STATE OF NEW YORK
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CASE 14-M-0101 - In the Matter of Reforming the Energy Vision
CASE 15-E-0302 - Proceeding on Motion of the Commission to Implement a Large-Scale Renewable Program and a Clean Energy Standard

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New York State Department of Public Service
90 Church Street, 4th Floor
New York, New York 10007

TECHNICAL CONFERENCE ON ENERGY STORAGE

TRANSCRIPTION OF PROCEEDINGS

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MIKE DeSOCIO - Senior Manager, Market Design, NYISO
SHARON HILLMAN - Market Policy & Business Development, AES Energy Storage
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MIKE JACKSON - Market Development Director, Advanced Microgrid Solutions

SARAH VAN CLEVE - Energy Policy Advisor, Tesla Energy

PRESENTER:

RICK FIORAVANTI - Energy Storage Consultant

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MR. WEINER: Thank you. I'm going to assume that looking around this room that people know about the CES, so I'm going to skip that part and free up time, but I do have a couple things I want to say.

First, I want to thank everybody for coming out today. We all recognize that the Department is putting out a lot of proposals, a lot of White Papers. There are comment periods overlapping the comment periods. The CES support is a big focus for all of us. So we appreciate you taking the time to participate today and these things that are a very important set of questions. And an important component for the CES and for REV, in general.

I would start with a couple introductions of the folks who are here. I'll let them introduce themselves and I'll start at my far left.

MS. MITCHELL: Good morning. I'm Tammy Mitchell. I'm Chief of Electric Distribution for DPS Staff.

MR. ADDEPALLI: Good morning. I'm

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Raj Addepalli, I'm the Managing Director of Utility Rates and Service with the Department staff.

MR. DOLING: I'm Jason Doling with NYSERDA and I help lead our energy storage deployment activities.

MR. WALLACE: My name is Matthew Wallace, I'm an engineer with the Department of Public Service.

MR. WEINER: And I want to start by thanking Matt and Jason for all they did together in coordinating all the work that goes into preparing and executing for a day like today. I also want to extend the regrets from our Chair, Audrey Zibbelman, who could not make it today. Those of you who are following the CES proceeding in general and this topic in particular know her key interest in it.

Today we want to explore the role of storage as it impacts the distribution system. You say there's a lot going on led by discussions by NYISO and in other forums looking at the system. Today, we

want to turn our sights to the distribution system. So both the presentations will be focusing in that area. I understand there isn't always a bright line, but we're looking in that area as people frame their questions, that you keep that context in mind. And we do this so we can delve into issues involving storage and how storage can help us sustain the objectives of REV, in general, and also obtaining the goals of the CES in particular, the Clean Energy Standard. And to that end, I look forward to having a discussion where we can understand the role, talk about the value, but most importantly, identify barriers that might be preventing the achievement of that value, the acquisition of that value, and address strategies and actions that can overcome those barriers.

And with specific regard to the CES, which will be the focus of the afternoon discussions, we want to explore what role storage can play as a component of the CES

itself, meeting the 50 by 30 goal, achieving our carbon goals but, very importantly, how do we determine that value and what do we compensate for that value that storage might provide and what's a reasonable time frame? Everything doesn't have to happen on day one, but maybe it can. In its simplest terms, there are folks who will say that storage should have a tier in the CES. Other people respond by saying I'm not sure how that works. Some people say storage should be able to generate RECs on their own. That raises all sorts of interesting complications.

What we want to do today is get those issues out on the table, explore the feasibility of some of these but, most of all, understand what actions the Commission will be taking to help accelerate the integration of storage as part of our energy frame work.

Before we start the program, I just want to ask Raj if he wants to add

anything.

MR. ADDEPALLI: Scott, you covered it all, thank you.

MR. WEINER: And lastly, a couple logistic items. When it comes time for questions, if anybody would like to ask a question, please use the podium. That will ensure both that people will be able to hear you with the microphone but, also, that you will be picked up on the webcast for those watching on the webcast.

And also, the agenda points out this there will be a lunch break and Matt's going to do everything he can to keep us on schedule.

Matt, it's all yours.

MR. WALLACE: So next up, I would like to introduce Rick Fioravanti, our energy storage expert, to give us an -- I say "our," he doesn't work for the Department. He's a consultant -- and he's going to provide us with a level setting presentation on the state of the storage industry today.

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MR. FIORAVANTI: Great. And thank you for the opportunity to speak.

Again, I'll use the term "we," but we were discussing about before this session started, it would be good to take a look at what other states have done, what is going on in other places and whether there are lessons that could be gathered from that. And I know gosh, nobody wants to start the day off with lessons, but I think when you look at the activities we've seen, there are things that we can draw from them and guidelines and sign posts that we may want to take a look at to see how they would apply to what New York is doing.

So for today, very brief, very simple, I just really want to go over how storage has been advancing in other key states. Again, are there recommendations that we can get from what those activities are and, also, just do a brief level setting on whether the current state of storage technology, it's changing rapidly.

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No matter how hard we try, there seems to be a knowledge gap with the understanding of the technologies and how do they apply to applications, so I wanted to briefly talk about that.

Should I make that announcement about cell phones?

MR. WALLACE: Please mute your phones.

MR. FIORAVANTI: So just to talk about, first, one of the -- the most obvious thing to look at is California and what has been happening there. And everybody looks at that and they think about AB2514 and the 1.225 gigawatts, but a lot of the efforts that happened there started even before that. And much like New York, California began to push a very aggressive renewables goal for the state. Initially, they were looking at 33 percent in 2020 but they were talking about this in the 2008-2010 period. The ISO in the California Energy Commission -- I use a lot of acronyms, so forgive me for that --

examined the impact of what this penetration would be. In fact, there was a study that was conducted by FEMA that looked at the impact of wind, solar, and whether storage could be a tool to mitigate what we were seeing and what we could see with that kind of penetration levels.

And what the study shows was that for the potential impasse that we were seeing, there was a possibility of three to five gigawatts need of storage to help mitigate some of the potential issues that we could get from that type of penetration.

So there's actually two things that were really green from that effort. The first was the fact that storage could mitigate the issues. That putting in large penetration of variable renewable devices would have an impact on how you operate and maintain the grid, but the key factor also was they started looking at the timeline; 33 percent by 2020 and working backwards and what they would have

to do starting in 2010 to get that three to five gigawatts deployed onto the system and that was rather daunting. And when you started looking at the trends, they were seeing in the latter part of that decade to where they want to go by 2020, they realized they needed to take steps. And this "no regrets" term was actually starting to get floated around at that time.

Right after that, it was really AB2514 and by no means will I want to take anything away from the effort, but to having an AB2514 come into fruition.

But again, a lot of the impulse and the motivation behind making that work was, really, this desire or this understanding that they had to get storage deployed if they wanted to get the renewable penetration they were hoping to see. So AB2514 was launched. It was an analysis that was very forward looking. They examined the benefits of storage costs and the effectiveness of storage,

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but it looked at storage on transmission, wholesale and customer side applications. The impact of that is what we see on the chart that many of us are familiar with, was how they were going to go about deploying 1.225 gigawatts over a seven-year period culminating in 2020.

The mandate that they were actually focusing on is encouraged use of storage at all levels, not just on the customer side, but distribution with utilities and transmission. They targeted deployments over the seven-year period and it really started ushering the concept of utility ownership, which at that point had not been looked at, but also how the technologies in the customer side of the meter could also be used to help operations.

And despite the ruling having off-ramps, there were some skepticisms about the numbers. Today, we actually are outpacing these goals and so the success has been shown in how the storage has been

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deployed and the speed with which it's getting deployed.

Another thing that California did, there was a road map to look at the barriers. One of the divisions that came out, if they were going to push the technologies to get deployed, they wanted to make sure that there were no regulatory policy barriers that would prevent that from happening. So the California Public Utility Commission, the Energy Commission, and the ISO got together and conducted a very stakeholder inclusive task of looking at all the barriers that may be out there that could potentially prevent storage from being deployed at the speed (inaudible).

So that was actually something that was much less advertised, but very key in the efforts that were going on with storage in California.

And again, some unique approaches came out of and are still coming out about how storage is getting adopted. The

process is allowing utilities to look at not only their ownership structures but also working with customer side applications bringing things together, like renting storage and utilizing it from applications that have been deployed on the customer side of the meter and pioneering some unique relationships and some unique structures of how to do that.

The other state that also gets talked about is Hawaii. And again, you know, Hawaii is providing -- had some very unique opportunities, because A, it was an isolated grid, and B, they were seeing a tremendous amount of renewable penetration. The early aspects of it were the impacts of large scale variable renewable generation that was being deployed, and, in fact, much like California, the State of Hawaii did take the first steps of doing the analysis of looking at what would be the impacts of high penetration levels of variable renewable devices on their grid and what

would be needed to mitigate that.

From that, they actually started putting interconnection policies down forcing the developers or asking the developers to make sure that storage accompanied most of the projects that were being deployed that was needed to get the interconnection.

What else was happening within that state is the amount of solar that has been getting deployed, as well, solar being deployed on the customer side. Even though the state is looking and driving toward a hundred percent renewables, they're already seeing penetration rates of 50 percent.

So it's a great petri dish of what we're trying to look at in justifying some of the tools and models that have been looked at. But also, when you start looking at what's happening on the customer side of the meter, they're already seeing penetration rates of about 15 to 20 percent residential storage. And

what this is driving them to do is look at how they can utilize that, utilize that asset as a tool, combining it with storage, entering the programs with the DOE to look at how storage and solar can be combined, how it can be utilized to better operate the grid and further examine the potential that the coupled applications could have.

Now, a lot of it was also because their net metering tariff was being added, as well. New developers of solar systems weren't being allowed -- were not going to be allowed to take advantage of that program. So again, something that would incentivize people to use storage in its place, but once those devices were coupled together, it came to the point of how to use them, how to utilize them.

So Hawaii is interesting in the respect that not only did it look at the impact of how storage is needed to help them reach their potential of the overall penetration, but when they started looking

at what was happening on the customer side of the meter, as well, storage was allowing them to take advantage of the activities that were happening there of the penetration of solar on their system and then how storage could be utilized to help make that more of an asset as opposed to a burden.

So just breaking away from that and talking a little about the current state of the technologies and what we're seeing in the industry today. Storage, it's great. Great to say it's advancing, improving itself in multiple applications and for some specific applications, it's actually nearing price parody, traditional solutions. Cost reductions are occurring at a rate faster than what most folks were anticipating. There are still advancements going on in technologies continuing, even as technologies are commercializing.

However, I think I would use a term that we're on the precipice. I'm not sure

I would be there to say that we're at a point of mass deployment, but we're just nearing the precipice to get to that point. It may be a more appropriate way to describe where storage is.

It's been stated before and it's still appropriate today, that storage simply isn't one technology nor is it advanced technology. We often, when we start looking at it, we get caught in the lithium whirlwind that most people will associate storage with that one technology, just because it's being seen in many areas. But when we start looking at the deployments and mapping the applications, the requirements of the applications to the needs of characteristics of what we see in storage technology, it becomes pretty clear that it's not just one technology, it's both energy and power. It's long duration, it's different methods and methodologies to look at.

So when we examine and see that we're

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going to have to see more than one technology, it's not just lithium advancing rapidly in the cost reductions, but it doesn't mean that because one technology is going down that path that it's going to be the best for every application. So that is something that's still being seen today and in some ways causing what I call a knowledge gap in some of the conclusions that we're seeing around storage.

And again, when we look at the multiple application requirements, this mix of traditional, advanced power, energy, we can see how storage is creating a knowledge gap of sorts. The cost components where all these technologies are cost reductions trend lines that we're seeing, they vary across technologies, but as we get more and more individuals into this area and looking into developing and looking to adopt it, it's now, I think, more important that ever to cover this knowledge gap and make sure that everybody

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that's talking about this subject is on the same page and working with the same numbers.

One of the things that we did, just quickly want to talk about, is differentiating and looking at the different technologies and what they do and how they're utilized.

So electrical mechanical, the category that we're talking about. Between electrical, mechanical, pumped hydro, thermal, and mechanical, I just want to give a brief description of it.

So when you talk about the electrical mechanical, it's really power and energy. For power, it's lithium, fast response capabilities make it ideal for renewable integration. However, its rapid price decline is allowing it to be stretched into other applications more into the energy side. On the energy systems, we're seeing new entrance. Folks like EOS, less commercialized but the technologies may be more appropriate for some of the longer

duration distributed applications that are looking to happen on the customer side or even on the utility side of the meter.

Will they match the price declines that we're seeing in the lithium? Are they going to be able to be competitive with it? It's still a great question. As I said, these technologies are a little behind what we've seen on the lithium side but they are opportunities and they are rapidly being developed.

When we look at pumped hydro, it's still, by far, the largest of storage technology but there are questions about the speed and ability to be utilized for some of the renewable integration systems that we're looking at.

One of the questions that really, you know, is hard to get an answer to is when you start looking at how storage can mitigate some of the potential issues we see at variable generations, the question is: How fast does it have to be? We get an idea of how many megawatts or gigawatts

are going to be required, but the next question is how fast does that technology have to be? Does it have to be all one technology? Does it have to be all one speed? Or can it be a mixture of fast, medium devices that come in to mitigate the emission?

These are questions that really need to be investigated because the options are out there and they -- all the technologies have the potential to contribute to some of the solutions that we're looking at.

The thermal side often -- always doesn't get talked about. Many times when I talk about storage, I tend to focus on the advanced systems and every time I do that, I get people from the thermal side saying no, we're part of this, as well. I do consider thermal storage more of a low shifting technology rather than just pure storage. But we are seeing with the communications and controls capabilities today that these devices can be utilized to work with and help integrate renewable

technologies, as well. So even though we look at it as a storage technology, it doesn't yet really fit the exact definition of storage, because, again, it doesn't push electrons back on to the grid, but it can be utilized today in a lot of aspects.

So quickly, just to wrap this up, some of the recommendations. I think the real key is the common theme that we've seen in all of these examples that we've shown is the analysis to determine what the actual needs are for storage, to help the planners understand what may be necessary to contain these renewable goals that New York has.

So now that we look at the penetration that's being contemplated, moving beyond targets and looking for actual goals, this is probably more important than ever to have this understanding, to gage what's going to -- what the penetration is going to be for the State of New York, what the impact of

that is going to be on the grid and then how you can mitigate that.

There's an extra piece to that, as well, as we've seen solar and storage combinations advance as well and we've seen developers look to deploy on that side of the meter. There also needs to be a deep understanding of what's happening at the edge of the grid. I think of it as a triangle. When we start talking about the goals of the renewables that we want, the amount of storage that probably is going to be hard to help integrate that, and then we look at what's happening on the customer side of the meter and get an understanding of what's actually happening on the customer side of the meter, then we'll get a good understanding of what we need to fill the gap.

Is that going to be with utilities? Is it going to be with developers? Those answers right now are still a little unclear and it's essential for the next step to go forward that that analysis

happens. And again, it's the common theme that we've seen in all the activities that have been happening prior to New York.

Final recommendations. Find ways and more ways to close the knowledge gap. And frankly, the studies that typically take place that we're mentioning in other states is a great vehicle for that. When you start looking at these efforts, they tend to be stakeholder, engagement stakeholder efforts. It brings the whole community together because people develop a consensus on the cost, the trajectories, the applications and how they're used. So they kind of go hand in hand.

And when you first look at the need for studies and then realize there's still a knowledge gap out there, that conducting these studies in a way that's been done goes a long way to closing that gap and helping get everybody on the same page as to what technologies are, where they're going and how they can be best utilized.

So that's all. I hope I didn't get

any flashing lights. Again, trying to set the stage --

MR. WEINER: My eyes are being tested.

MR. FIORAVANTI: I'll make it larger. The presentation side will be available, as well. Forgive that if you are having trouble seeing them, but there's a lot of information.

Are there any questions or any thoughts or contributions? As we look to -- again, we're just, really, looking to try to set the stage here, offer some recommendations as to what may go, but I know the panels are going to be discussing more specifics of what can be done. But also, just want to let folks know what has been done and how some of that can be leveraged or should be leveraged to what some of the steps in New York may be.

MR. ADDEPALLI: Quick follow-up question on California.

