

Exploring Opportunities for Energy Efficiency as a Revenue Stream in the Forward Capacity Markets November 15, 2012

Sargon de Jesus (SDJ): Good morning. My name is Sargon de Jesus. I work for ERG. We're a contractor to the U.S. Department of Energy. I want to thank you for joining us and welcome you to today's Better Buildings Neighborhood Program webinar on exploring opportunities for energy efficiency as a revenue stream in the forward capacity market. I'm going to quickly turn it over here to Subid Wagley for some introductory remarks, both logistic and content in nature. Subid?

Subid Wagley (SW): Great. Thanks Sargon. Hello everyone and good morning. My name is Subid Wagley and I work with the Better Buildings Neighborhood Program here at the Department of Energy's Office of Energy Efficiency and Renewable Energy. Thank you so much for joining us, and welcome to today's Better Buildings Neighborhood Program webinar, as Sargon mentioned, on exploring opportunities for energy efficiency as a revenue stream in the forward capacity market. As you know, the Better Buildings Neighborhood Program partners explore opportunities for program sustainability in the post-grant period. Some of you have expressed strong interest in learning about the possibilities for selling the energy efficiency program yourselves to the regional transmission organizations (in other words, RTOs).

In today's webinar we will highlight the two RTOs, one being Independent System Operator New England, also called ISO-New England, and PJM Interconnections (PJM). These RTOs operate the forward capacity market and the reliability pricing model, also known as the RPM, in all or parts of New England, which includes Connecticut through Rhode Island, Massachusetts, Vermont, New Hampshire, Maine, as well as some PJM territory—Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia (DC). This webinar will also try to address some definitions, criteria, pricing schedules, M&V monitoring and verification requirements, and an example or two of the programs bidding already into the forward capacity market.

We have framed today's webinar into two presentations from the industry experts, and then we'll have the question and answer session after the two presentations are done. With that, it is my pleasure to introduce you to our expert speakers for today's webinar, not in any particular order: Mr. Doug Hurley and Ms. Terri Esterly. Doug is a senior associate with Synapse Energy Economics. He assists his clients in navigating through the ISO and RTO market rules, especially regarding the participation of energy efficiency and distributed generation and wholesale capacity markets. His work includes representing the interests of consumer advocates, environmental and renewable resource clients at numerous ISO-New England and PJM stakeholder meetings. He's currently serving in his fourth year as the vice chair of the New England Power Pool Alternative Resources Sector (NE-Pool) and has spent six years in actively advising numerous clients participating in the forward capacity market with energy efficiency and distribution generation resources. Pertinent to know here with today's topics, he has testified before public utility commissions regarding their least-cost integrative resource plan and utility mergers and energy efficiency plan. He has a master's degree in electrical engineering from Cornell University.

Another speaker, Ms. Terri Esterly, is a senior lead engineer in the capacity market operations department of PJM Interconnection. She has worked at PJM for over 14 years and is currently responsible for implementing PJM's capacity markets rule changes and ensuring PJM is compliant with capacity-related tariff requirements. As a project team leader, she was responsible for the implementation of the reliability pricing model in 2007 and currently supports RPM auction efforts. She has extensive experience with respect to the obligation and capacity resource generation, demand resource, and energy efficiency resource processes in PJM. Prior to joining PJM, she was an account manager for PECO Energy Company in Philadelphia and an engineer for Newport News Shipbuilding in Arlington, Virginia. She earned a master's in mechanical engineering from Catholic University of America in Washington, DC and an MPH from Villanova University.

Before we get started, let's go over a few logistical items. Sargon, do you have a slide up for that? Thank you. First of all, all participants' call lines have been put on universal mute just to prevent background noise during the presentation. If you haven't done so already, and if you are using the telephone to join us, please enter your two- or three-digit audio PIN that you will see here. You can also find your audio PIN in the control panel box on the right-hand side of your screen. To enter it, press "pound," the two- or three-digit numbers, and "pound" again. We ask you to do that so that we can unmute your line if you have any questions during the question and answers period. If you're listening to the presentation through your computer speakers, you will not be able to ask any questions orally during the Q&A period. Today, questions will be addressed at the end of the presentation, so after Doug and Terri's presentations. During the Q&A session, you can virtually raise your hand by clicking the blue circle button with a hand in the control panel and we can unmute you and you can ask a question. You can also type in a question at any point during the webcast or webinar in your questions box in the control panel and we'll discuss those during the question and answer session.

