, those are the three things we need to talk about, wanted to talk about. And, we need to use data analytics and new technologies that are coming up, like machine learning which a lot of companies are trying to do. I saw General

Electric Company posted some jobs for people with machine learning experience, that they want to look into all the data that's available from all the wind turbines, all the solar panels. So, they want to look at the data and see how they can improve the grid, improve the distributed energy system. Same way other companies are also looking into data analytics. And, implore BPU to also use these modern technologies to improve the reliability of the grid, and find the optimal capacity mix for the state. So, thank you very much for this time.

MR. BOYD: Thank you. Mr. Ogden, followed by David Giordano. Matt Davey, are you here? Okay. And, David Kingle. No?

Okay. So, these will be our final two speakers. And, if you do wish to speak please give me a wave after the final two speakers.

MR. OGDEN: Thank you very much. Good afternoon, Commissioners, Madam Chairwoman, committee members, ladies and gentlemen. My name is Henry Ogden. I'm an Assistant Deputy Rate Counsel for the New Jersey Division of Rate Counsel. These are preliminary comments, and we will submit brief comments by the October 12th deadline.

In the interest of brevity, I'm going to do just bullet point responses to the thirty points. First is the modern grid. What does it look like in 2030, 2050? When you consider the grid now, some electric distribution companies have components that are over seventy years old, some of the substations. It's clear certain components will require timely replacement and modernization. But they have to do that while providing safe and reliable service. That doesn't change. Distributed generation, electric vehicles, smart grid technologies, electrification, demand site management, all of these things have created different opportunities for the EDCs to address and manage. But what hasn't changed is the electrons moving from the generation to the meter. We're moving from centralized generation to a decentralized system, which will require more monitoring and a more responsive grid. This grid is not going to change over night. It has to be gradual, deliberative, and transparent process that will deliver this safe and reliable grid at a reasonable cost to the ratepayers.

Number 2; critical steps. First consider what components are obsolete, which are

adequate, which future components will address the future needs, and which components provide most benefits to the ratepayers at a reasonable cost. And, how do you prevent over building of the distribution grid. The EDCs have the ability to gradually modernized the grid and recover these costs with no on base rate case. And, the adoption of N.J.A.C 14:3.2A also creates a mechanism for them to modernize the grid.

Number 3; climate change. The evolving grid should enable the adoption of the cost-effective distributed energy resources and technology at a decreased customer outage duration and incidences, and also decrease customer utility bills and usage. It should enable the adoption of technologies that decrease carbon emissions at a reasonable cost to customers, and allow all technologies to compete on equal footing.

Number 4; fuel diversity. New Jersey's RPS requirement and the recently adopted SECs to zero emission credit, in addition the off-shore wind, all of these policies are encouraging fuel diversity and renewable adoption.

Number 5; integrated distribution planning. It's important to have a purposeful and

transparent process to ensure that all utilities are appropriately planning and all technologies are being fairly evaluated, and the ratepayers are being protected.

Number 6; global warming response. The grid should allow integration and delivery of more cost-effective renewable generation, and demand site management to reduce carbon emissions.

Number 7; a state policy to support modern grid. They all should require regular planning, evaluation, transparent evaluation of technologies, and that would provide certainty for the utilities and also so that the costs are reasonable, and that the benefits outweigh the costs.

Number 8; what regulations need to be updated? Utilities have devoted to modernize the grid through normal rate making, and they should also have performance metrics to match the goals of the policy makers. These performance metrics shouldn't be developed just for the sake of reporting.

Number 9; regulated rate design and tariff structures. N.J.A.C. 14:3.2A already encourages distribution utilities to accelerate

infrastructure investments. And, Rate Counsel will continue to study that issue.

Number 10; what could the state do to manage energy costs? It can reduce overall energy consumption across the EDCs, and reduce their load share allocation for future regional transmission which may delay the need for future projects. Cost-effective renewables and DSM will also reduce overall energy costs for the participants and non-participants through a price mitigation.