Besides setting goals or targets to get X gigawatts of storage, are there any

specific pricing mechanisms that they put in place to compensate them or provide certainty to the installers?

MR. FIORAVANTI: Well, I think one of the major efforts was the utility ownership. Half of that 1.225 gigawatts was going to be utility owned and a major step to help advance that. I think, also, if you look at the ESTRA program that was there. As that ESTRA program started evolving in California, you start seeing storage become -- play a more and more prominent role. First, it was being part of their program -- incentive program if it was coupled with solar. Then, right after that, soon after that, they started saying no, standalone will be fine, as well, because it was identified as a technology that the state wanted to keep as its options of available tools to utilize. So the ESTRA program was -- is still very prominent in the state and very active for folks looking to deploy, particularly, solar storage combinations.

But also, utility involvement in the effort, as well, I think, is the big driver to it.

MS. HUANG: Hi. Jin Jin Huang from Con Ed. So in your closing slide, you say there's information gap, right? So when we talk about energy storage, there's a big, huge space from customers to integrators to regulators. Where do you see that knowledge gap is most or the biggest? And where do we start in terms of filling that gap and how do you see that gap being closed?

MR. FIORAVANTI: Well, it's, again, I think, the stakeholder involved effort is key. The more people get involved in this -- there's always a saying that the knowledge verses the participation -- in early days, when you have fewer participants, the knowledge was greater and as you move and get more and more folks involved, that knowledge gap start increasing. I really do believe that stakeholder efforts are key, particularly

in this area, because the technology is moving quickly. It's not just that it's advancing quickly, the evolution of the pricing trends, the combinations of how it's being utilized, the introduction of new technologies, the utilization of traditional technologies is being moved at a very rapid pace and it's really just basically folks have a hard time keeping up with it. People in the industry have a hard time keeping up with it, let alone people coming in from the outside.

So I think more reliance on some of the studies of stakeholder efforts. Of course, in New York, we have New York Best. They have recently put out a road map to talk about storage, making that, you know, a go-to place for people that are looking to understand the technology. I think it's key. But it's a change, a challenge and it's always going to be a challenge because storage isn't a static technology, and it isn't a single technology. It's multiple technologies,

multiple applications and it's still, really, in a state of rapid advancement. And it's going to always create a challenge and making sure everybody is understanding exactly where we are as of May 2016.

MR. ACKER: Bill Acker with New York Best. To follow up on Raj's question, one of the things a lot of our members have pressed upon has been the confidence of future revenue streams and the business model that we put together for storage projects.

And I'd like you to maybe comment on in California, how that's being done and how you're seeing it be the contractual efforts and mechanisms that are in place that allows for enough revenue and confidence to market forward.

MR. FIORAVANTI: Well, there's -- it's a great question. I'm not sure they have all the answers for that at this point.

There are things that are --

mechanisms that are being tried. And one of them I reference SoCal Edison's Bring Us Your Megawatts, where they're looking to utilize the deployments that are happening at commercial facilities at customer facilities. So the recognition that developers are able to deploy storage on the customer side for their reasons, but then accessing that and paying for that access as a means or an alternative way of developing on their own.

You're also seeing other mechanisms to just straight utility ownership, and they're looking at various models for that. Whether it's build own lease, build own transfer, or something they're trying to construct on their own. I think each of the utilities out there are -- they certainly can speak for themselves, but are looking at different mechanisms and they're not all following the same path. But what they are trying to do is be creative in how they're looking at utilizing the adoption that's going on and

then also taking advantages of the insurgence (inaudible).

MR. ACKER: Thank you.

MR. FIORAVANTI: I don't think I answered the question. But it's still something that --

MR. WALLACE: Let me cut off questions right now. We are going to have a Q&A in a little bit though.

If I could ask the first panel to come on up.

All right. So this panel is going to focus on operations under high penetration of renewables. We have Bill Acker, the Executive Director of New York Best; Mike DeSocio from New York ISO; Sharon Hillman from AES Energy Storage; joining us over the phone and over the Web X here is Rick Cutright from GE; and lastly, is Dan Vickery from Green Charge Networks.

So we'll let Bill kick off the panel.

MR. ACKER: So Matt and staff had asked me to talk about the energy storage road map for the New York electricity grid

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that New York Best led the efforts of putting together that was realized in January.

So this effort involved nearly a hundred stakeholders to work on developing an understanding of the applications for energy storage on the electricity grid and discuss some of the challenges and pathways and actions to bring energy storage forward on the New York State electricity grid.

In that work, there are three key areas that we view energy storage as being very impactful and a critical, enabling technology to help were the REV objectives. And first is supporting the improvement of the efficiency and capacity factor. This gets to the peak load and to other aspects of what other storage can do on the grid. The second is increasing the amount of renewables, which we've already talked about today. Clearly, there's a lot of levels of how energy storage engaged to do that and (inaudible) go

forward. Third is resiliency and reliability of the grid.

So in the road map, we spent the time on these aspects and how energy storage can perform these functions and came out with sets of recommendations around that. Now, in thinking about this, it's important to recognize, that as we're making this transition, the whole principle of REV, which I think is a very, very forward looking and important initiative, is that we're going to see a dramatic transformation of both how it functions and, also, what assets can be brought to bear to make it function and enable new business models as we do that.

And so as we look at this transition from top down grid to a more networked grid transaction grid, we recognize that there are a whole host of different services and functions that energy storage can provide.

And I should step back right now and say this is actually one of the key

challenges that energy storage has had. It's kind of the curse of the plentiful. Every time you hear talks about energy storage, you hear two things. One, there are a million technologies, and two, there are a million applications. And when you start there, you don't get any meat to the argument, right, you don't get the points where you can actually tangibly make progress forward.

And the other thing that we struggle as we do these things is that in many cases, in almost all cases, energy storage will be performing multiple applications simultaneously, providing multiple benefits, even whether you intend to or not.

So part of what the road map looked at is how these things do work together. And in looking at this, we characterized many different applications on the grid and we characterized them by the three large areas that I just spoke about. So the whole capacity peak load reduction,

the renewable integration, and the resiliency and reliability, and then where energy storage is sited. So it could be behind the meter, on the newer system, on the generation or transmission grid. And when you look at that, there's lots and lots of different applications and lots of different ways these do interact as we move forward together.

Now, in an effort to avoid the confusion of saying there are a million applications, I want to focus on two areas here and then talk about how they hold together.

So the first load area is the flattening of the peak on the electricity grid. And as the PSC staff and most people in the room are well aware, there is a large opportunity in New York State with respect to flattening the peak and having derivative savings that the PSC has estimated that 1.24 to 1.47 million dollars a year flatten the top 100 hours.

Energy storage: We're going to talk

about goals in a minute. We lay out a few goals. The year trim goal of one gigawatt, two gigawatt hours would eliminate 30 of the 100 hours. Two gigawatt, ten gigawatt hours would flatten the energy. Importantly, as you look at the flattening of the grid and the services, all of that can be performed in a very short time period. So unlike a peaker plant that's only running those time periods, the energy storage is doing that flattening, it's doing that flattening and it's available for all of the different applications. So when you're doing this flattening of the 100 hours, you're talking about only six days a year of doing that on the 2013 data analysis report, which allows you to spend a lot of time doing many, many other pieces.

Now, another question that was addressed in this lead up to this point was, what areas can be done, what business models can be done to further reduce

greenhouse gas emissions? And of course, I think we all recognize that the peaker plants that are now serving this, generally are single cycle, generally are high emitting, both on CO2 and OX and other pollutants that go with that. The shifting of that load from the peaker plants to the combined cycle have great emission benefits and there are a whole bunch of other somewhat hidden benefits. Moving the power at night, you get less line losses. There are a whole host increasing the load on the gas turbines, the cycle gas turbines, whole host of other pieces that go into that.

So we have a lot of advantages of taking these steps with energy storage. Now, as I just said, these same devices can be doing other things and another very, very important thing is the renewable integration that we're talking about today.

So we have a goal that we've talked about here, a set goal of renewable energy

by 2030, and I think it's important to recognize that is a steppingstone towards 80 percent of greenhouse reductions in 2050. So the pathway to that goal is very important because it's the pathway that needs to continue. We need to be on a path that can continue to grow past 2030.

And how you do that, whether you take an approach where we use the old business models where renewables are kind of extra on the grid and we're going to have, basically, a redundant grid fossil fuel back up for everything. Or we're going to tune the grid, not have fossil fuel backup for everything. It's very, very important. And then the true integration of renewables in the grid, that choice then gets to having to shift both load and energy in some ways.

I would argue that you cannot just shift load. Obviously, we need to be able to have energy available when people need it and there's a point that's needing to shift energy and later we're cut by

(inaudible) around that we made some estimates in the road map associated with this.

So with renewable integration, obviously, because the low capacity factors a lot of renewables with that goal of 50 percent is a very large amount (inaudible) firming and smoothing is going to be important, energy shifting is going to be important.

In the road map, we estimated we would need at least four gigawatts of multi-hour storage and as Rick just talked about, he was on the board when the road map was written. We recommend that we do do further detailed studies to further quantify that. But we do believe that there's enough knowledge, especially now as time progresses this January, to set some levels here that we should be getting to.

So in the road map, we talked about some of the challenges. There are a couple I want to address here a little

today. One of the first challenges associated with energy storage on the electricity grid (inaudible) is the inability to modify the full value of storage currently, both in the existing markets where you can participate under certain circumstances but many times not multiple ones at the time -- same time, and also there are other (inaudible) at all.

Second point is confidence in future revenue trades, this is absolutely vital. In order to put in harsh cap projects, we have to have models associated with the regulations right now that allow project developers and financiers to have future (inaudible). And even though we will be having interim approaches, we need to make sure those interim approaches, just as the solar ones that were recently put forward, have that establishment of either a future revenue or front loading (inaudible).

I'll be moving very quickly through a couple things. Points have been made that

batteries are coming down very rapidly. This is lithium ion packs versus solar cells. (Inaudible) over the last five years, very, very quick reduction in price.

The road map lays out a number of goals, two gigawatt (inaudible) by storage in 2030 renewable goals.

And my last slide, I just want to end on a couple of recommendations. We do our best to file any recommendations throughout the REV process (inaudible).

Within the need for near term extending existing programs are very important. We have existing programs that are in place that are ending in New York for energy storage. Interim programs that realize value, particularly local path load release. New York Best has recommended asset utilization tariff. We've recommended a load reduction tariff and bridge incentives that are in our file and we can take you through some of the details as we talk today. We believe

steps like that are very, very important to get to this, having confidence in project development.

And then under the Clean Energy Standard, as Rick talked about, the established four goals are very, very important. And we believe that having a separate framework to address those goals which we've recommended a flexible energy credit would be valuable.

But critical to all of this and fundamental to all of this is that even though we're in a transitional period, I believe, is a very important good path forward. Even that transitional period we need to establish ways to have enough revenue confidence and developers that they can move forward and that's where these suggestions will help in achieving that.

So I'll end on that and turn it over to Matt.

MR. WALLACE: Thanks, Bill. We'll have questions at the end of the panel.

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With that, I'll turn it over to Mike.

MR. DeSOCIO: First, I'd like to thank the staff for the opportunity for being here today and we are proud to be part of the state that's got such noble goals as those goals laid out in the CES White Paper.

I want to reflect a little bit about what New York has done with storage in the past and provide some context that we've been here before. New York already has a great, vast amount of energy storage resources already integrated into its grid, well over a thousand megawatts of energy storage. And in 2009, the New York ISO pioneered integrating even more energy storage into the grid where we looked at ways to adapt its market rules to incorporate resources that didn't have long storage capability. That program is referred to as New York Energy Storage Resource Program, where storage devices can provide regulation service to the grid.

Now, those are some things going on with storage, but I want to provide some context of what NYISO's responsibility is for the grid. We're here to manage and maintain a reliable bulk system. That bulk system spans far outside of New York State. It goes from Florida up to Canada from the Atlantic Ocean out to the Rockies. And so the ISO has a small part of maintaining that liability, but it's still critical to making sure we maintain a safe and reliable interconnected grid. And to do that, we need to think about what services and products are necessary to maintain that reliability. And the ISO has spent many, many years, over a decade, developing those products and services and administering those products and services through competitive markets. I think we've done a fairly decent job of doing that.

So as we think about what's happening with the future and the potentials for increased penetrations of clean energy,

highly available energy, we need to be thinking about what other services will be necessary to help deal with that on the grid. And then once we understand those services, we can then develop what value is available for providing those services.

Part of what the ISO is working through is trying to build up from its foundation a gap on what services are missing or where are there opportunities that could be expanded upon? So for example, in the ISO, markets storage can participate in various ways. We have a program referred to as Energy Limited Resources. That program is really there for storage devices or resources that have limited capability. They can't sustain output for the entire day but it can sustain output for a large portion of the day. And so they're qualified to provide services such as capacity, iron in the ground or energy the balance service right now, reserves really that insurance policy for short-term capacity or regulation,

which is the second by second balancing of load and energy.

The other -- another program we have is the Limited Energy Resources Program, which I spoke about earlier, which allows short duration of resources to provide regulation service. And then we also have some programs that deal with resources that are behind in the meter providing ancillary services. We refer to that as our Demand Side Ancillary Service Program.

And then lastly, we have a program where, to Bill's point, there's a desire for some reduction and load on the hottest day of the year, and so for those resources, that can guarantee they can do that and are behind in the meter, we have a special case resource program where the ISO can call on resources to curtail their load on these critical days.

And so where we have these programs, we recognize that there's probably some areas where we can improve upon those capabilities. And so we started an

initiative. We call it the Energy Storage Integration and Optimization Initiative. And that initiative started in March, where we outline these services and programs that we already have and what we're looking for is stakeholder engagement and feedback on (inaudible) where are the opportunities that we're just not seeing? And what do we have to do with these programs to relieve some of those barriers or obstacles?

And so the ISO looks forward to working with stakeholders. We continue to work on this initiative, foresee us working on this initiative for the next few years.

I was happy to see Bill had it on his slide for 2018, so that's good news for us and I look forward to working with all of you on these issues and opportunities.

Thank you.

MR. WALLACE: Thank you, Mike. Next, Sharon from AES.

MS. HILLMAN: I just want to thank

you, the Commission staff, for inviting AES to speak today. I've got more slides I'm going to go through, that you can look at at your leisure, but I'm going to try to hit on a couple of high points that I think are of interest and important.

AES is a global power company. We have operations in the United States and California, Midwest, Texas. Traditional power plants, utilities, as well as storage as an emerging business line within the company, so that's who we are.

Right now, we're, we believe, the largest fleet of storage in the world. We have about 400 megawatts either completed, in construction, or very late stage development. There's a slide here that kind of explains where that's at. I'm going to talk about a couple of projects here in the United States and how they interface with renewables and also a big part of New York REV, which is TD Alternative.

And one of the themes you'll hear

consistently is you might build something for one reason and use it either a year later or 99 percent of the time for another reason, that's one of the big advantages of storage versus the traditional thermal resource, such as the peaker.

So this slide, actually, very much mirrors what Bill outlined in terms of what the big categories where storage can bring benefits to the grid. It improves the utilization of existing assets, whether the case transmission assets distribution assets. It imports the integration of more renewables and improves grid reliability and security of supply. And like I said, a specific asset can do all of those, maybe different things, different hours of different days. And it costs less than traditional technologies at this point and, basically, does more. That's the key method.

This next slide is a little bit of a set up for our next speaker, but it also

focuses on who is the customer. And when Rick did the introductory stuff, he talked about questions of who is the customer? Who are you contracting with? How does that happen? It varies a little bit by use, but it can be utilities, it can be traditional independent developers, it can be system operators. We consider the system operator to be a customer because folks peaking usage for behind the meter or TD Alternative five days of the year, it might be being used for the TD focus. The rest of the time, it's getting the traditional ISL programs as was mentioned earlier by Mike. The other aspect can be commercial and industrial. Those are primarily behind the meter and our afternoon panel will talk more about that, but it's the other aspect.

The third column here shows what are the uses. Rick will go through that in a little more detail in his analysis, but I think he comes up with eight uses and I think we've lumped a few of them together

in a couple of bullet points to keep it consistent. These are how those uses are typically used by the typical variety of customers.