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Lastly, today's webcast is being recorded, and the recording, along with today's presentations and all of the information that you see here, will be posted on the Better Buildings Neighborhood Program website soon. So without further delay, I'll turn it over to our first speaker, Doug Hurley. Doug?

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Doug Hurley (DH): Thank you Subid. Hold on one second, folks, while I get my screen up and running for you. There we go. Thank you everyone for joining us. I'm Doug Hurley from Synapse Energy Economics, and as Subid mentioned, I spent several years helping a number of clients participate in ISO-New England's forward capacity market with energy efficiency and distributed generation resources. So with that, I'm going to start walking through my slides for you. If you've never heard of Synapse Energy Economics before, we're a very small consulting firm based out of Cambridge, Massachusetts. The majority of our office does a number of studies and modeling on the electric industry for various consumer advocate and environmental clients. There's a team of three of us that spend most of our time representing consumer advocate, energy efficiency, renewable generation, and environmental

advocates in the New England Power Pool (NEPOOL) stakeholders process to some degree and PJM and NYISO as well.

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I'm going to be specifically speaking about ISO-New England, so I thought it would be good to throw up a quick slide on the region I'm going to be talking about. And of course, Terri has a similar slide in her presentation that will show you the PJM region so that as you hear my comments, you can know to which states this applies and then the same for her. So that's just a quick overview slide of ISO-New England and the regions that we serve.

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Since we're talking about energy efficiency and distributed generation in a capacity market, I thought it would be good to take a minute up front to talk about what a capacity market actually is. This is one of my favorite slides to use for this presentation. What you see on the slide here in front of you is the load being served. I happened to pick New England because that's the region that I had at hand, but it's a similar load shape for certainly any Northeast states and probably other areas in the country as well. And you can see, as we progress throughout a summer week, the load rises during the middle of the day and then falls at night, rises again during the middle of the day and falls at night. And that's a pretty typical load shape. For those who are paying very close attention, you'll notice that each of the humps on each day as it drops off at the middle of the day--there's a little tiny period there that flattens out for a moment before it drops off again. And what you're seeing there actually is the effect of millions of households and businesses turning on their lights as the sun sets. You pull up a load shape for any time of the year you can actually see this effect, and I think it's an interesting artifact. As you look at the load for the entire region you can see the exact time of the sunset and everyone turns their lights on all at once. So of course, the ISO has to meet that load with supply from generation, and effectively what this slide is trying to show you is an economic order. The ISO for New England and PJM and others as well, they stack up all the generation resources that they have available to meet that load in economic order. Typically, nuclear is the cheapest. Coal used to be the next cheapest, in our region anyway, and I think in other regions as well. Coal has actually moved up in the stack and is showing higher on this list. But then some renewable, some hydro, some natural gas, and at the very top, we have oil peaking. And the energy market takes care of, every single day, providing energy onto the system for the next day, and that's a pretty easy one to understand so I won't go into that one too completely.

But what we're concerned with here is, the vertical line there you see that I have labeled "capacity." The interesting piece here as you'll notice is that in this example, our oil units are very expensive to run, and they only run in a few hours every day. So if you were just to ask them to run for energy alone and that was it, it would be a very risky financial proposition for them to build an oil unit, put oil in their tank, and spend millions and millions of dollars to do all of that and then have an opportunity to recover that cost in only a few hours every year. And that's as you can imagine a very risky proposition. The only way it could make financial sense for them would be to allow the energy price to rise thousands, tens of thousands of dollars per megawatt-hour (MWh), because if we have a particularly mild summer, they

might not run at all during the entirety. So what both the generation owners and the load agreed to years ago was that it would make sense to set up a capacity market specifically designed around units like that, such that we would provide them a monthly reserve payment, if you will, that says, here's a certain amount of money you get every month and what we get in return is the promise that you will run and be available to run on those high load days. That's effectively what a capacity market is. It's the ability to provide load energy during high load hours. And that was the concept behind this in the first place, at least in my opinion. Lots of different people will argue about what the purpose of a capacity market is. That's my best way of explaining how they came about in the first place.