Number 11; how should costs be allocated? They should be allocated fairly among the beneficiaries of the upgrade, and the operation of the grid. Cost causation principles should be maintained even though that becomes more difficult with distributed generation and volume metric pricing.

Number 12; the interface between energy distribution systems. That depends what you mean by that. If it includes microgrids, it is a question of who owns those, who controls them, and how they might be operated to benefit the overall grid, and who pays for them. So, there's certainly questions to be answered there. And we'll go into that more for our written comments.

In terms of incentives. Again, that's a similar on the issue, where does one draw the line on those. We'll provide more comments on that.

Number 14; how do you address interdependencies between energy distribution systems? Well, the storm hardening strategies that some of the utilities have recently adopted, that may be an example. Those programs with a targeted investments to focus on critical infrastructure within its service territory. And, these investments may also benefit the overall distribution system.

Number 15; how can a modern grid utilize these new technologies? If it facilitates the adoption of numerous cost-effective technologies, both in terms of distributed renewables and demand site management, these technologies should lower utility bills for ratepayers.

16; How do you make the distribution system more efficient? You can encourage the reduction of energy usage through cost-effective means. That's still a good way to do it. Technologies that would reduce energy losses still

need to be cost-effective.

17; technology, how can that assist? All the technologies mentioned in the question could benefit the grid, but they should demonstrate cost-effectiveness. And the adoption of additional distributed energy resources may require localized control and visibility to ensure appropriate system tolerances. And the EDCA should have detailed knowledge of their system in order to adequately plan for increased distributed energy resource penetration.

18; who should own the data? To date, advanced meter infrastructure has not be broadly implemented. Ownership of the data needs to be mindful of privacy. Also, the economic value of such information needs to benefit the ratepayers, not just the private entities.

19; advanced distribution monitoring. The utilities need to make the business case that such investments are necessary and cost-effective to benefit ratepayers.

Number 20; natural gas leak detention. Federal and state regulations currently outline the frequency of leak inspection for gas infrastructure. New Jersey has to continue to

work in tandem with the federal authorities to ensure the safety of gas operations by the utilities.

21; cyber security. New Jersey has New Jersey cyber security and communications integration cell. New Jersey could consider following FERC 848, and require the reporting of attempted cyber security breaches.

22; security risks of expanding distributed energy. Increased automation and communications of the grid creates opportunities for cyber security breaches, and increases the impact of the cyber security breaches in terms of data breaches and operational impacts.

23; what can the state do? The New Jersey cyber security and communication integration cell could provide a forum for the utilities to share Best Practices to prevent and mitigate these breaches, and provide a repository for the reports. But cost-effectiveness should be a consideration.

24; work force training. The utilities are facing the retirement of the staffing. It would be in the best position to identify what skills are needed to create and operate a more connected and integrated grid.

These skills require probably like other industries facing automation and integration of increasingly technologies.

25; new or existing industries. The installation and maintenance of electrical equipment should remain local. And the development of cloud-based integration software solutions could be fostered here.

26; environmental justice. The cost of grid modernization should not be born by the disproportionately affected communities. It needs to benefit all disadvantaged communities by improving service reliability and lowering overall bills.

27; energy efficiency. Rate structures should be needed to enable cost-effective energy efficiency, distributed energy resources, and variable renewable energy resources to make sure they're appropriately valued and implemented to well work energy cost to both parts and non-participants.

Number 28; current barriers. Barriers include imperfect information, split incentives, lack of capital, high transaction. All of those we'll submit more in our written comments.

And, finally, 28 and 29; what policies limit the barriers participation by the disproportionately impacted communities. The requirements in distribution planning should benefit dispiritedly and impact the communities, limit bill impacts of infrastructure investments for these disproportionately impacted communities.

Thank you very much for your attention.

MR. BOYD: Thank you.

MR. WINKA: And, you did that all that with just over thirty seconds.

MR. BOYD: And I'll take this last chance here. Anybody that has not had a chance to speak or would like to speak, please raise your hand. Seeing none --

MR. GIORDANO: Good afternoon. My name is David Giordano. I'm the head of Governor relations for Dooson Fuel Cell America, which is a fuel cell manufacture located in South Windsor, Connecticut.