So let's talk about some specific projects in the United States. AES has a wind farm in West Virginia and they built a battery project, it's a fifteen-minute duration project. Most projects you see today, many are longer duration, up to twelve-hour duration. But the batteries were not necessarily put there because it made a whole lot of sense. It was because there were tax benefits of having them there, but it was primarily built for frequency regulations from the battery project. But one of the things that we've learned is it helps with the ramping of the wind, even though it's a very short duration project. It's not a longer duration low shifting type of project.

This is a picture of Floral Mountain, very scenic in West Virginia.

The next project is the very large --

world's largest battery, a hundred megawatt project. It'll be completed in 2020 in Southern California Edison territory. It was built as part of the initial procurement site utilities on the road map.

California had a requirement for local in-the-ground reliability and they looked at peakers and they looked at batteries. And this was one of the first procurements when the decision was made to go heavily for batteries because the price points worked and because of the additional possibility that the batteries provided on the system.

So while its initial primary focus, technically, in the procurement process was local capacity reliability, it can be used in a renewable context, it can be used for many reasons. It's going to be four-hour duration, very similar to ELR type application in New York. No admissions of water.

The other question that came up

earlier is how does the developer get the revenue every year? This is dedicated -- it's Southern California Edison but it's a tolling agreement like a traditional peaker as opposed to ownership by the utility. And that flexibility for different ways provided -- this is an example of how the traditional tolling arrangement or PBA is being used to provide the revenue for the project.

So what are some of the more recent activities? As our introductory speaker mentioned, many of these applications are further along in California. And what we're seeing now in the West is an increasing focus on distribution network level reliability in front of the meter, but distribution levels never behind the meter. They're smaller systems, one to five megawatt, but you might see a utility putting in 50 of them all over their system. They're typically one-hour duration or more, might be one hour and six minutes, might be two hours, depending

on what their needs are.

They are typically, in this case, to date, they're typically thought of as being owned by the utility but they could be contracted with the utilities, lots of different ways in doing that. And especially in California, they do, often times, looking at targeting feeders with high renewable penetration.

As far as New York is concerned, you know, I think you're very aware of the various utility RFPs and RFIs going on, ranging from BQEM to the Long Island, LIPA, Northfork RFP. Those are initially TD Alternative applications, five-hour duration, as it will probably be an ELR asset, which will function as such a vast majority of the time. And then, also, New York REV demo projects.

And one last example, this is Europe, where you have high renewable penetration. This is a European style form of regulation services and it's a great picture because there's a windmill in the

background, but the reality is the battery is here because that was the best site, not because of the wind farm within the sighting of the photo.

So, you know, once again, this whole emphasis on flexibility helps with renewable integration and also can help with reduced emission, not just carbon but also NOX and SOX when you look at it in a peaker alternative world.

And finally, this is my concluding slide. So, you know, we've been closely watching in the last year, year and a half, the development of REV and the Clean Energy Standard. The primary conclusion that we take away from the White Papers is that yes, we agree that contracting and REC structure changes will reduce in lower cost to consumers, ultimately, and will be necessary to get large scale development done in the state.

From a storage perspective, I think we're here today, people are increasingly aware that storage is cost effective, but

like renewables, it's really no different than any other development project. It might be less in total cost than a large scale renewable site, but stable revenues are important; whether it's BPAs, RECs, that are known at the time of implementation, the consistent theme, that's what's important in terms of getting projects developed.

MR. WALLACE: Thank you, Sharon.

Okay, so next is Rick Cutright from GE who's joining us remotely.

So, Rick, can you take control of the WebX?

MR. CUTRIGHT: Sure. It's not letting me grab the --

MR. WALLACE: Okay, one sec.

MR. CUTRIGHT: All right. It's heading my way. I think we're getting there.

MR. WALLACE: Okay.

MR. CUTRIGHT: I apologize for the technical difficulties.

So while I'm doing this -- so I'm

Rick Cutright. I lead production management and product strategy for energy storage at GE. I've been in this role with GE for about six years now. It's been an exciting journey to think about how these new technologies are intersecting with changes in the market.

MR. WALLACE: Is there anything I need to do, Rick?

MR. CUTRIGHT: No, I think it's coming. A little firewall issue there.

All right. Let me know if something is coming through.

MR. WALLACE: You're good.

MR. CUTRIGHT: So these are the key points I wanted to make. A lot of these are the same ones Bill made and Sharon and everyone before, how I think the industry has evolved a lot in the six years and we're starting to get some consistency in where we have a vision with New York Best and AES and other organizations, the way things are heading.

The main thing I want to talk about

is that load profiles matter and I think there's a need for new metrics. I started to see a couple major changes in industries with changes in the metrics that they used to measure themselves.

So I think it must now, in a world of unlimited talk, text, and data, we're still trying to charge by the minute or by the kilowatt hours is archaic and I think this is part of the transition and the struggle that we go through and REV is a forefront of that.

I want to talk a little about system optimization with asset utilization being a key part of that, and needing to get an understanding of the objective of specific constraints and how we apply these aspects.

The fact that I think everybody realizes energy storage is different from other aspects. I heard some great examples at the conference that utilities are watching that I'll hit on. And then lastly, the merchant risk aspect and how

that's going to be a different approach within our industry.

So moving on. I'm -- my background is systems engineering and controls. I much prefer pictures to words, so I wanted to show pictures to kind of visually represent what a lot of these things mean. And it took six years to finally get the six, seven benefits for energy storage into a chart that I think is fairly straightforward.

So the key thing to look at here is, I think most people are familiar with New York's load profile and what a typical peak may look like. And that's going to be something like that dotted gray line. I think the specific chart is derived from California, but it's not so different from New York. And what's important to think about is as we move forward into these future scenarios where we have lots of renewables, and I think the duct curve was the most powerful thing that happened in energy storage, because it forced the

world to start to think about load profiles.

So the duct curve is essentially by adding on solar, you see that big drop in load that dips down during the day, potentially below zero and then comes back up. And a few key points here, I heard before somebody talking about peak shaving and sharing four hours, six hours, eight hours, whichever the case may be. And what's important when you look at the future is that as we bring on solar, the intersection that's solar, between storage, where the peaks are going to change. So what has been a long duration? If you look underneath the number two, to shave that same amount of megawatts or gigawatts in this case, it would have taken a lot, but because of the energy and solar and storage, I'll get there with a much shorter duration, like a four-hour battery instead.

The rest of this just visualized where within one day I could be doing

regulations, number four, all day long, with a four-hour battery. I could scoop up extra renewables in the middle of the day, shave the peak in the afternoon. While doing that, I increase the base flow. It lowers the emissions and increased efficiency on the traditional aspects, like the combined cycles and could also provide spinning reserves, like turbines, for when the a cross patch is over and there's a wind gust, it disrupts that generation. I look at this like in a visual way, everything that can happen.

I think it's important that we allow storage to get credit for all these things and it's not something that every other aspect can do all those things simultaneously in a day. The other part of that -- this is that exact same chart, but now I'm looking at 8,760 hours of it, so I'm looking across a year. And a few things come into play here.

Bill referenced the hundred-dollar example where you've got the loads. I

like to visualize that format. If you look towards the middle, you can see the very tiptop of one of those gray lines. That's two gigawatts of stuff that got used a handful of hours in a year.

And the question is: When we built out peakers, built out transmission, built out distribution to serve those peaks, what good did those do with the other 8,750 hours of the year? The answer is: They didn't do very much. But they -- looking not only at the daily profile but the annual profile, this is a great example, where if I shave those peaks, whether it's the two gigawatts at the top or the four gigawatts or eight gigawatts, those energy storage systems, without fuel and without emissions, can provide ancillary services to support peak shaving renewable curtailment all year long, which is something you wouldn't do with the traditional peakers that have been in that role.

So when you kind of bring all of that

together, you can see where you can compare what storages benefits you have for the duration of assets. And we can do all these things without storage. We can go to 50 percent without storage, but by going to 50 percent renewables, storage is going to make it a lot better. It's going to give us better capacity factors and better asset utilization.

So everybody always asks for a thumb rule, and it's a different answer for every system, it's a very complicated question. But generically, how we say there's something like this, that's for a system of varied levels of renewables. Ten percent of your peak capacity is energy storage with something like a two-hour, three-hour battery, it's probably a good no-address point, as mentioned earlier. At this point, you're going to utilize that asset very well, using lots of ancillary services throughout the year and you're going to have those assets available for the tips

of those peaks.

I think as you get more and more renewables, as you ramp up from the 25 to 30 to 50, and in particular, a lot of that renewables is solar, the ideal mix would probably be something like 25 percent of your peak is energy storage.

And I'll say if you were building it from scratch, the reality is we've got existing assets and you're coming up with that blended optimization as you transition, but if you're building it from scratch and you said you wanted to build a grid to satisfy New York's load, I would say you should target 25 percent of your peak generation at about four hours, five hours as where you would want to go to serve that mix.

So we've put together some models. We needed to put together some special models because existing tools really don't value all those benefits simultaneously. Dispatch models, economic dispatch, even security constrained dispatch would not

allow you to fully realize how storage is going to work on the grid. There's lots of tools coming in the industry, but we're not quite there yet. But this does show at the four-gigawatt level that this build is suggesting, your benefit to cost ratio and the top is still very high, you're getting much less curtailment down at the bottom left, because you've got the energy to source to pick up any of that generation.

What I don't like about the (inaudible), if you look on the middle chart to the right, is you still have a lot of peak there. You've got a lot of peakers. You still have some assets that are low-hanging because they're only being used in the summertime.

So we pushed this a little further and I've moved on now to an eight-gigawatt, 32-gigawatt hour case. So it would be 2030 if we had eight gigawatts and four hours of energy storage systems throughout New York.

You're now at the point where you suppressed all peaker operation whatsoever. You're at 50 percent of your energy coming from renewables. That energy storage system on the bottom left has eliminated almost all curtailments. You still have a levelized cost of energy on the top right, which is competitive, much better than without the storage. Your carbon emissions are great compared to where they're at, and you're in a world where you almost eliminated peaker (inaudible) required to serve New York's load.

That entire analysis doesn't look at additional benefits that you would get from avoided costs and upgrades from transmission and distribution, that was? Fairly much a generation view. Especially in New York City with a lot of problems that go on with Brooklyn, Queens, those types of issues, there's more value on top of that storage that pans out just from that holistic view in terms of specific

utilizations and deferrals and things of that nature, as well as other benefits and things like that.

So kind of going back to the key points I wanted to make -- I think I'm coming up on my ten minutes pretty soon here -- is a low profile matter. When I talk to people, very, very few people in the industry really know what the load profiles look like. When people think about (inaudible) and they think about system peaks. I think as we transition into distributed generation, we need to have a better understanding of profiles, in general, to make sure we're optimizing our systems. I think whatever the policy is, it needs to be holistic and think about that same level of system optimization. We need goals around overall capacity factors, capacity values for grid, the assets that are on the grid, so we're doing the right optimization for the system for all New Yorkers, not specific entities.

The ES is different. The pickup truck perspective, I heard, I was in this conference down south, I heard lots of other analogies, the pickup truck I thought was great, people picked up on it very well there. It's, you wouldn't buy a pickup truck to drive to work in the morning 'cause you're going to get better gas mileage with a Prius, but I'm not going to be able to pick up lumber from the hardware store, take my trash to the dump, or going hunting with the Prius. So if you don't factor in and be able to economically assess all the other things you can do with it, it's going to drive you to an answer that you're not happy with because you still want to do all those other things with your vehicle.

Someone's made the comparison that it's not generation, it's better wires. I like that one. It's interesting to wrap your head around that concept.

Merchant risk, I think most people will talk about it later, but I think the

big kick-off with solar and wind has been around PPA's and agreements where the financiers don't have to take on merchant risks and the developers don't take on merchant risk. I think people like GE and AES, another of the other system integrators, are taking on all the technology risk.

So back to that knowledge gap question from earlier, I don't think people need to understand factory chemistry. I think there's plenty of reputable companies now that will take the technology risk and offer performance guarantees on systems. I think the gap to see real growth take off sooner is around the merchant risk and getting PPA's or tolling agreements in place to enable people to get the loans and get the financing they need for projects.

And the last one that I want to discuss is a lay matter. When we think about this as a maintenance and verification, I think as we move to a

distributed generation of these sources, in general, the policy and the incentives we have in place need to consider maintenance and verification of those assets in order to make sure they're really there when we need them.

I used to do combine heat and power systems in the heating space a little bit, and I used to talk about 70 to 80 percent of hard wear occurred on one of two days; the first cold day of the winter or the coldest day of the winter, because people didn't do the maintenance, they didn't test ahead of time to make sure things were going to work. So I think it's problematic for your home heating system. It would be a really big deal if we moved on to that hot summer peak and the assets that are on the grid hadn't been verified, didn't have the proper maintenance.

So when we think about policy, I think we need to think about performance guarantee, testing validation, things of that nature to be a part of those

programs.

And that's it for me.

MR. WALLACE: Thanks, Rick.

All right, so let's move on to Dan Vickery from Green Charge Networks. I'm going to put your slide up in just one sec, sorry.

MR. VICKERY: Dan Vickery, director of market development of Green Charges Networks and we appreciate being here, so thank you guys very much.

Thanks, Matt.

So to give a brief intro on Green Charges Networks, we're not a charging company, we're a developer of energy storage behind the meter for CNI Industry. One of the largest in the space, we have 50 megawatt hours under contract for those customers.

And we actually spun out of -- we started in New York for the Con Ed and DOE demonstration project. Spun out of that and agreed to California. We're interconnected in six utilities, again,

New York and California, and our business model, really, is a shared savings model that's a hundred percent financed and owned by Green Charge, so we'll develop a system on the customer site and share in any savings we can generate from that site.

And most recently, we were acquired by NG, which is better known as GES, which I think is a sign of the times that the world's largest IPP is getting limited in energy space.

Just real quick, customers we work with, very well-known companies. These companies are adopting energy storage with scale. I know everyone likes seeing projects, the project in the middle that is on 43rd Street in Manhattan on a roof, we shut down 43rd Street to get that thing on the roof. The other projects are mostly in California and on the bottom right, you could see a solar storage project.

So couple things I really want to

drill home today, I think, you know, everyone has mentioned it, energy storage is a critical grid asset for the TD grid. As you know, it reduces costs and it can help drive higher renewable penetrations.

In New York, specifically, you know, you have network by network issues. As renewables further penetrate the grid, you're going to have substantial issues, you're going to have back feeding and network trips. So if the network in Times Square trips, that's going to be hard to set back up.

And each network from Green Charge's side, Rick went over kind of the high level way it's distributed, or thousand foot view of the New York grid, where Green Charge comes in and we surgically put capacity on third targeted networks, which, you know, each of those things each have their merit.

And again, from -- also from Green Charge's side from other developers that are in our space, aggregation is key.

They're small systems individually, but when you put hundreds of small systems on a network, that scales.

And finally, this solution is technologically driven. I'll show you a lot of slides here that -- we're not in the RMP stage anymore, we're in the market deployment stage, and that's where I think the industry is.

So if you look at the value stacking, this is -- it starts -- for us, it starts at the retail demand charge build or retail energy builds, I should say.

The darkest blue line, that's your initial building load profile, peaking about 1.8 megawatts. You put solar on, you get to that light green line. You put solar and storage on, you firm that up and you can produce your demand charges three or four times as much as with solar.

And energy storage -- with solar energy storage, you can double. Obviously, this is a reference from another site. It's one of the sites we've

analyzed, but it's pretty indicative of the analysis we did.

More importantly, solar is going to go away from (inaudible), there's cloud cover. What you see in this image, the green -- sorry, the orange is a building load profile that has a solar system on-site and in the middle of the day, the clouds come over or the inverter trips on the solar and you see massive spikes. This is only a 300 kilowatt spike, which is not very major when that happens. That scale is a huge issue. With energy storage, we completely wiped out that spike on the grid and kept it to this green color, the green background, and shifted that energy to eliminate that intermittency on the local grid.

When you look at -- so, you know, the slides I just showed, the retail behind the meter, demand charge reduction for customers. That is Green Charge's core, but that's one of our -- many other services we provide and any system we put

in is a multi-use system. It provides multiple benefits and many of those benefits are really -- hopefully, what we're here to discuss is how we open those revenue streams in the wholesale market from the utilities and from other entities.