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So how is it that we actually procure capacity in New England? The rest of my slides are going to be specific to New England, so I want to make that very clear. In New England the forward capacity market is just that. It's a forward market. We procure capacity through an auction, three years in advance of a time period over which that capacity has to be delivered. So I put on a quick timeline here and I've done this specifically for the next time period. If you sit down today and all of a sudden decide, hey, I want to participate in this, what's the next one available to me? And that's FCA or "Forward Capacity Auction," which is for delivery, you can see on the slide, June 2017 through May of 2018. And you can see that there are a number of steps involved. I'm going to go through these steps in the future slides. This acts as a little bit of an agenda for future slides. In February of next year, you have to submit a show of interest form. A few months later, all existing resources that cleared in the prior auction have the opportunity to submit an existing resource qualification package. I'll talk a little bit about that when we get through. In June of next year, all new resources that had submitted that show of interest form back in February have to submit their own qualification package. At that point, the ISO gets a number of months to review your qualification package and decide whether or not they think that you have proven to them that you can deliver the number of megawatts (MWs) that you propose and that you can deliver it at the price that you propose. You get a qualification letter back from them that indicates their decision on that. Then in February of the following year, the actual auction itself occurs. At that point, you clear in the auction, you take on a capacity obligation, and you have a number of years in which to build your resource, specifically delivered on or before June of 2017 in this case. In between the time period of the auction and the delivery year, as you can see here, we have a number of annual reconfiguration auctions where you have a chance to true up your position in the capacity market. You can decide, well, I told you I could provide 10 MW or 50 MW but actually it's going to be a little bit less than that, so I can trade away that position. But we'll talk a little more about that as we go along.

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Let's talk about the resources that are eligible to participate in this whole process, in the qualification, in the auction and all that. Obviously, this entire market was designed primarily with generation in mind. Just to put some numbers on it: in New England, we procure roughly 33,000 MWs of capacity in every auction. It varies a little bit from year to year of course, but that's a rough number. Approximately 30,000 MWs of that comes from generation resources. So it's important to always remember if you were to start to participate in this market, that most of this is designed around generation resources.

Many of the rules don't make sense explicitly for energy efficiency or distributed generation, because it's designed around generation. Demand response and energy efficiency, distributed generation were sort of tacked on at the end of it, so keep that in mind as you try to figure out the market. Renewable generation can also participate, of course. We have ways in which we value energy output from wind resources, hydro resources, solar resources. And then lastly, the focus of our presentation today is on demand resources. And that includes both demand response and distributed generation and energy efficiency. I want to be very clear, as you can see down at the bottom of the slide, that any projects that you might want to submit at a forward capacity auction and later as you deliver on your obligation, you have to absolutely make sure that these projects are not also being reported on to another entity. To the extent that you are working with a local efficiency utility or a local distribution company that has their own energy efficiency programs, or a merchant entity of some kind, or a demand response provider, you have to absolutely make sure that the measures that you are reporting to the ISO are not also being reported by another entity. That's very important.

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Let's break down the demand resources in ISO-New England into a couple of different categories. One of them is active demand resources. These include both real-time demand response and real-time emergency generation. As the prior slide indicated, the key here is that these resources primarily do not run or are not activated until they are dispatched specifically by the ISO under certain conditions. That's the key variable with the active resources, is that they respond to a dispatch signal from the ISO-New England. Demand response is a reduction in load; emergency generation is when a customer starts up an on-site backup generator, usually run by diesel but could have other fuels as well. These resources are measured for their performance specifically during those hours when they're dispatched by the ISO-New England. The passive demand resources are the ones that are more applicable to today's presentation, so I'll spend a little more time on those. Those are broken up in New England into two different types: on-peak and seasonal peak. And you can see that I've put down on the slide the hours in which they are measured. So if you decide to yourself, okay, I'm going to go do a number of lighting measures, you have to figure out in advance, exactly how am I going to measure the demand reduction value of those lighting measures that I've done? Do I want to go and have an entity study for me the average reduction during all summer afternoons, and December and January from 5 to 7 pm, or would I rather choose to have them measure just during periods of high load? Note there that one of the key pieces about the seasonal peak resources, should you choose that, is that you don't know what those hours are in advance; you only know that they are hours where load is very high. And it's key to remember that you get to choose whether you want your resource to be on-peak or seasonal peak. That's not a choice that someone makes for you. You get to choose that.