Doosan Fuel Cell is a global leader in providing clean, continuous-duty, cost-competitive stationary fuel cell energy systems. Our combined heat and power PureCell systems operate 24/7 with

high efficiency and ultra low emissions, allowing our customers to generate their own electricity and heat on site while reducing their utility expenses and environmental emissions. With over twelve million fleet operating hours, PureCell systems have demonstrated unparalleled durability and reliability. Doosan Fuel Cell is a subsidiary of the Doosan Corporation, which is a global company with 42,000 employees and worldwide revenues of 20 billion dollars.

Doosan has significant experience in customer-sited behind the meter applications. Our PureCell Model 400 systems operate at more than fifty sites throughout the U.S., providing nearly 40 megawatts of power. Worldwide, Doosan has more than 210 units deployed, producing 100 megawatts with many more megawatts coming on line in the next year. The reliability and resiliency attributes of our fuel cells are felt during grid outages where our systems continue to run, providing essential electricity and heat to critical facilities. Such was the case here in the northeast during winter storm Alfred in 2011, and Superstorm Sandy in 2012. Doosan fuel cells kept the power on during these critical times of need.

Doosan Fuel Cell is excited to see that Governor Murphy and the state of New Jersey are committed to exploring ways in which to build a better and more modern grid. We look forward to the fact that fuel cells can play a major part in achieving this goal. We feel that enhancements to maintain security and reliability should include technologies that can island from the grid and create resiliency and diversify the energy portfolio to avoid gaps in generation caused by intermittent renewables. Stationary fuel cells provide firm power at both the utility scale as well as on the customer side of the meter. Fuel cell systems can be installed to provide heat and power for entire communities, using the existing natural gas infrastructure or running off renewable fuel.

Doosan is experience the success of large utility scale applications outside of the U.S. Korea is using hundreds of megawatts of fuel cell systems to modernize their grid. Fuel cells help Korea meet their RPS goals better than intermittent wind and solar. Also, in densely populated areas, land constraints limit large scale renewables, whereas fuel cells can be installed on

a very small footprint. These fuel cell systems function like substations providing primary power and heat, even when the grid goes down. For example, in Korea, Doosan has installed 30.8 megawatts of fuel cells for district heating and electricity for 71,500 homes in the City of Busan. Our fuel cells are configured in a tiered structure sitting on only one acre of land, whereas an equivalent 30 megawatts of solar farm may require more than 75 acres.

Doosan is also currently installing a 50 megawatt fuel cell system in Korea that will run on direct hydrogen. The hydrogen is a by-product of a chemical plant that will be used to run our fuel cells, and therefore giving the electricity back to the utility.

Doosan is currently working with microgrid developers in Connecticut and New York to improve redundancy and reliability to create a more modern grid. We feel that New Jersey with benefit from a grid with a diverse portfolio of technologies for reliable modernization.

Also, from an environmental justice standpoint, by valuing the reduction of criteria air pollutants in addition to GHG reductions, the

State can provide an important benefit to disproportionately impacted communities.

Stationary fuel cells are a valuable contributor to the state's clean energy strategy, providing power that is continuous, efficient, and resilient. Doosan continues to support the New Jersey Energy Master Plan, and believes that fuel cells will play a major role in providing on-site distributed generation, as well as larger multi-megawatt utility scale projects.

Doosan Fuel Cell looks forward to continuing to work with the State of New Jersey on this and other very important issues. Thank you.

MR. BOYD: Thank you, sir. That concludes the speakers list at this point. Mr. Winka.

MR. WINKA: Unless there's anybody else, the comment period is open until October 12th, close of business. Our next session is this Friday here at ten o'clock on the Sustainable Infrastructure, and that's on the basically the transmission side and the competitive markets. So, some of the comments today should be repeated and provided to Cynthia Hollands, who is back there in the room, at the next session.

So, thank you very much. And we look forward to your comments and further discussions on the Energy Master Plan.

(Whereupon the proceedings were concluded at 1:00 p.m.)

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.

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

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