So if you look at the three major issues that I think New York is dealing with, especially under a 50 percent RPS, right in the middle, you have Con Edison, low duration curve, very well known probably to most folks in the room, and Bill mentioned earlier that if you flatten a hundred hours of this, it's about $1.2 billion in savings per year.

On the left is the intermittent issue of solar and on the right is the back feeding issue of solar conductor. I think energy storage is a major player for all three of these things and including with a single system.

So if you look at -- I'm going to post a couple more examples from

California and the programs we're participating in.

This is a program that in the middle of day, we're peak shaving, we recharge and then provide capacity to the utilities. This capacity, whether it's for resource advocacy, whether it's for economic wholesale dispatch, whether it's for TD deferral, we're providing it.

The contracts with the utilities varies, but they're there. We have the contracts with the utility and we can count on that revenue stream.

Again, back to the image I think Bill mentioned earlier, you know, redundant grade with back up natural gas, natural plans isn't what we're going for. If you can back up a solar and firm that solar with an asset that's also being used with multiple other, you know, solutions, it's much more cost effective to the entire ratepayer base and New York State overall.

Finally, the back feeding issue. Back feeding will become an issue when we

get to 50 percent, especially if you're looking at network by network. The whole grid may not be back feeding but any given day there could be issues on a given network.

This is, again, we're charging the battery in the middle of the day to prevent that back feeding and, you know, charging up again later in the afternoon and all while peak shaving and saving energy on the customer bill.

What I really want to say today is it doesn't have to be connected to solar BP to provide that service. This is a program I'm participating in from California called Access Supply Pilot. We're effectively charging to eliminate -- California is testing out this issue of okay, what happens when we need to curtail solar or the grid? We can charge at any given time, whether or not we're with solar.

So there's questions of when we get to the REC conversation of how do we do

this in context of renewables? I think there does need to be some mechanism that doesn't necessarily need to co-locate these services, because energy storage can provide these services no matter where it is and it's very valuable to the grid.

One -- so the three images I just showed you, or four images I just showed you, those are site by site but those are all part of aggregations. We are aggregating systems and providing that capacity to the utility. These, you know, for a variety of reasons. Whether it's network peak relief, whether you're curtailing solar, whether you're providing resource advocacy, or just bidding economically into the wholesale market.

It doesn't matter, you know, the aggregating systems is providing meaningful capacity to the utilities and the ISO is where this industry is going and there are a few barriers, but there are a lot of (inaudible) from day-to-day.

So we appreciate you guys and others

for doing that.

You know, just some of the programs that I just highlighted. In New York, we recorded the management program in our initial Con Ed pilot demonstrations and in California, the demand response mechanism (inaudible) various other programs, again, at the pilot stage but how California went about this process was kind of get capacity into the ground and open up these pilots.

So if I look at the barriers that we're dealing with, first it's performance and experience. I think we're there in terms of performance. Capital cost reduction, what we need there is more competition and potentially incentives whether it's through a REC program or an ESTRA program. Development cost and certainties, this is a natural regulatory function, but more so it's on the experience level, the more experience, the developers have, the more certainty we'll have there. So I think that one's on us.

Revenue availability and certainty and regulatory risks, I think that's what we're here, really, to discuss today. Long-term contracts simply don't exist to the extent we need them to today.

And as I always say, New York is by far the most attractive market for energy storage, but it's easily the riskiest market at this point. We know there's a lot of changes coming but we don't necessarily know where that's going.

And, you know, real quick, the three barriers that I look at is lack of certainty in the direction of the state in maybe a commitment-based, which could result in an affordable mandate.

Lack of investor insurance -- assurance, we get around that through certainty in prices through progress in the REC market.

And then lack of market mechanisms, we need to start opening up pilot programs and have new market oriented programs for us to participate in. So that'll do it.

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MR. WALLACE: All right. Thanks, Dan.

So if people have questions, could you please queue up at the podium?

MR. WEINER: Just, I know your agenda called for lunch now.

MR. WALLACE: We have another 15 minutes.

MR. WEINER: I want to suggest another 15 minutes, cut into lunch a little bit.

MR. WALLACE: Okay, sounds good.

MR. ADDEPALLI: Couple questions.

One, you talked about potential note of RECs level of penetration. That's a language ratepayers like in order to make solutions. So is there an analysis that the industry has that shows this quantity in New York at this time or the next number of years should be considered no regrets and is this the backup for the benefits and costs?

MR. ACKER: There is not a specific focus analysis, as you just asked for,

Raj. There is a piece in the road map and pieces that didn't drill what energies have done, like GE, that is something that probably could be put together.

MR. ADDEPALLI: I think that would be very helpful. Second quick question to you, Dan or others, is: In California, the mandate is -- has to be procured by the utility, local utility. And given your involvement and your entrepreneurship in putting these together, do you have any strong feelings of the role of the utility in this case? What does it mean to competitive providers verses utilities owning these systems?

MR. VICKERY: From our side, we prefer that we own them. I think there's certainly a play for both sides to own. The -- with that mandate, part of that is allowed for maybe half of the ownership can be third-party developers, which I think strikes a reasonable balance for kind of navigating a new area.

MR. WALLACE: So we'll go to the

podium. If you could introduce yourself and ask the question.

MR. SPECTOR: My name is Herb Spector, I'm president of Micro Utilities, Inc. I'd like to return to the very nice graph that Mike put up showing the enormous impact of getting rid of the peakers, billions of dollars, and of course, we assume that those savings, in part, will accrue to the customers.

As a consumer of electricity here in New York that pleases me a lot.

I want to point out that the problem of getting rid of the peakers and all the savings that would accrue to that, plus the reduction in greenhouse gases as you get rid of these peakers and air quality issues and so forth, that problem, I believe, is about to be solved, and I will talk about that briefly.

And also, associated with the solution of that problem, I believe it's going to be a yet unrecognized challenge for distributed energy resources. It

seems that when you look closely at storage, sometimes it's a two-edged sword; helping in one area and challenging in the other. How is that problem going to be solved?

Right now, New York State is embarking on a new program to work with a company called Ice Energy who's been doing a lot of sales out West.

Basically, they have a system that uses off-peak electricity at night to make ice. They use that ice during the warmer hours the following day to reduce the air conditioning load. The air conditioning load is the load which has driven the load factors in New York State to terrible conditions.

Back around the mid-'60s, the load factors -- for those of you who don't know what the load factor is -- it's the percentage of the time that the fleet is being used.

Well, that -- years ago, around the mid-'60s it was around 68 percent. Today,

it's down to 50 percent.

And I recall Richard Caufflin saying, No business could survive if they only used their equipment 50 percent of the time, but that's what we have in New York.

That problem will largely be solved, I believe, by ice storage at night with off-peak prices using a technology that's already been out in the field and well proven.

Incidentally, it's energy storage, but it's thermal energy storage, it's not batteries.

The second part is that what would that mean for distributed energy resources? Distributed energy resources, of course, has to compete on price, but the prices of electricity from the utility will decrease significantly once you have the ice storage. Distributed energy resources has a benefit in that it will reduce greenhouse gases, so will the removal of the peaker plants in basically the same market. So while everybody

agrees that you need energy storage to enhance distributed energy resources, this very big application of thermal energy storage may be a big challenge for DER.

And finally, intertwined in this is a policy consideration. When you look at the goals of the state, some of the goals will speak to reducing greenhouse gases.

Some of the goals will be to make the economic burden on the consumers lower, et cetera, et cetera. It's not clear that all of these goals can be met simultaneously, and that's an issue I think worthy of discussion going forward. Thank you very much.

MR. WALLACE: Does anyone want to respond or should we move on to the next question?

MR. ACKER: I would point out that the ice energy and thermal storage is a very important vehicle and when we speak of storage, we actually include that into our storage.

MS. REICH: Hi. Brit Reich, Con Ed.

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This is a question for Mike from NYISO or maybe also for GE.

Do you see the value of energy storage systems that can discharge greater than four hours, increasing over time? I don't know what the GE model says about that or I don't know what NYISO's policies are about that, and how to incentivize systems that have longer durations than four hours.

MR. DeSOCIO: That's a fantastic question.

MR. CUTRIGHT: I can start if you want.

One of the points I was going to mention, I think as the product manager for GE, I would like to see people buy lots of high power frequency regulation systems like dip and deployed DEM. But as a New Yorker who pays electric bills here and taxes and whatnot, I think we should be looking at building energy storage systems that are shorter, for something like two hours, because the

interconnecting inverters, the transformers, the controls are identical whether at 15 minutes worth of battery or two-hours worth of batteries. I would rather see two or three four-hour systems go in, so we get not only the ancillary services benefits, but we also lay the foundation for the shifting and the renewables and the peak shifting and all those other benefits.

So I think it was great for PAM and it coincided with where the technology was at. I don't think other people should repeat that exact process. I think it's important that -- I think any four-hour system can do ancillary services and will do it the majority of the time throughout the year. And the larger the batteries get, the less impact you have on life associated with doing the ancillary services. It starts to become a low tax service for those resources to provide. So I think however we think about bringing those together, it's important that you

can simultaneously do everything, including the frequency regulation, frequency response, (inaudible) in that mix.

MS. REICH: And just a clarification, I guess it's all relative. When I say longer time scales, I'm not just talking about super short time scales to four hours but even beyond the four-hour discharges. If you see those becoming of value.

MR. CUTRIGHT: So I'm not a fan of duration longer than four or five hours, because when I look at the load profiles and I think about the use cases, especially when you're looking at renewables, there's -- the time period for where I need to charge and discharge. So while I may want to discharge over a long period of time, I'm going to want more power on those systems so that I can scoop up their renewables as they're available, and that tends to pull me back to six, five, four hours, where I'm charging that

over-generation. So I may charge for four hours when I've got a lot of extra solar, and I may charge that over the course of eight hours or overnight.

So the power to energy ratio is probably more appropriate than duration, although we all use duration more commonly.

MR. DeSOCIO: I think just to add on to that, when the ISO is looking at the low duration curves and looking at the load profiles for the system, what we're starting to see is that the load just doesn't go away as quickly as it once did. It hangs in longer, and longer, and longer. So to the extent that we do rely on a device that is a limited energy device, some form of storage, we need to be thinking about how much of that we need to get us through the no longer than two or three hours of peak, but it's really, now, four to six. It's approaching seven, and as we flatten that out, it's going to get longer and longer where we're not

starting up conventional units anymore to meet that longer area because the next marginal resource is potentially a storage device.

So as we think about that, we're thinking about it in the form of building blocks. What we don't understand yet is where that real cost benefit from a size perspective really hits the sweet spot. So we're looking at it from a perspective of how do you build up multiple assets to get you to the four or five? So that's what ISO is focused on as we roll out things like aggregations of DERs and the like.

MS. REICH: Thank you.

MR. ACKER: If I could add. I think this a key lesson learned from the BQEM work is that as opposed to thinking about one block doing everything, looking at it in building blocks as Mike just said, and so you get eight hours from two four-hour systems. You can combine them in different ways and those kind of things

become important.

MS. ELSON: Hi. Erica Elson from Sustainable CUNY's City University of New York.

So a few of the presentations hit on this need for a target, and I think that's really important in setting our policies moving forward. So New York Best set some targets in a road map and then Rick from GE also suggested some other targets.

So I'm wondering who should be taking the lead? Is that going to come out of the REV process? And how do we set those goals for the optimum level of storage?

MR. ADDEPALLI: That's a good question. That's what I was trying to elicit. For us to set some goals, we need some rational basis and some amicable work. And I think Bill promised he'll take that on and get us an analysis that will help build a record.

MR. WEINER: In that same vein is the opportunity for demonstration projects. For folks that may not be aware, Con Ed is

recently in the midst of conducting and evaluating a solicitation demonstrating projects. (Inaudible) hear something about that this afternoon. So there's lots of opportunity to help build up our level of knowledge. And I'm very keen on this panel, particularly the afternoon panel, to go beyond stating the challenge and suggesting some specific actions. So setting a target is fine.

If anybody has, at this time, ideas about where that target should be set or how large it might be, I'm very happy to hear it.

I take the point on the need for revenue certainty. There's lots of ways to do that, we've heard some of them.

Particularly in the context of REV and the CES, if there are specific ideas, some have been offered, those are things that we would like to explore today beyond just listing them on a PowerPoint.

MR. LaBRANCH: Brian LaBranch, CEO of Todum.

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Dan, I have a question for you: You made an interesting comment about marrying solar and storage, not necessarily co-located. Can you give any more color on some of the opportunities around that, how you're thinking about that, or how Green Charge is thinking about that?

MR. VICKERY: Well, I think one of the questions today was could -- would co-located solar and storage get a higher benefit with CES? And why I wanted to bring that up was you can still curtail the grid if a solar plant down the road is over producing. It can provide the same exact services, whether it's behind that same meter or just (inaudible). That's really what I was referring to.

MR. CUTRIGHT: If I could comment on that. I think lots of people are very interested in that. In particular, there's ITP tax credit benefits to co-locating storage with solar right now. But early on, like six years ago when I started, the nay-sayers for storage would

talk the benefits of averaging the noise, whether it's generation or load noise on the grid before you try to solve the problem. So I think whether it's demand charges in a building or excess generation in the building, but you can roll that up one more tier to a tier or a distribution substation. Any extra that I had at one building that I needed in another or things of that nature, that can balance each other out without charging and discharging the batteries. It's going to be better for the system because there's less life and batteries that were required to solve the problem. Whether the asset is physically located there, but you're controlling and managing those assets based on the next level up where you're taking advantage of that natural noise cancellation, that would occur within a complicated system.

MR. DOLING: I've got a question for Mike and it's a practical question. So many benefits that have been talked about

with costs savings with emissions reduction, have to do with retiring peakers. Regardless of whether those are being retired because of reducing peak load or because they're not being used to firm renewables. And I understand part of this has to do with a level of competence in the storage asset being the dispatchable and reliable. But I wonder if you could spend a moment just speaking from a reliability standpoint. What do we actually need to be envisioning in the future to enable some of the less efficient peakers to actually come offline?

MR. DeSOCIO: So I think the first thing we need to be thinking about is how are we going to get the power to the areas we need it the most? And so to the extent today we have a fleet that has been historically located right in the load centers, right on top of where we need it the most, that has provided some fantastic resiliency for the City of New York, Long

Island, the really highly populated centers.

And so it's not clear to me that there's a lot of space left to install large storage devices in these load centers.

But that said, if you could get around it, if you had expanded the transmission compatibles to get power into those load centers, as you think about the services that we are procuring and managing for maintaining the liability on the grid, I spoke about a few, you've got long-term capacity, where we're really just making sure we have enough resources to meet that peak load. We have the energy product, where that's our five-minute product, we settle that on a five-minute basis. That's fantastic for our storage resource to get some value.

We, in the market, allow resources to vary their offers hour to hour, which will help them manage those situations where they find themselves discharging at a rate

that's greater than they anticipated and need to kind of back that off, pump the brakes, so to speak.

But where I think we get most nervous about all of this stuff is when you start to think about situations where there is a system of that, and we talk about nice uniform (inaudible), and then we talk about how the day in and day out load profile may change. We haven't really spoken a lot about what happens when that event occurs on a system.

Now, I'm not talking about an event where we lose half a network in Manhattan. I'm talking about an event where we lose a thousand megawatts of capability into the city or we lose a large resource outside of the city or we lose some other piece of infrastructure that's critical to maintaining that balance. That's where I think we really need to be cognisant of the fact that, yeah, a peak shave might only require a four-hour asset, but when we get ourselves in a situation where

you've run out of the short notice resources, to start to deal with that issue, we're going to need to have building blocks where we can extend that need and extend the use of those storage devices to cover what a peak power plant does today.

So when we start up a peak power plant today, we start it up for that immediate need, not knowing if this situation remedies itself in the next ten minutes or doesn't remedy itself until the next day.

And so those are the things that I don't know how to predict, I don't know how to tell you to predict them, to figure out exactly how much storage it's going to build.

MS. HILLMAN: I would like to address the space issue. And we had some New York legislators on Long Island where we built the ten megawatts storage project recently. And the most interesting comment that came out of it was wow, this

is smaller than a lot of restaurants in Manhattan.