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So let's step through the process that I laid out on the timeline slide earlier, now that we've gone through which resources are eligible. The first one that you submit is the show of interest form. It's a reasonably simple form that you submit up front. You have to submit a thousand dollar deposit that pays the ISO for the time that they spend reviewing yours. And you can withdraw this at any time. It's

kind of an up front, almost like an application, and you can withdraw later if you decide you want to. But you can see, you need to put in the project name, the commercial operation date (when you expect the measures to be installed), which type of demand resource you want to be. You have to estimate both your summer and winter demand reduction value. Later on, as we get to the prices and the potential revenue that you can get, it's important to note that the amount of energy reduction you're creating during these peak hours at the customer site—we use the term demand reduction value—the actual amount you're paid for in the capacity market is 8% higher than that. And that just accounts for the impact of the losses on the transmission distribution systems between generation source and the load. Just keep that in mind. You have to indicate to the ISO which load zone within New England your resource would be aggregated together with, and you need to aggregate resources to achieve at least 100 kilowatts (kW) of peak load reduction. Then you have to put in a project description, which measure type, the customer classes, whether that's commercial and industrial, residential, or a combination of the two of them. Then you have to indicate whether any one single facility will have measures installed such that the total production capacity is greater than or equal to a 5 MW capacity. If you have, then you kind of get into a different category. Some project contact information, and then market participant status. It's important to note that in order to participate in this, you have to go through the process of becoming a market participant, and there are fees involved with that. You effectively become a member—whether you choose to be an active member or not is up to you—but you do have to be a member to participate in this.

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A few months after you've submitted your show of interest form, you have to submit a new capacity qualification package. There are a number of elections you can make at that time. In New England, when you participate in an auction for the first time, you're a new resource, and new resources get the option to choose a first-year price for up to five years. If you happen to think that the market is going to clear and lower in price for the next five years, then you might want to choose five year so that you can get that higher price for five whole years. Or, if you just want price stability, you can choose that option. If you think for some reason that the clearing price for the next five years is going to go up year by year, you may want to choose a tighter time frame. That's up to you. You also have to elect some other things that are a little more difficult to explain so I'll leave them for later or for questions—whether you want to be rationed at the clearing price, which means you may or may not clear the entire amount of your offer, whether or not you want to bid below a particular threshold price, and if so, you have to provide a good amount of information to the ISO to prove that that is within the costs and benefits of your particular resource can justify that price, and whether your resource is a simple or a complicated type of resource. We can get into more of that detail later. Which indicates what type of critical path schedule you're going to submit to the ISO. I'll talk a little more about that later. And then there are forms to submit as well. Project description, which gives more information than the show of interest form did about the facilities that you plan to install measures at, measurement types, et cetera. You have to indicate to the ISO the source of funding. This is their chance to review whether or not they think that you'll actually get the funding that you believe you'll get in order to get these measures installed. They essentially want you to prove to them that, yes, we really can form these resources, and yes, we really

can build them. If you don't submit a sufficient source of funding plan, they don't think you can get the funding to do your end of the work and they won't qualify you to participate. It's important to note that if you do get qualified and you do participate in the auction then you clear—let's say you have a very aggressive project and you clear 100 MW, that's 100 MW of generation that they're not going to purchase in the auction. So they want to make darn sure that you can provide the 100 MW before they allow you to participate. Along those lines, you have to submit a customer acquisition plan, which is a bit like a marketing plan where a person says, here are the customers that I intend to go out and contact. And here's how I plan to do that marketing effort. And here's how I know that I can actually get these customers to agree and I can sign up with them. And along with that, there's a description that you need to submit of your staff and the persons on that team and their experience in the industry. You also have to submit a measurement and verification plan, which I'll detail in the upcoming slides, and any supporting M&V documents, which are studies that are usually done by an independent third party that indicate that these types of measures that you're going to go out and install provide savings over a year, over this type of lifetime of seven or ten or 25 years, coincidence factors of summer and winter peaks of certain values, which you can justify. If I were to do a commercial lighting project, for example, or if I were to replace a number of chillers on multifamily rooftops, this is the kind of savings that I would expect in this region. This is the coincidence factor I would expect.

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The M&V plan that you have to submit has a number of sections. I don't want to go through them all here, but just know that this manual—you can see here, it's called the M-MVDR, it's available on the ISO website—but you can see just a hint here of the various types of detail that it requires. One of the key ones to this is that, if you're going to install measures across a wide number of facilities, they don't expect you to go out and meter or verify each individual installation. You have to go out and sample them. But you will need to meet some statistical precision and accuracy requirements.