So I have a slide that I didn't put up today that basically talks about the batteries are great for the urban, because it is a very small footprint. You know, people ask what is size, you know, ten megawatt, 13,000 square feet? That can be outside in the container, in a building, in a warehouse. So that is one, you know, one advantage and, frankly, we put many projects on retired power plant locations, including the big one in California. So that's a pretty good one.

MR. DeSOCIO: Just to add some context to what I was speaking about. When we talk about the peaking plant fleet, we're talking about more than 3,000 megawatts of peaking power plants. And so that's the scale of retirement that I think might be alluded to.

I'm not sure that's what was alluded to in the slides, but it's what we rely on day in and day out to deal with the

reliability in New York.

MR. WEINER: If I may. In thinking about the challenge of sighting an urban area, and I'm inviting the panel to comment on the barrier permit.

MR. ACKER: I can address that a little bit.

So it was mentioned earlier that there are lots of different battery chemistries. So we have either classic acid chemistries that are in many, many buildings that peak gas systems are ready and in the code and building code. Then you have newer chemistries like (inaudible) that have lots of experience with in carrying them out today. But they are not in the fire building codes for going into the city. So for indoor applications, you need to go through an exceptional process in New York City.

That's now getting worked out, we've had, now, a year and a half experience with that and things are moving forward.

NYSERDA and Con Ed funded some

particular testing that the New York City Fire Department was interested in and those results are being finalized and going forward right now.

So we're now moving forward with moving from what is a very long time frame process. It could be a year and a half type of time frame process to get things through -- a couple times through for something that's faster and eventually becomes standardized.

One ramification of that is the DEP program has 15 megawatts of batteries queued up that didn't get through that process quickly enough with the building department. So it will need to extend that program to now getting approved and getting them in.

So I think that we had work to do there, we did a lot of work in the past year and a half. We still have a little work to do, but we're going in the right trajectory to get these solved.

MS. HILLMAN: And in terms of

barriers and how quickly you can build something, the project itself is really quick, months. The issues are interconnection, which once the rules at the distribution levels (inaudible) basically going in the distribution system. And the general building permits, fire being one of the ones that's been evolving.

MR. VICKERY: I would add, I think we're close to being there. It's the same technology going into the same building every time. So pre-approval process, something along those lines, battery put here is same as there, so that would help speed things along.

MR. ADDEPALLI: Let me just follow up on the co-location issue for Dan and Rick. Do you have specific analysis that shows the value streams of solar located by itself, storage by itself, and then coupled together at the same location? Are there synergies? Are there additional distribution value streams that you can

derive by co-locating as opposed to being a different location? Is there some analysis both from the life of the enhancement and value streams in terms of what it costs to be total?

MR. VICKERY: From a reliability perspective, the values, if you're, you know, if your inventors are tied together, you can have a microgrid where we would come in and solar storage, more on the retail demand savings side, there's substantial benefits when you put them together, it's that one, plus one, equals three argument.

On the network level -- the third component is we have slightly less sufficient losses if they're together. But for me, I see if you're on the network level and you're on one building and the next building has different technologies that work together, I think you have similar benefits there. We have plenty of analysis on this.

MR. ADDEPALLI: I think if you could

share that, that would be helpful.

MR. WALLACE: All right, so 25 minutes after the hour. This is probably a good time to break. If we could limit it to a half-hour lunch that would be good. So if we could start back up, let's aim for one o'clock. We'll start back up at one o'clock.

Just so everybody knows, there's a deli right across the street on Vesey Street, so it's pretty close by. Thank you.

(Whereupon, a short recess was taken at this time.)

MR. WALLACE: Okay. So for the second panel, we're going to be talking about integrating storage into the REV and CES framework. We'll start off with Doug Staker from Demand Energy, SolarCity represented by Carlos Gonzalez. Jin Jin Huang from Con Ed, then Cameron Brooks from Sunverge, Mike Jackson from Advanced Microgrid Solutions, and then we'll end the panel with Sarah Van Cleve from Tesla

Energy, and then at that point, we'll have a Q&A session.

So again, after all the panelists are done, you can queue up at the panel.

There was a little bit of trouble with people hearing the panelists last time, so if you could make sure you're talking into the mic and make sure the speakers are picking you up. I think that's everything.

So without further ado, I will hand it off to Doug Staker.

MR. STAKER: Great, thanks Matt.

Everybody hear me okay? How's that? It's just 'cause we're all shy. Okay.

Thanks for the opportunity, I appreciate the invite to participate on this panel. One of the things I'd like to point out that just two buildings away from here, we built our first behind the meter energy system that's been operating for four years over here in the Barclay Tower. So every day, it's been optimizing savings for the owner and helping support

the grid as far as load shaping.

So as we look back and try to point out, what does storage really do for the grid? I'd like to say that the grid is really perfect, just in time inventory system. Generation has to have enough capacity, transmission has to have enough capacity distribution to match the load that's required at the edge of the grid.

So there's been lots of discussions about value proposition along the way. Co-locating storage with generation, co-locating storage on the transmission system, co-locating storage on the distribution system, and then finally putting storage out of the edge of the grid. And we believe that it provides the most opportunity to drive a valued proposition behind storage.

And one of the points that I like to talk about when we talk about a Clean Energy Standard, and this is a real world scenario that we like to point out. So one of the areas that when we talk about

Clean Energy Standard and optimizing the existing fleet is a case in point where there's a lot of generation during the day that is load following generation. And load following generation usually goes idle for a certain segment of the period, usually through the troth of the day. Now, a lot of combined cycle plans, actually, to achieve that. What they do is they turn down their steam load. So instead of generating electricity through steam in a second turbine, they just eject that heat into the radiators in the sky. Now, what that does is as far as heat rate when you look for the kilowatt hours produced, it takes something that when they have both cycles running during their load, following operation, it really transforms that system back into a single-cycle generation cycle. So it changes the heat rate from 6,000 BTUs to 9,000 BTUs per kilowatt hour.

So when we talk about clean energy and improving the efficiency, better load

capacity or grid utilization, I think there's some aspects to think about, what storage brings, and this isn't getting discussed enough, I don't think, the ability to create load at off-peak. So if you think about if we could have corresponding load, and we can match load with generation very easily, and how the market mechanism is put in place, not quite sure, there's many different ways to look at it; bilateral agreements, things through congestion pricing, things we do today just in the wholesale market by and large. And if you could create load and move that generation to allow them to run that secondary cycle, take that electricity, move it through the transmission system, move it through the distribution system when they have lower line losses, that really is energy efficiency and improving greenhouse gas reduction and optimization. That's one thought process to bear in mind as we look to what can storage do to, you know, drive

value from the Clean Energy Standard perspective.

This is a graph from the Pacific Northwest and this is in a time period where there was a lot of wind moving in line and there was a lot of contention out there, because in the Modernvile Powered Administration, they have to balance hydro supply with demand. And in the springtime, this time of year, we get really good wind, a lot of wind moving through, but we get a lot of water flow through the snow melt. So we've got a balance of -- and then on top of that, we're trying to mitigate around fish, migration of salmon and steelhead. And there's rules about if you're a hydro generator, you got to run the water through the turbine, which puts less dissolved gasses into the water.

So BPA started reaching out to the wind guys and turning them down because, as you can see, a lot of the wind generation here in the blue line is 180

degrees out of phase with where the peak is for the day.

So there was an argument, they took him to court, PERG sided with wind generators and just said, you can't discriminate and go out and turn off wind, you have to have a better economic argument here. Well, caught between getting penalized by National Marine Fisheries or getting sued by the wind guys, BPA did what they thought was the right thing.

So again, if we look at what storage could do very easily during these non-coincident periods, storage that's located at the edge of the grid can react. We have the control systems, we have the metrics, we have the meters. We can build, certainly, off signals, like ACG or whatever, and be able to manage and control load when needed, as needed to support better integration of wind resource.

As we look at trying to move load

through transmission and the distribution system off-peak, you start to look at what's the effect of reducing line loss, because we talk about transmission capacity, distribution capacity, and when you look at losses in distribution systems, they're not linear. There's a squared function. It's a function, really, of the amperage that causes line loss.

So if you looked at the ratio of the peak on July 19th here in the city in 2013, the ratio of troth to peak was about 1 to 1, 1.46. So it's not that if you were going to move energy through the distribution system at that time off-peak that it's just a 1.46 to 1 ratio, it's really a squared function as far as what the reduction would be. So by being able to move -- when you look at that, really being able to move that energy out to the edge, catch it and use it for peak shaving, there's benefits that we see in the form of line loss reduction.

And if -- when you look at line loss reduction in the summer, Con Ed has an average rate of about 9.9 percent line loss, that's average grate. And the way line loss is typically measured is they measure energy generated over a period and then energy metered over the same period, and then look at the differential between them.

Well, that is a true averaging. So if you look at the ratio that the line loss at peak verses the troth is a 2 to 1 ratio, this tells you that line loss peaks around 13 percent. So when we're generating 13 gigawatts at peak demand down there, 10 percent of that is 1.3 gigawatts. That's a big number.

So being able to optimize and turn the distribution system into a managed system has a lot of benefit. And it's -- what's difficult is some of the market structures that we have, there are probably tools and mechanisms that we can price that around, but that's why we're

supportive of storage being able to earn credits.

Another key point that I'll talk about is one of the things we're doing out in Brooklyn Queens on a project. How do we take solar that tends to peak from about 10 a.m. to 2 p.m. as far as man output, and match it with load out in BQDM where the peak period is basically 7 p.m. to 11 p.m. So being able to -- not that the grid can't use that excess energy midday, but it has higher value at seven at night to eleven at night, and being able to store is, time shift it, and generate it, that, I think, is another element that shows storage with flexibility to provide better utilization of that resource at a time when it's needed and does all the things we just talked about as far as line loss reduction, third-grid adjustment.

Let's skip that. Everybody knows my story about rates. We need more rates, more hourly data. I'll stop there.

Just in conclusion, really, you know, storage is here. It's nothing technological that can't occur. We believe that storage should follow what New York Best has put out there, a Flexible Energy Credit. Just due to the fact that it can create load and supply generation.

Storage is remote, it doesn't need to be co-located, we can react very fast. Storage has that capability to form up intermittent resources, be it wind or solar, whenever they're located. And just the overall improvement in greenhouse gases and the current fleet, we think that has substantial benefit. And to be truthful, the generators hate it because we're taking away that peaking power which they earn the most on, so naturally, we're going to see resistance.

So thank you very much.

MR. WALLACE: Okay. So next up we have Carlos Gonzalez. I'll let you take it away. And excuse me, I'm just going to

be messing around for one minute. Do you want to steer or should I steer? Okay, just let me know next slide or whatever.

MR. GONZALEZ: So again, Carlos Gonzalez with SolarCity, and we were asked today to present on the business model for solar plus storage, and also talking a little about our current projects.

So we're here -- let's go to the next one. So three key messages that we have here. I know you've all heard quite a bit on the multiple use application today. I think we just wanted to add the emphasis on the virtue of being behind the meter, how you can address more of those multiple use applications, and kind of our renovation of how we try to enable that.

The second one is that while we're encouraged by, you know, the mergers of those multiple use applications and there's a limited opportunity right now for some of those to be commercially viable. As of having that commercial mindset, one of the things we wanted to

propose here is we're not set on what that number should be but from a concept perspective, perhaps to renovate markets right now, to the extent there's a gap that we could leverage some sort of incentive to move the market forward. So we'll get to that in a little bit.

So just to go to the multiple use applications that I was talking about. Everybody has touched on these, but we explicitly break them down between what we can provide to the customer, to the distribution grid, and the wholesale markets.

And -- let's go to the next, Matt -- I think RMI put together a very good visual about this and the way to describe it was that by virtue of being the deepest into the grid, the behind the meter resources are the ones that are more capable of doing the most of these values to the grid.

So that's the mindset we have taken, and from that behind the meter

prospective, I'm going to talk about what we released in Hawaii to unleash those values. But let me step back for a second and just describe the three types of business models that we have currently.

The first one is in Hawaii. We did a deployment of 17 megawatts. The use case that was used by Hawaii island was to shave a peak that was going from 5 p.m. to 10 p.m., so this was a great example of a dispatchable large-scale solar, so that's pretty encouraging. We're trying to do the same with Connecticut Municipal Co-Op, as well. That's another large-scale deployment. It's 13 megawatts, so that's our first piece.

The second one -- Matt, go to the next, there we go. It's the demand logic product. You heard earlier -- some of you spoke this morning about the main business case here is shaving those demand charges. What you see there in the graph is to the left is an industrial load profile where you see at the top is literally the peaks

during the day, and then the one to the side is once you have incremented the battery, you know how to shave those demand charges, so that's the key economic driver for those commercial applications.

And then finally, at the residential level -- let's go to the next -- here it's just the whole portfolio that we have released in Hawaii. The idea is to aggregate homes and offer them as a resource for the utility.

Potentially here, what we're proposing in Hawaii is a self-contained home that can really manage that load for self-consumption, and it's not just storage, it's other load resources, as well. So here we're talking about a thermostat and other devices that can be a comprehensive system.

So the way we are trying to make this work for New York is the aggregational resources. As I mentioned earlier, to the extent that we can move them in sync with what the utility needs to provide those

services to the grid.

So just to recap here, then, where we stand on the business model today, the batteries are providing reduction on energy and customer demand charges. We can increase the solar self-consumption and we always have the back up power value.

We heard earlier today that Mike, suggesting, you know, increased ability to deliver value to the New York ISO through capacity and ancillary services, and then from what we've seen, there's the pretty positive development from utilities to do alternatives. In fact, we're pretty eager to see what comes out of the opportunity we're expecting by this summer, and we're expecting more of those to come out. But the vision would be that we have those portfolios providing those two services.

Then what's next? There's three pieces there. One is the potential development of smart rates. The idea there would be some sort of opt-in rate

for homes that have the capability of whole comprehensive load management.

The other one is to the extent that we develop hosting capacity methodologies with the utilities and there's opportunities to perhaps enable capabilities with smart inverters. That's a potential additional revenue stream.

And the last one is those distribution services that I mentioned, such as BBO.

So let's skip this one, Matt, one more.

So when we talk about what's holding us back, we just wanted to provide a really quick summary of what are the things that we could be addressing? From our rate design perspective, the customer demand charges sometimes are not really aligned with those distribution system peaks, so that's a great one to get started. I think we'll help ourselves and the utilities if we can make those match.

The other one is from a TOU rate

perspective, those are great developments. One of the things we've looked at is when you get into the weeds, is that the inter-period netting may not be the best set you have, so what I'm talking about is can you offset super peak kilowatt hours with peak kilowatt hours? Or could you offset winter kilowatt hours with summer? It's some -- that's a design question, but it could really make the economics go far. That's one.

The second one is market eligibility. What I'll talk about here is that some of those other programs that you can participate in, let's say, CSRP, the ICAP special case resource, and others are great positive opportunities for us to participate in, some of them explicitly may have exclusions for M customers. There may be reasons for that, but to the extent that we can talk about modifying those rules, you may be able to get into stacking those values.

And the same applies to timing of

markets. One example I have there is utilities needs sometimes. We talked earlier that perhaps the need is typically four hours, potentially even longer. We could get into the situation where resources can provide those values within 15-minute increments, rather than be required to dispatch the full four hours.

Measurement and verification. Here it gets to cost. So sometimes the metering requirements may be overly costly, so that's one to take a look at.

The other one, this is a little more nuance, but it relates to how the utility measures that shave, and some of the utilities prefer to have a customer baseline versus and measure inverter outputs and there may be opportunities to do that more transparently.

Interconnection. I'm not going to belabor this one, but there was a good development in the new SIR rules. From that development, we still don't see a direct addressing of storage for those

rules, so that's another opportunity to improve.

Permitting. I think I see DD Hubs folks in the room, so I want to say thanks for all the work you've done to get the Department of Buildings and New York State -- New York City Fire Department to really move the ball in getting those technologies approved, and also give transparency to the market on what else we need for permits in perspective.

And then last one, some market values may just not exist today.

And so the final punch line I have here is just a call for what can we do to perhaps animate the market? The way we see it is we try to extract as much as possible revenue streams from the market. The first stack, of course, what you can derive from the customer. Then to the extent we can have utility contracts for services we can provide to the grid or for participation in the ISO, and even in those cases, you may still have a gap to

cover the full battery cost.