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So assuming you've submitted all those forms and you've qualified successfully, you get to participate in the auction. When you do actually participate in the auction, it's important to know that this is your final action in which you're actually accepting the capacity obligation. Up until the auction, you can feel free to just withdraw your project if you've decided by that time, you know what, I don't want to participate. You can also pull out during the auction itself, and in ISO-New England, the way they run the auction is they do it as a semi-clock auction. They start at a high price. They say: Who wants to provide capacity at \$15 a kilowatt-hour? That's a very high price, and a lot of people will say yes to that. So we get a lot more capacity than we usually get. In the past year, we had 39,000 MW of capacity offering to provide at \$15. That's more than we need, so we drop the price. Okay, who's willing to take on the obligation for \$10? And a few people will drop out. You just start dropping the price and dropping the price, until you get to a point where you hopefully get 33,000 MWs of capacity that are willing to provide at whatever price you give them. You can exit the auction at any price. Once you've exited the auction, you don't have an obligation anymore. You've done all the qualification work but you don't take on the obligation, so you don't have to provide anything after that. It usually takes two days to actually run through the

auction itself. And it's important to know that once you've cleared the auction, the ISO comes to you with a contract to actually provide that capacity in the coming year at the clearing price, so if you can't, then you need to cover that or there are some penalties involved.

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One of the things to consider: You are going to be asked to put up financial assurance once you've qualified of \$2 per kilowatt (kW). If you withdraw your project or if you don't clear the auction, that money is returned to you, but you do have to put it up. Once you've cleared in that auction, you actually have to put up another \$3 per kW that you've actually cleared. So if you qualify 50 MW, then you decide to only clear 10 MW, you just have to put up the \$3 per kilowatt for the 10 MW. \$2 per kilowatt on the extra is returned to you. Those two numbers, as you can see, add up to roughly \$5—it changes year by year, but that's the range that it's been in in the past six, seven auctions. And then you have to provide that amount twice more, a year after the auction, then one more year later. All of that money is returned to you when you can demonstrate to the ISO that you've installed all of the, in my example, 10 MW that cleared in the auction. That money is returned. As I said earlier, you have a couple chances in between the FCA, the primary auction, and the delivery year, to actually shed some of your obligation if you need to. There are also a number of times that you can enter a bilateral contract with one other entity if you prefer to do it that way. If you can't deliver that resource in its entirety, then you actually lose that financial assurance. They give you a two-year period in which you can cover your obligation, and you have some extra time, but if you can't deliver by that time, you lose that financial assurance. So if you can't perform, there's a penalty there. And then in future years, after you've provided the resource in the first year, you have to go out and manage that.

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I want to take this moment to say, once you clear in the auction, you build the resource, you're not done—you have to send to the ISO quarterly reports indicating to them, here's the progress I've obtained in meeting my obligation. If they're not thrilled with the progress that you're reporting that means that your progress is too slow. They have the option to put you on monthly reporting. They can call you on a regular basis and say, hey, I see you haven't signed up enough customers yet. What are you doing to assure us that you really will deliver on this obligation? If you can't prove to them that you will deliver it, and if you haven't covered it by yourself, they will forcibly put you into that last reconfiguration auction. They will put you in that reconfiguration auction at the starting price, so it's important to know that there is a risk. Let's take the example of the first auction. You cleared in the auction for \$4.50 but you couldn't deliver it and you didn't cover your obligation. They put you in the reconfiguration auction and I believe the starting price in that was somewhere around \$15. So in that situation, you would be getting paid \$4.50 but you would have to pay back \$15. You would be losing money. That's not the way that it turned out. It turned out that the reconfiguration auction price is low, but that is a risk that you have to understand. So once you've actually delivered the resource, there are monthly reports to the ISO. Every month you have to report how many MW you're actually delivering in that month. Every year, you have to submit an annual M&V certification from an independent third party. And you're subject to audits from the ISO-New England staff on the studies that you've provided

that prove the savings per year that you are providing to them, that prove that you're handling measures that have expired because they've reached the end of their lifetime, and other items. And then each year, you have to participate in the existing capacity qualification process to some degree. At some point, once your resource is not providing savings anymore, you have to actually exit the market.

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The last point here was, the ISO wants to make sure that every entity participating in their markets is a financially viable one and is fully aware of the obligations of participating in the market. So there are a number of minimum eligibility criteria that you have to meet at least once per year. And that process is also around, like I said, officer certificates saying that you are a financially viable company. Just to let you know how much energy efficiency has cleared in our market, so far we had a big jump in the first year, and then each year thereafter there have been roughly 200 MW that have cleared from all six New England states. The large majority of these are from state funded programs.