So where do we go from here? And the suggestion is to have a stepping down incentive that could close that gap. We know what the path forward is for declining cost of batteries. So you would get into the far right chart here where the costs have come down, the incentive is gone, and your opportunity to participate in markets is profitable.

So I'll just leave it at that. The only reference I had to that was you may have followed that in California they recently revamped the S chip incentive mechanism. It is indeed a step down approach to incentives with a clear timeline. It's separate for large commercial versus small systems. That's one approach. I'm not advocating for a particular number, but there's one approach to deal with it.

So leave it at that.

MR. WALLACE: Thanks, Carlos. I'm just making it easier for the presenters.

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MS. HUANG: My name is Jin Jin. Good afternoon, I'm senior engineer and distribution engineer at Con Ed. And for the past three years, I have been deeply involved, as Doug knows, and probably most of you in the room, in all of our battery storage projects, especially in the application of load shifting.

Today, I'm just going to give you a brief overview and I think a lot of the speakers today have already covered most of the topic in the first half of that agenda, and then I'll talk to you a little bit about benefits of customers, Con Ed, New York State, and touch on projects that we're working on in REV and some of the incentive programs that we have launched in the past for battery storage systems. And then I will close with just a little on the collaboration project that we have with the FDNY and DOB and addressing some of those challenges.

So I think I'm just going to go through my first few slides very quickly.

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You have heard this over and over again. The only thing I want to point out in this slide is the curve on the bottom, that's actually a typical curve of our large commercial customer. So one way -- and you've been hearing a customer can save money and reduce their peak demand charge, that's how they can do that. At night, you can see there's a huge troth when energy is cheaper, so you can charge your battery and actually reduce that.

So the blue line is what the customer would have been using and the red line is what you can do in reducing that cost with the battery storage.

For Con Ed, we can -- battery storage can help defer transmission and distribution costs and I can give you some examples later on in my presentation. And for REV, we are exploring how we can find new sources of revenue. And I think most of you also have heard of our virtual power plant project, where we're partnered with Sunverge and Sun Power, and you'll

hear from one of the speakers later, to install -- we're going to try to install a few hundred systems that are solar battery combined with a total capacity of 1.8 megawatts and four megawatt hours and the main goal in this demo project is to try and see, do we have a space in Con Ed to play in the energy market? Can we produce additional revenues where we can provide additional reliability to the customers without increasing their bill? And also, is there a space for a third-market player? And hopefully, the answer will be yes at the end of these demos.

And the other one I think, was referenced earlier. An RFI for batteries -- not batteries, but storage systems, in general, and I think the gentleman mentioned earlier that when we talk about energy storage, it shouldn't just be battery storage, and we've been trying to cast a wide net and asking providers to give us good ideas on what do you think can motivate the market? How can we

utilize energy storage to not just provide additional revenue for third party, saving money for the customer, and also increasing our reliability?

And we had a very strong response, 47 responses and of those, we will be selecting ones that make the most economic and feasible sense in the short term. And Con Ed and O&R plans to file for demo projects in the third quarter of this year.

And I'm not really going to dwell on this because I think the speakers this morning really touched on the benefits and how energy storage can benefit the state and how it can contribute to the state's energy plan for renewables. But just to reiterate the goals, here is -- we want to enhance customer engagement. And I think you'll see later on in the program that I'll be talking about, this energy storage movement, I should say -- I don't know what's a good term for it -- has really engaged our customers. It really

challenged them to start taking more proactive stances and not just being a passive user. Now, they can control their bill and start thinking about, I'm not just turning on equipment and getting charged for it. So now they can be smart about when you turn things on and how to make and save money.

Demand management. So now I'm going to go into our programming. Again, I hope all of you, if not most of you, have seen this program. Demand Management Program was the first of its kind for Con Ed where we were trying to address a specific system need and our coincident -- we were trying to reduce -- get customers to reduce their use during the times that's coincident to our system peak, which we defined as 2 to 6 p.m., Monday through Friday, June 1st through September 30th.

As you can see here, we provide a very generous incentive for $2,100 to KW for battery storage systems, and the reason for that large incentive is because

we're trying to reduce large megawatt goals in a very aggressive timeline. And this program in itself is sort of a pilot.

We had really just put our -- we had to design something where we can get large reductions per project and need to see where the market took it, and we had a really great response for energy storage. We had 21 batteries storage project applications totalling up to 18 megawatts, and that's all customer cited solutions, a combination of outdoor and indoor. This program, Demand Management Program, all of the funds have been committed and we're deciding part of that RFI is where do we put storage and how can we encourage it beyond DMP?

Brooklyn Queens is another unique program. So DMP, we were addressing a system peak. DPM -- so BQDM, we were trying to defer capital costs. You can see in that chart there, the red is where the capability of the area stations are from the three networks in Brooklyn and

Queens, and the projections are various scenarios of where we think we'll be in terms of load growth.

So the option is when your demand is higher than your capability, historically, we would build a new station, but it's costly and it adds to our ratepayers in their bill. So we were challenged to be creative and say what can you do to try to avoid a new station, and how can you reduce not just at the customer side, but also what kind of creative solutions can you apply from the utility side? So we were given $150 million to solve that demand, I guess, overflow -- that increase in demand and 11 megawatts of that is dedicated to the utility side. A majority of that is working with our customers and seeing how we can reduce that demand in energy efficiency as well as load management.

In the BQDM program, we had 18 customer cited proposals for battery storage and you can see the various

chemistries that were proposed. And for the first time, we're installing a large battery at your unit substations. And I think Rick mentioned earlier that he doesn't really see a need for greater than four hours, and in this case, we bought a battery for 12-megawatt hours. So you can either have one megawatt for two hours or we have the flexibility of two megawatts for six hours. And energy storage is not the only solution we're applying in the utility. We're trying a bunch of different solutions and what's most effective. And what ends up being most cost effective is what we will deploy in future network needs.

And lastly, I'm just going to touch a little on our permitting collaboration with the FDNY. When we first launched DMP, we recognized the code currently doesn't address energy storage systems for a daily cycling for peak demand management. So we approached FDNY and DOB and tried to -- how can we alleviate that

issue, because we are expecting our customers to increase their use in energy storage systems beyond a UPS, which is what we've been seeing in New York City. And based on our conversations with them, we were able to develop a testing plan that will ultimately provide a first responder's guide and supporting material in setting new code requirements for ventilation systems. And this project will be co-funded between NYSERDA and Con Ed.

That's it.

MR. WALLACE: Thank you, Jin Jin.

So next up we have Cameron Brooks. Could you pass the mouse to him, and I'll queue up the slide?

MR. BROOKS: Thanks very much, and it's a pleasure to be here and up on the panel. I'm here working with Sunverge, which I'll walk through a couple sides of who Sunverge is, and then maybe share some thoughts on our perspective on treatment of storage, especially under RECs, which I

know is one of the questions.

So Sunverge was founded in 2009. It's a San Francisco-based company. It has raised a fair amount of capital over the last few years, and grown to a staff of over 50. The first devices went in in California, but there are other projects around the country, including in Hawaii, Nevada, Kentucky, and overseas, New Zealand, Australia, South Korea, and Germany, and soon to be here in New York State.

So part of the vision is to be able to interface at the customer level, premise level for residential customers and be able to provide a lot of those benefits you've heard about already and are mentioned in some of the projects here in New York around resiliency and reliability for customers and the ability to deal with time shifting and deal with rate arbitrage. But then also to be able to network that with resources and be able to provide a variety of different grid

level services.

So one of the things that I know others have touched on but there's really value at all scales with storage, which is one of the things that makes it unique from other technologies. There's value down at the residential scale as to more megawatt class. And I think some of that is captured, so this, I suppose, will be my eye chart for this slide, since a lot of the slides have used really small fonts, this one has a few of those details, as well, but hopefully, it gives an idea of how at the customer level, you can maximize solar demand and have some built in intelligence around demand and energy prices, and an ability to participate in grid services.

And on the grid side, many of the sort of benefits that we've talked about are at play.

So just in terms of the overall fleet, there's a few statistics about how where Sunverge is right now in terms of

its developments, so I know these slides are going to be available. I'm not going to spend much time on this.

And I also won't spend a lot of time on this slide touching on the variety of different services or value streams that are available. I think a lot of these have been touched on in earlier presentations and we'll get to talk about them more.

I think, I guess, one thing I would say about this is that probably each of these different services has behind it, perhaps, or available to it, a different kind of mechanism in order to either participate in a market or be compensated, and so I think you've heard from speakers today there might be a variety of approaches that New York State looks at in order to think about how should we incentivize storage and solar, and solar, as well.

As Jin Jin mentioned, Sunverge is a partner in the upcoming Clean Virtual

Power Plant. She's already touched on that a little bit, but at least we have a picture of that building, so, you know, with some idea of who Sunverge is, I wanted to spend a minute or two talking about how does this apply in New York State.

And I know in that staff memo, there's a lot of questions about what should be the right kind of incentive. Now I'm -- far be it for me to walk in and say that we have an answer, 'cause we clearly don't, but I think we know some of the questions that I think are worth asking and to consider. And, you know, there's probably two things we can affirmatively say, and the first would be that yes, storage should be included in the incentive scheme. It's clearly part of the valued stack of the technologies that provide resiliency, that enhance renewable energy to deal with things like intermittency. And so it's part of the chain.

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For the benefit of those who might not be able to see me, I've got a sling on from some recent surgery, so I've got connective tissue on the brain, and Sarah does, too. And, you know, it just strikes me that we can have, you know, if there's an analogy here, we can have a muscle that can get stronger, but if there's no connection to actual infrastructure, then it really doesn't do any good.

Now, hopefully, they've repaired that in my case and I can start to build that up again. But, you know, to take the analogy one step further, there are different nutrients and different kinds of exercises that you might do to deal with the muscle verses the connective tissue, and I think the same applies here.

So, you know, so that the second piece of the affirmative things that I think we can say is that yes, somehow there should be incentives that go to solar. Right now, Renewable Energy Credits are sort of the coin of the realm

and it's something that we have here available and so the question becomes, well, should storage be eligible or should RECs be used?

To the degree that that's the only coin available, then I think the answer is yes, but I think probably the answer would be we might want to think about whether there are other coins that we want to introduce into the system.

So, I know, for example, the idea of a Flexible Energy Credit has come up and that certainly resonates with me and I think is coming, that's worth exploring a bit more. But there's a few other options that have, you know, been put forward and whether it's maybe a multiplier on RECs or perhaps, you know, there would be some kind of way to enhance a capacity value, because clearly, storage does have a multiplier effect there.

So, you know, I guess I would just say, speaking broadly or maybe stepping back, the idea of a Renewable Energy

Credit is really established probably at the beginning of the century, 15 or so years ago, as a means toward an end of how to enhance renewable energy. And so it was probably aptly named at that time, but maybe now we need to think about how to either expand the scope of what renewable energy is or what the benefits look like, or, as I say, think about other kinds of mechanisms, whether it's a Flexible Energy Credit or some kind of multiplier that really allows for storage to be recognized for the value that it's providing.

I think that's probably about it in terms of just trying to set up a few of the questions.

I guess, the last thing I would highlight that, hopefully, you know, supports this idea, is that looking through the Track 2 Order, clearly this conversation that we're having here, while it's in the context of a specific proceeding, that proceeding was within the context of a much larger proceeding --

initiative, I would say. And if you look at the Track 2 Order, it's pretty clear that they want to figure out -- the Commission wants to figure out how can utilities be able to benefit from and be rewarded for decreasing costs of the Clean Energy Standard compliance and increasing the capacity of clean energy? And so some things like RECs might have mechanisms available to them that will probably flow directly to either project developers or the consumer, but then there's also a piece of services and the ability to build out that infrastructure, that connective tissue, if you will, that are clearly worth exploring, too.

So my guess is there isn't one answer to the questions that are being posed -- the question being posed here, but hopefully, a few different areas where we want to explore more. And I look forward to being part of that conversation and the rest of the conversation today.

MR. WALLACE: Thanks, Cameron. So

next up we have Mike Jackson from Advanced Microgrid Solutions, and I'll bring up your slides right now.

MR. JACKSON: While we're waiting for the slides, I just want to thank the organizers, Matt in particular, for all the work you've done today, and the others that were involved, and we're pleased to be a part of this.

My name is Mike Jackson, I'm part of Advanced Microgrid Solutions, and I'm based in the Northeast and Boston. I'm responsible for developing markets in the Northeast.

So I have a nice picture of New York, and hopefully the font will work out for you guys. We really appreciate your time. And so I'm not going to spend much time on this wheel, which you have already seen, thanks to Carlos. I will say that what I'm focused on and what I want to bring to the floor here is the business model innovation that has to happen in order to make it happen at scale.

So we have three different types of customers represented on this wheel. We have the utility customer, and we have the grid, and we have the CNI customers. And the next project I'm going to talk about has value components for each one of those customers and that's the basis of the business model that has to be built and rolled out hundreds of times and aggregated behind the meter storage solution.

So it starts with a developer. Could be A&S, could be any other developer that's out there that wants to build, own and operate for the long-term battery assets behind the meter. In this particular case, the utility or DSP services that we're providing are related to resource advocacy in an area of congestion. And there's a bilateral contract where we're providing specific services back to the utility and they're providing us with a long dated financeable contract.

One of those methods that Cameron just mentioned is in the Track 2 proceeding. So that's the first part, that allows us to develop the batteries for a longer duration contract with our host customer.

Second part is the host customer. We focus on large batteries behind large loads, commercial, industrial loads that typically are in the 500 KW to multi-megawatt loads, and corresponding large batteries behind them.

The way that we structure that is with a shared savings agreement with the customers. The customer and A&S have aligned interests and we share savings equitably during the life of the contract, that's our upside.

And then the third customer is the ISO and ETRO, enabling with these multiple values to be stacked and include ISO participation, with guys like Mike in the back, is really an important part of the long-term growth for storage and I think

we all know that.

So I'm going to give some big pictures, too, you know, so you don't have to look at the fine print.

This is a capacity constrained area just around LA. It's, as you can see, the airport, John Wayne Airport, there. What we're focusing on is, basically, the targeted substations across that area and identifying where we can put behind the meter storage in order to create, essentially, a non-wire alternative with a financeable contract. We need that financeable contract because it takes a lot of work to go out and recruit the customers.

And what I'm going to talk about, here again, picking up on what Jin Jin said earlier is customer engagement and how critical that is on the CNI side and residential side.

Our focus is developing large clusters of behind the meter storage, which then we can aggregate into utility

grids solution. That's what I call the storage (inaudible) flexible and configurable and the adaptable. With the emphasis on flexible, because we're talking about FLECs like RECs, but flexible. Very important for us to be able to aggregate those resources, many of them may be below a megawatt, which is an issue we hit here in NYISO.

So what we're trying to do is be able to set up an extraordinarily easy and fast, in the context of everything that we do in the utility and energy world, customer engagement process. So our typical offer out to the customer is demand charge reduction and other levels of bill savings related primarily to time and use, rate arbitrage, and things of that nature.

It's a significantly compelling opportunity and the customers having to consider putting batteries on their site for ten-plus years. In order to accelerate the process, we have to work

very quickly around a compelling value proposition with folks that don't have a lot of time to spend on it.

So there's a lot of performance risk in the kind of contract that we're talking about here. You have the financial and merchant risks associated with building the batteries and that's where that can be a portion back, in part, to the utilities. The developer's taking technology risks 'cause we have a performance contract with the customer and with the utility. And I think that the customer engagement risk, which is the risk to the deployment, just like you have with energy efficiency customer management process that has to consider how you're going to engage new customers across the board in a rapid way that allows us to expand energy and efficiency as a resource. We have a signature risk with customer engagement, and that's why the financier contract is so important 'cause it brings up a compelling offer. It works, we're proving

this now every day.

You've heard from Doug, Carlos and Sunverge, a lot of companies are out there doing this now. One customer in this case liked the idea of hybrid electric branding for the buildings. They offered 26 commercial office buildings with a total of about ten megawatts, just one customer, all behind the meter, zero emissions, no distribution upgrades to the customer.

So it's important to understand the business model and it's also important to understand that a big part of this business model is this offer that drives it. All those storage-ables (sic) that I mentioned, the adaptable, configurable, and flexible, all happened because of software platforms that the utility and the developer or operator need to collaborate on to develop value of storage across all the different stackable values, as well.

In this case, what we're looking at is some peak shaving that's happening by a

utility called Event in the Afternoon, related to resource advocacy. All of the opportunities that you have around using the software to co-optimize and configure the batteries are really essential for the batteries long-term value and increasing value as there are changes in the environment.

So we're here today to talk a little about how storage fits into the Clean Energy Standard, so I have the slide that shows the duct curve. In this case, it's a little different than what we've seen so far.

This is one commercial industrial customer that has been representing their days, their weekdays in October 2015, and you can see the higher curve is where the customer would have been without the solar. The lower curve is with the solar, and the new peak, and the effect of batteries, in combined batteries with solar, is undeniable and this is a great illustration for one customer. You can do

that for hundreds of customers, it becomes meaningful.

So let me wrap up in conclusion which some ideas, many of which have already been mentioned here around emanating the New York State storage market. We're working hard and we're involved in a lot of the proceedings around identification of the co-location of value from behind the meter storage that's clearly what's going to drive the difference and make these deals financeable.

The financeable revenue streams for development could be FLECs, it could be capacity contracts like the one I referred to earlier. The key is they're long-term, they're predictable, being able to support the batteries which are, you know, flexible. Deploy the storage across the key parts of infrastructure first to maximize the hosting capacity for renewables and that aligns directly with the 50 by 30 guidelines. And leveraging behind the meter storage for customer

engagement, as I mentioned earlier, is essential to how the whole innovative business model holds together.

We need to be able to value the flexibility of storage distribution resources and in the case of grid support, be able to open NYISO to aggregated behind the meter resources that may be less than a megawatt per site.

Thank you all for your time, I appreciate it.

MR. WALLACE: Thanks, Mike.

Okay. So we'll round out the panel with a presentation from Sarah Van Cleve from Tesla Energy.

MS. VAN CLEVE: So, I'm Sarah Van Cleve, I manage Tesla's energy storage policy, so I'm bringing the technology provider perspective, but also until about a year ago, I was at Southern California Con Edison when we were implementing the procurement target, so hopefully, I can share some lessons learned from the utility side, as well.

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So first, I'm going to run you guys through a few fun pictures of projects that are actually out there getting deployed, and then hit on how this fits into REV on a larger scale.

So first, I think you all know Tesla because of its cars. We do have over eight gigawatt hours of storage deployed, most of it has wheels on it, but we have a whole lot (inaudible), as well.

Last year you probably heard the big announcement about Tesla Energy, in realty, we've been working on the stationary end for about six years, but now is the time where we're really going worldwide with that. And you probably know about the power wall products. That's the home products on the left, but for a lot of the utilities, we are looking at the power pack, which is our other larger project. It comes in 100 kilowatt hour blocks, but that can stack up to hundreds of megawatt hours, even gigawatt hours.

So that's what a lot of our projects are here in North America.

All right. So here's some pictures of residential installations. You've heard a lot about what residential storage can be for customers but I want to focus on utility applications. And a good example is Green Mountain Power. So right now, they have a program where they're putting 500 power walls in customers' homes and they're, essentially, splitting the cost with the customer. The customer gets the value of the backup power. They can self-consume their solar, but the utility is also controlling those devices on peak days to reduce their peak costs.

So we're really excited about innovating projects like that. Con Ed is doing something similar in one of its demonstration projects.

Here's an image of a commercial building installation out in California. This particular project is two megawatts, four megawatt hours. So a two-hour

resource doing all the things that my colleagues have mentioned.

We do have about 40 of these projects in California, and what's, I think, different and adds on to what they said, not only is it for customer demand management, time use rate, backup, but also these projects are bidding into demand response programs, and some of them are being aggregated into contracts that A&S and others are working on, so certainly a lot of applications for these larger commercial scale building installations.

And then finally, this is a rendering of the utility scale project that Carlos mentioned. So the Hawaii project, we're happy to be providing the batteries for that project, 52 megawatt hours. And I know it's easy for folks to say, that's Hawaii, they have super high energy prices, it might be economical there but it's not here. That's really not the case.

So you look at the price of this contract. It's 14 and a half cents per kilowatt hour. So $145 a megawatt hour. If you look at the levelized cost of energy of gas peakers, I looked at a LASERD study last night, it's between $179 per megawatt hour to $230 per megawatt hour. These projects are economical here on the mainland, as well.

All right. I was at Edison both when we had the 1.3 gigawatt target for the state, Edison's portion was 580 megawatts, but within that in this particular solicitation that started in 2013 called the LCR RFO, Local Capacity Requirements RFO, in which the utility was looking to buy 2,000 megawatts of capacity because the nuclear plant went offline, the cooling units, old gas fire plants were going offline and needed a lot of capacity.

And so the California Public Utility Commission said in this particular solicitation, at least 50 megawatts has to

be storage. You can also look at demand response and energy efficiency and gas peakers and look at all of it, but at least 50 has to be storage. As it turned out, Edison ended up buying 251 megawatts of storage. It's because we went through the process of actually looking -- putting storage into every bid offer form, really going and contemplating how storage was going to play out at every part of the grid, and so these are the results.

I know the front is kind of small here, but to give you an idea of what we picked up in that solicitation, it was 36 megawatts of behind the meter thermal storage. So that's the HVAC type of storage, 100 megawatts that was mentioned earlier, so that's in front of the meter grid scale, and then 135 megawatts of behind the meter lithium ion batteries.

So that's a lot of those commercial building deployments that can be aggregated to provide capacity that the utility can really utilize. So this was

such a great lesson learned from the utility perspective, like when we did the hard thinking, how do we include storage in the evaluation? That's, really, the first time storage was valued against all different types of resources for capacity and it was an economical proposal even when this solicitation happened a few years ago. And obviously, everyone is talking about how much prices are coming down and continue to come down.

How does this fit into REV and the Clean Energy Standard? REV is all about making a systematic change for clean, affordable, and resilient power. I don't think there's anything that embodies that more than storage. Obviously, we've heard a lot about the clean components of storage, how it helps integrate renewables, how it improves the system efficiency.

I thought Doug did a great job of talking about reduction and line loss, as well as having generators run more

efficiently if you have storage on the system, and that plays into affordability, obviously. We've heard a lot of examples of where storage is the economical choice for the customer, regardless of renewables, regardless of anything else.

And finally, obviously, resiliency. The more distributing you could have and the more resilient grid you're having and we see that in a lot of projects through New York Best.

And I do want to point out that the DPS did say that storage should be included in system planning as part of its DPS guidance, I think last fall it was. So I think the DPS has acknowledged that storage needs to be incorporated into all its specific (inaudible), but I don't think we've gotten there quite yet.

And so this next slide, I want to hit on what are the barriers to storage? There are a lot of barriers, including financeability but I think at its core, the issue is that storage is not included in

every utility process.

Right now, there are great demonstration projects going on, but when you put together a demonstration, you have your R&B teams going out there looking at one project. You don't have every group in your company looking at it.

What we really need is every guy in the procurement group who's writing RFPs and making bid offer forms to be considering, how do I put storage in here? You need the guy in the operations room in the middle of the night knowing how he's going to use storage. We need every distribution planner to think when they're proposing a new solution is storage, the right option here.

And I think you really get there from a storage procurements target. That's what we saw in California was -- when I was at Edison, all of the sudden, we're, like, oh, this is real. We have to do this hard thinking and develop new processes, essentially, that contemplate

energy storage.

So for that reason and, basically, in order to get to that place where storage is incorporated in every process, a storage procurement target puts you in the right direction. You should have a storage procurement target forever. You know, eventually, you should be technology agnostic and use the technology that fits the needs of the systems. But to get over this hump of storage being such a different resource, not being incorporated in our processes right now, that's what a storage procurement target is really useful for.

And I will point to the fact that there can be cost effectiveness provisions built in. We're very confident that storage is a cost effective resource, but I know there's a lot of concerns. We don't want to jump the gun and buy a lot when it's not cost effective.

Well, California had a cost effectiveness provision in its target, and

two and a half years later and 500 megawatts procured, no utility has said we're not buying or deferring our targets because of cost effectiveness.

So, hopefully, that gives folks some comfort that we can buy these projects, we just need to set our mind to it and develop this systematic change within utilities and the general energy planning process to incorporate energy storage.

So I guess to round it out, I heard four things. I wanted to have three but I couldn't leave out the fourth. But I heard from a lot of my colleagues today about how do we push the energy storage market?

First, I think the message was loud and clear that storage is here and economical. I think that's really important for everyone to understand because there's been too much talk over the last few years that it's too expensive now. Certainly, the price will keep coming down, but the price is down enough

to be buying it now.

Secondly, I thought a few people had a good point about long-term certainty in contracts. You're not going to build a storage project, a pretty substantial capital investment with a one- to three-year capacity price guarantee. You really need some longer term contracts in order to get those projects developed.

The third point is co-location with renewables. There's absolutely benefits to co-locating with renewables in some places, but that is not necessary in order to still have storage that supports renewables. Just, especially in load dense areas, you can have a more effective resource that's both incorporating system renewables while also providing other values that are more local.

And finally, I think that pretty much everyone up here has said that we need a substantial storage procurement target. And some folks have talked about that with the idea of a FLEC, Flexible Energy

Credit, but essentially, that's the same thing. You're setting a goal of energy storage. We need to have a mission as a state to go buy that. And so we should have a discussion about what exactly is the right mechanism?

Personally having been through California's mandates, I think that was quite a good process. But regardless of how it shapes out, I really think that a storage target for the state is the right way to go.

So with that, I guess I'll turn it back over to Matt. Thank you.

MR. WALLACE: Thank you, Sarah.

Okay. So let's finish off the day with a final question-and-answer session. If audience members want to queue up to the podium.

While they're doing that -- actually, also, Rick, after you ask your question, would you mind maybe coming up here in case anyone had other questions for you? I know there was a few earlier and we kind

of cut them off.

MR. FIORAVANTI: Thank you. Rick Fioravanti.

Sarah, I really appreciate the way you ended it, because I think it was real rounded out, how we started this.

But that's my question for the entire panel: What should we focus on first? Because we talked about doing analysis to create that no-regrets system. We talked about trying to find ways to remove barriers. Unleashing Jin Jin to give her more opportunities to incorporate those, or just getting the cash and providing incentives.

What would you recommend New York do first and foremost to move this forward and accelerate this deployment of storage?

MR. STAKER: Well, I'll start. But I would say it's really economic certainty. What's the business case? What's the model? How are we going to shape that? Is it in the form of incentives? Rate structure design? Is it, you know, a

blend of the two? That's what I think is holding everybody back right now, we don't have the financial structure, be it for the value added or the market structure that we think is going to evolve out of REC.

MR. WEINER: I'll accept that point. But then I hear Sarah and others talking about the cost effectiveness, today, of storage. So how do we reconcile? Is it segmented? Is it certain applications where there's a cost effective application and others where there may well be a need for some incentives?

MR. JACKSON: That's an excellent question, and I think I can point you back to the presentation that I did, in that there's incentives that cross these three stakeholder groups. And -- I'm sorry, there's benefit that crosses the three stakeholder groups and there's risks associated with each one of those stakeholder groups. And I think they both should be allocated fairly and equitably.

And I think it's cost effective right now without some of these benefits, it's going to be -- to get it done at a large scale, every benefiting group needs (inaudible) to the solution. And I'd start with opportunities for utilities to be able to benefit from storage at a market based earnings way.

MR. WEINER: I don't want to take the time now, but I'd be interested to know what that would look like.

MS. VAN CLEVE: I mean, I guess to add to that, there are cost effective uses, but it's a matter of being able to capture all the value streams that are there. So you put in a storage product at a customer site. Yes, it reduces their demand charge, helps them with time of use rate shifts. However, unless there's a utility signal saying, look, there's also this utility value to having that storage dispatched at these certain times, sort of having those opportunities to combine the values is really what we need.

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MR. WEINER: And I think that in New York, there are a number of initiatives that are looking at those different opportunities to create value, that from a policy point of view would stack the value.

One of the things we're hoping for in which Con Ed is one, that utilities use a demonstration project as an opportunity to demonstrate how those values will be brought together, so that maybe some other utilities who were listening will think of some opportunities.

But the possibilities, if not infinite, are varied and it becomes three and four dimensional. So without promising success, it's very helpful if the industry comes along and says, Here's what we need. And if it's to combine the value streams in a way that becomes financeable and bankable, that's fine.

So I take all the messages. I get it, we get it, storage is important, storage is valuable, storage needs a

market design. Left to my on devices, I can design one thing, Raj can design something else, we can put it out for comment, but you all deal with this every day.

And when I was on your side of the table, I used to look for opportunities to say, if you will do the following, I can produce the following. So with no guarantees, I want to invite you to answer that question.

MR. GONZALEZ: So to add a little to more color that question and what Sarah has mentioned. Probably, I would say, that the approach is going to be different by segment, and so maybe just relating to how California procurement targets were filled out, I would suggest that -- so first of all, there were three categories: Transmission connected storage, distribution connected, and customer sided.

The distribution connected and transmission connected is a competitive

solicitation open to discuss cost effectiveness measures and we found great opportunities there.

From the customer sided targets, what maybe you don't see together is that the role that SJEP is playing into that. So for commercial sided and some of the residential, the SJEP did play a role. So I'll just offer that as one perspective, how things played out in California.

And the other thing that's super important is what Sarah mentioned, some of the things that did trigger that cost effectiveness, too, is the actual needs that was experienced in California, as well, that really gives you some clarity about what you are really shooting at. And that allows you to get to that cost effectiveness threshold.

So having the visibility from the utility and the transparency about what is needed, will get us there.

MR. BROOKS: If I can. To answer your question, as well, and to answer the

question before. And if I understand your question right -- if I understand the way you framed the question, it was how do we reconcile the idea that we need to deal with cost effectiveness and that it's cost effective, which I consider to be the value, verses the fact that you all seem to be moaning about the idea that you can't get financeable contracts.

They're not necessarily the same thing, so I'm not sure there's a reconciliation that needs to happen. I heard the question if this is so great, then how come it's not just happening on its own? And this is a challenge that has faced renewables and other new technologies over and over again.

So I wrestle with the idea that that's something that needs to be reconciled as well as something that needs to be identified and addressed.

MR. WEINER: Fair enough. I'll take your point and I'll change the word to clarify, because I think that in a public

policy discussion, people go towards one of those two extremes, and that was not my intent. My intent was to get clarity on what's missing. And I think, as Carlos pointed out, what's missing varied by segment. And a particular interest right now is how can the CES, and not the 50 by 30 goal, but the CES itself and the mechanisms that produce RECs and is going to provide the modernization of those values, what role does storage have?

Now, whatever the answer is, there are at least a dozen other opportunities that have been identified today throughout the state to identify and monetize that value and bring that value into the New York system.

But one -- by asking about the CES as I mentioned some people said, well, why don't you have a tier for storage, since you have a tier for Class 1 renewables? How about bonus RECs? All those ideas are legitimate, but they all come with other implementation problems. For example, if

a REC represents one megawatt hour of generation, then all of the sudden REC, doesn't represent that anymore.

Now, it may be that there are other incentives that are needed in order to allow storage to provide its value to the New York system as a whole and help the state achieve its renewable goals and all the other goals that are available in REV, but that don't mean it's a REC or bonus REC. And I really want to take a minute to explore that, again, without going to say it's one or the other, it's not binary.

MR. BROOKS: And I think that goes back to the question that was originally posed, which is what would we propose that you do? And bringing it back to the context of this technical workshop, which is within the CES proceeding, which is moving toward some kind of action which was stated in June, I don't know if it's still on that timeline.

I can see at least two things that

might be done within the context of this proceeding. The first would be to do some kind of assessment to say what is the -- if all of us have essentially said, which I think we have, storage enhances the carrying capacity of the grid to take more renewables on board. Well, that shouldn't be a particularly difficult number to at least provide some bands around. How much extra capacity can be put on the grid if storage is put in place?

In the morning, we heard that two gigawatts would be able to shave off a third of the peak hours of those top hundred hours. And if I did the numbers right, that's $4- to $500 million right there and it shouldn't be that hard to come up with a similar assessment of how many more extra megawatts can we put on the grid at the bulk level, distribution level, residential level?

And so I would propose that one thing that could happen in the proceeding is to come up with that kind of potential, and

the second thing I would propose --

MR. ADDEPALLI: I just want to clarify that number has been thrown around a few times, that hundred hours. Those estimated savings are gross savings, not net savings.

MR. BROOKS: Fair enough. It's still a very big number, but I take your point.

And I would say it's a number that overwhelms the cost, the value, very clearly, overwhelms the cost, 'cause it wouldn't take $500 million to build that amount of storage and put it in the system, not from the estimates that I've seen.

And so the second thing that I was going to say that could happen within this proceeding is, if not to define a tier or a specific instrument, at least to define a process on whether it's -- the staff, I think, would need to make the determination of what can go into the next order to come out in this proceeding. But presumably that could, at least, identify

we're encouraging the Commission or establishing a process by which we're going to explore these things and determine whether I fully recognize that a REC, if it suddenly becomes something else, maybe doesn't become fungible across state lines and that would certainly be a detriment to the market, so maybe that's not the avenue. Maybe a tier is not the avenue. But there must be some creative solutions and if they can't be done within this proceeding, then, at least, it can define what the pathway is to start that conversation.

So those are the two things that I would say, what's the potential and what's the pathway?

MR. WEINER: And I have to apologize. I have to step out and take a call that came up.

So I want to say thank you to all of you. This has been very informative, very helpful, and who knows? Maybe you'll see something in the order.

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(Laughter.)

MS. HUANG: I just want to add to that question. For us, we're trying more demo projects and, you know, I think one of the speakers mentioned earlier that -- it was Green Charge, that behind the meter ownership seems to be a good model and should be a leading model, but we think we should not take ownership by the utility off the table, because we need to look at all revenue sources and how we can have these reliability assets and maintaining the cost down for customers.

MR. WEINER: That's certainly a theme of this season.

MR. FIORAVANTI: Well, I mean, we can finish up. I appreciate that.

You know, one of the things that's going to make when we start looking at how to get to this target number, I think cost effectiveness has been done. I did it with, you know, for the California study, and my colleague (inaudible) did it for the California study. So I understand the

point if we may want to take it to the next level, dive more into the details to get more, you know, not just cost effectiveness but what it's really going to take to get it done in New York. And leverage has been done in California as opposed to try to replicate.

So I appreciate how we get there. I think we do need to get to that target number. How we do that is something I think it's going to be left up to the folks in the room to help form.

Does this mean we're wrapping up?

MR. WALLACE: If people are into it, we can keep rolling. Next question.

MR. ROGUE: My name is Joshua Rogue from Vision Energy Storage. And with the words "rate design" and "tariff structure," an important leg of the stool seems to be the inclusion of a renewable resource. So whether that be PV or other, and the qualification for the 30 percent federal tax credits, that limits how you charge and discharge the battery, of what

electrons come from where.

So I just wonder if the panel has given some thought towards a set of recommendations that includes how we're interacting with renewables, specifically towards leveraging that 30 percent tax credit, because it is important to offset some of the cap.

MR. STAKER: In our modelling, we just look at qualifications as far as where the IRS is today, that you have to have at least 75 percent of that energy that is stored from renewables. And that's easy to do, easy to track, easy to maintain. But the hope is that eventually storage will qualify for ITC benefit, as well, just storage won't. It should, I mean, this is an early market, we're in early adoption periods, so it needs help just like other technologies to get people comfortable to ensure financiers that the structure's there. They don't have the market metrics quite right.

When you look at the wholesale

market, there's costs for the supply, there's cost for congestion, line losses, that's the way the market's reconciled today. I think eventually we get there in a mode where if you think about the distribution system platform provider between the market settlement operation here within the distribution system and the way that we start to build value around load and load shaving and load management within the distribution grid, there's market that involves that. There's a lot of work to do to moving forward.

MR. CUTRIGHT: While the renewable part is great and it's extremely important, we shouldn't lose sight of some of the stuff that was pointed out earlier. If I'm misplacing an old peaker that was running for a couple hours at a very low load, emissions and the (inaudible) were pretty poor compared to if I was charging a battery with a combined cycle running near its optimal points.

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So it's not just a renewable integration where you're going to get a big emissions benefit from energy storage.

MR. GONZALEZ: I was just going to add, in response to the previous question, so we do follow the same -- there's minimum pressure to charge a battery from solar to ITC. I think there's probably room for clarification on setups where you're part charging from the grid. What's going to be the treatment? New York, in particular for them, eligibility, I think that there's some clarification that could help us, as well.

MR. ADDEPALLI: Just want to be a little more granular in the value streams that all you spoke about, different buckets of value stream, capacity, peak reduction, value filling, or energy arbitrage values, or providing other ancillary services, or other value streams.

Given that there are different ones, is there one we should start with all in

focusing and putting our attention on getting the tariffs right or pricing right? Or should we tap all these streams at the same time? Which one of those four or does it matter or does it differ, depending on the application?

MR. STAKER: I'll take a stab at it. I think, first of all, we ought to look at some of the low hanging fruit, right. And so one of the challenges that we see that we've looked at from a distribution system optimization, is if you really look at Con Ed, service to provider, right where we're at down here, peak down here is from eleven o'clock to three o'clock. So the building that's two blocks over that has 100 KW storage system operating is going to shave a peak today at 10 a.m. outside of that window. So from the building's perspective, we're going to derive savings today for that reduction. We're going to add very little value to Con Ed and the distribution system because today it's from 11 to 3.

When we look in other areas and there's, basically, downtown, 11 to 3, some of the midtown stuff is, as well, mainly core commercial areas. When you start to get into a blended mix, it's basically 2 to 6, 4 to 8. And then when you get out to residential areas, it's 7 to 11.

So one of our arguments has been when you look at the way demand structures were based, and that's our key metric for earning behind the meter storage, and you look at the way the demand rates are built, I like to say the analog rates living in a digital world. And we have the argument for building an hourly rate that prices demand at an hourly capacity level that adds value to the distribution system. So that every day we're incentivized to reduce loading in these districts that are pretty common about having a peak loading period day in, day out. Some areas of electric heat may be a little distorted in the area but try to

tie the value of load reduction for the distribution company and do that through pricing. And that's why we've come up with a concept of hourly pricing for capacity. We do that on supply today.

All of our buildings we put on a day head index rate. We play the wholesale market, we buy off-peak, we time shift that energy and we drive savings every day from that perspective. I think it's very similar to just start optimizing distribution systems, and I'll start to provide some of that peaking release in those distribution networks, which will help reduce just overall wear and tear of that area.

MR. GONZALEZ: I'll add to that some color. I think we have evolved quite a bit along the line of project solicitations to address a particular project deferral and my sense is those are going to be productive opportunities. I think where we probably need to do more is where you look at if resources are

providing sort of average systems but not necessarily deferring one single product but do have benefits to the system in several ways. So, let's say, even reducing thermal loading on the entire system, there may be opportunities with the help from the utilities to articulate where that makes sense, and that could be implemented through tariffs. But, you know, of course, we do need the institutional knowledge and ability to articulate where that would make sense, but that would get us from the stickiness of just relying on individual solicitations one at a time.

MR. BROOKS: I was going to add a little to this. You know, because I agree with that and if the question is: Where should we start next? And again, this may be a little outside of the scope of the Clean Energy Standard, but certainly within REV, proceeding on the incentive of smart home rates, which are somewhat undefined at this point, but presumably

relates to discreet premise.

And I think one of the concepts that's being tested in the demonstration project, whether that's turned or not, is, essentially, the idea of a network portfolio rate, which, you know, you suggest might be implemented through tariffs, and I think that's something that isn't really defined anywhere in the language of proceedings right now. So how do you take a -- what we've all discussed, this ability to coordinate these assets that sit out in the field, whether they're on the utility side of the meter or the customer side of the meter and have them coordinate to provide these great services. So developing some kind of pathway to understanding what those kind of rates would be, I think would be a very fruitful place to go next.

MR. FIORAVANTI: I was going to add another question at the risk of breaking this up, 'cause I know we're at 2:30. But Doug's needs are different from AES's

needs, are different from Jin Jin's needs, because one is in the customer side, one is in the distribution side, one is wholesale. And when you start talking about how to bucketize (sic) these, how to focus, are they all separate? Is there something common to all of them that will benefit everybody that invests in storage or do you really have to look at this as a wholesale, distribution, and end use process and try to come up with something for each one of these groups in order to really make an impact?

MS. HILLMAN: And I'll take a stab at answering that a little bit. I think you do have to look at them separately, in a total package. But there's one resounding thing that's critical, and New York is a competitive market state. And that's part of what we have to deal with, also, it's a competitive market state. That's a reality that's different than California.

And so the reality is that all segments need stable, predictable

revenues. You have a capacity market in New York, but it's a six-month market. It fell 35 percent this year between last summer and this summer. So while yes, you can stack the wholesale revenue and the retail revenue and the ancillary revenue, they're not predictable revenues.

So for the technology, whether it's behind the meter or in front of the meter, it's no different than what the renewable developers are facing, which is some predictability over time. Which, you know, is recognized in the original clean energy, I guess, the LSR paper.

At that point, it was recognized and that's the basic fundamental thing that applies to everybody. How you actually bring that most economically may need to be looked at between the in front of the meter, large scale, behind the meter paired with solar verses behind the meter storage, there might be some nuances there.

But the general common theme is that

stable revenue, in order for the projects to make economic sense to the developer.

MS. HUANG: And I'll answer for us. I mean, as a utility, we're technology diagnostics. Our key focus is providing reliable systems to our customers while minimizing any increase in cost. And the discussion today is on battery storage and we do see benefits to this technology, especially when dealing with the increase in DERs, renewables, increase in extreme weather events, and longer peak periods and trying to defer cost and capital investments.

Right now, storage just seems to be the best solution, but as far as technology goes, whatever comes up that provides us those happy mediums, that's what we go with.

MR. WALLACE: So I have a question from the Internet here. So Greg Petrick of NYSERDA notes that a strong theme today is outdated low profiles and the need for better data to inform better modelling.

He notes the difficulty in obtaining customer data with NDAs and the sensitivity around the customer's data. And then asks the question, should the utilities be mandated to obtain accurate updated load profiles? And then notes, if the utilities don't do this, he sees a continuing void.

MR. STAKER: I think the challenge here in New York, there's what -- where's Jin Jin -- and there's 1,800 meters that are automated with profile data at about total population 3.3 million. So one of the challenges in New York is there's just not the information.

Now, in California, where they've got AMI systems deployed in SEP, PGE, Sand and Gas Electric, most of them municipals, the Green Button Data that works pretty good, but there just isn't the available information that people are looking for and that's a challenge.

So you have to get kind of clever about how you go off the modelling effects

in different buildings. The good news is lots of buildings are very similar in shape, so you can scale appropriately and take a pretty good guess on it, but that's one of the main issues of trying to build business cases in the New York market.

MR. BROOKS: I would just pile on, I mean, there's a historic antipathy in the state to smart meters that I think has prevented that from being put out in the field, but I think that's changing. And certainly, there are many other groups who have highlighted this same concern around how do you actually get access?

So I know Mission Data, for example, has been very active within the REV proceeding directly around exactly these questions. Customers should have access to their own information, which should be part of basic service, and I think the most recent order coming out has actually highlighted a lot of those. And so there's language in the REV proceeding to make sure that that information is

available to customers, at least at a basic level.

There's probably a little bit of wiggle room that needs to get more precise about what exactly that means, but, hopefully, that, at least, establishes a policy foundation to move forward with smart metering and other kinds of load profiling information so that the policies are in place before the equipment goes in field. At that point of view, New York may have an advantage over many other states that have primarily done it the other way. Just put the meters out in the field and we'll figure out the policy environment later. And it's probably going to be more challenging in the other states to get that kind of profile information, 'cause they didn't do it upfront.

MR. WALLACE: So I don't see -- did you want to add something?

MS. HUANG: Only that we were just recently approved for AMI and we will be

deploying AMI in our service territory shortly. As far as how that data will be used or shared, that's something to be determined, but hopefully, that will provide additional information for our customers and market partners.

MR. STAKER: And in Con Ed's defense for the meters, they do have that data. The system they have in place is very good. Their response time is wonderful. All you have to do is get authorization from the end user and you'll get a file the next day. So what information is out there is available, you just need to get authorization.

MR. WALLACE: All right. So if there's no other questions.

AUDIENCE MEMBER: This is a question for Sarah. Suppose I'm a homeowner and I want to decide whether or not I should buy a power wall. And my understanding, the power wall that you were talking about runs around $3,000 and then, of course, you're going to have to buy an inverter.

So I don't know how much they cost, but it's not insignificant. Or I could go down to a Home Depot, spend $949 and I'll buy $24 worth of gasoline, and instead of seven kilowatt hours from the power wall, I'll get 42, six times more.

And then I would look at the power wall and I'd ask myself, What would I use it for? Well, as a homeowner, I guess I'm most concerned if there's some kind of a station blackout or blackout rather, and there are a variety of different loads, different -- that you get in the house, very small ones, like your computers, which already has a battery in it. If you get it to medium loads, refrigerator around 1.5 kilowatt hours, clothes washer, 2.3. These, incidentally, are your numbers, and a dryer 2.3.

So if all of the sudden there's a blackout, I guess I should run out and do two washes and one dry and I'm done. I can't do anything big like if it's space heating electrically, that won't do it,

power is too small, or if it's in the heating season, it's far too small to do air conditioning.

So I'm confused as to why I should put in all that money for a power wall when I could go to Home Depot and get a bigger capability.

MS. VAN CLEVE: So you might not go for power walls but I'll tell you why some customers are. First, you do get some value if you are on a time of use rate, which -- can you hear me? In some states, there are residential time of use rates so customers will arbitrage those time of use rates.

And secondly, a lot of customers do want to self-consume their solar, there's not always the financial incentive in the utility bills to do that, but in some places, there are. And then there is backup power, and, of course, storage has a limited capacity. You can't run every load in your house indefinitely. So you hook the storage up to critical loads, and

you don't run your dryer in a blackout, you have it on your lights, freezer, Internet and your TV.

And third, in terms of the fact that the energy is finite, you can hook up the storage device with your solar. So if you're in a hurricane situation, your neighborhood is down for four days, you can constantly recharge your storage device with your solar if you need to do that in that scenario.

So those are the reasons that we're seeing customers deploy the power walls in their homes.

MR. FIORAVANTI: My father in upstate New Hampshire did what you described. And during a blackout he started up his system and he had it in his two-car garage and within 15 minutes, the CO monitor went off. He moved it outside into the driveway and within 45 minutes, the CO monitor went off in his house.

So space and for some folks, they don't have the ability to do that. There

are emissions that may prevent it from happening.

So, Sarah's right, in some cases solar storage combination is the only thing that (inaudible) the gas infrastructure and electricity infrastructure. You can still maintain critical loads indefinitely, so there are some advantages --

AUDIENCE MEMBER: For very small loads, you mean. If I'm in North Dakota and I have a station, if I have a blackout, I'm not interested in running a refrigerator, I just have to open the door.

So I think what I hear from that is yes, there's a slice of applications where the power wall itself might be useful, but at the same time, I read in the literature where utilities are rushed out and ordered at billion dollars one way or the other of power walls and my head spins 'cause I have no idea what they're going to do with it.

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MR. WALLACE: Thank you. I appreciate the comments. Okay. So let's adjourn.

Thank you all very much for coming. I'd like to give a huge thank you to all of our panelists, they have been really great --

(Applause.)

MR. WALLACE: -- to, really, understand. This is going to help us inform as we create the order for July for the CES, move the ball forward a little bit. So thank you all. Does anyone have any closing remarks?

MR. ADDEPALLI: Thank you, Matt, for putting this together.

MR. WALLACE: Take care everyone, thank you.

(Time noted: 2:47 p.m.)

C E R T I F I C A T E

STATE OF NEW YORK)
) ss.:
COUNTY OF QUEENS)

I, NICOLE ELLIS, a Notary Public for and within the State of New York, do hereby certify:

I reported the proceedings in the within-entitled matter, and that the within transcript is a true record of such proceedings.

I further certify that I am not related to any of the parties in this matter by blood or by marriage and that I am in no way interested in the outcome of this matter.

IN WITNESS WHEREOF, I have hereunto set my hand this 3rd day of June 2016.

_____

NICOLE ELLIS