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The prices that we've seen in the first six auctions—the seventh auction will be happening in February—you can see I put in a seventh auction with an estimated price of \$3.15, and the reason I can say that with fair certainty is because we've negotiated \$3.15 as the floor price. And the prices that you see here are specifically the administrative floor price that we've had at every auction so far. So that's why they clear at that price. We have excess capacity on the system right now. If you have excess capacity you expect the price to fall all the way to the floor price if it exists, and it does. So, to the price that we've had so far, you can see that they're in dollars per kW per month. Depending on how many MW you think you might be able to provide, you can do your own math on the monthly or annual revenue. We do get paid in New England for the entire life of the measure. Let's say you only did commercial lighting projects and your studies indicate that those can provide savings for seven years, you would get paid for seven years. And the eighth year you would remove your resource from the market, and you wouldn't get paid anything for that. If you did lots of refrigeration or insulation and air sealing projects, the measure might be 15 or 25 years, depending on what your studies can demonstrate. You can see that for FCA-8 I have put in a rough estimate of a dollar. That's because the market rules have changed on us. There's no more floor price, or at least what's proposed at the FERC at the moment is a compliance filing that said no more floor price, and there are some tweaks in the market rules that describe it to people who are interested in the Q&A session that would allow existing resources to get out of the market at a dollar. We expect the price to clear somewhere—we expect the price to drop a fair bit in the next year.

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I'm not going to spend a lot of time talking about RPM prices because I believe Terri has some slides on that, but I figured I'd throw this in. Depending on where you are located in the PJM region, your prices have been moving around a bit., Could be high, could be low. I'll let her explain that more. One other thing to note—I'm sure Terri will indicate—the units that New England uses and PJM uses are different. Theirs are in dollars per MW-day, ours are in dollars per kW-hour.

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So a couple of quick takeaways that I think are important for folks who are considering this is it is absolutely critical to think like a market participant here. You're taking on a risk, you're signing a contract, you're doing that many years in advance. There are potential rewards, certainly, but there are also financial risks. And there's an ongoing process that you have to manage, reporting to the ISO on a regular basis. And you're participating in a market that has a supply and demand, so like any other market that has supply and demand, prices can go up and down year by year entirely out of your control and you have to be willing to manage that. If you're comfortable with the M&V that is used by many of the state reporting processes, it's important to understand the unique thing about ISO-New England process is that it's different and, I would argue, more stringent. They're not worried so much about your benefits-cost ratio as the state programs are. They're worried about the number of MW you can provide. There's also this issue of statistical accuracy of sampling that's very important. And there's an annual certification process. The last thing that I want to mention, that I think is a note on one of my prior slides, is that the market rules for the forward capacity market have changed every year since FCA-3. They're proposed to change again for FCA-8—I believe those changes will take effect. We are currently debating whether or not to change them again further for FCA-9, and I think it's pretty likely that we will. And I expect further changes in FCA-10. So as a market participant, you have to be willing to understand that these market rules are going to change on a pretty regular basis, and you have to be willing to accept that.

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With that, that's my contact information and I'll turn it back over to Subid or Sargon and then to Terri, and I look forward to your questions. Thank you.

SW: Thanks Doug. Why don't we have Terri's slides up, Sargon, and I believe you're navigating through her slides, correct?

SDJ: That's right. I'm pulling them up now.

SW: Okay, great. And Terri?

Terri Esterly (TE): Good morning everyone. I'm going to cover the energy efficiency in the PJM capacity market.

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Essentially, PJM Interconnection is responsible for coordinating the movement of wholesale electricity in all or part of 13 states and the District of Columbia. We are a regional transmission organization and are responsible for coordinating and directing the operation of the transmission grid, administering the competitive wholesale electricity market. So we're a day-ahead real-time energy market, ancillary services market, and the capacity market, which is the scope of our presentation today. We're responsible for planning transmission improvements to maintain grid reliability and relieve congestion. The map on the left shows the different transmission zones which encompass the PJM region.

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Essentially, there's a need for adequate resources. So that PJM can ensure that we are reliably operating the grids, we need to ensure that the demand for electricity can be met at all times. So we have this capacity product, which essentially represents a commitment of generation and demand side resources to ensure that the demand for electricity can be met. A load-serving entity, which would be the utilities or other electricity suppliers, they are required to have the resources to meet their customers' demand plus a reserve amount. And an LSE can meet those requirements with either capacity resources that they own, or with capacity that they may have purchased bilaterally from another supplier under contract or with capacity that is obtained through PJM's capacity market.

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Our market is known as the reliability pricing model, and we are procuring capacity resources for future LSE requirements. We're looking out about three years into the future. We're providing for the pricing signals which are locational in nature, so they encourage retention of existing resources and development of new resources. We're trying to get those resources where we need them, so we have forward pricing signals which are locational in nature that help us to ensure that we are getting those resources developed where we need them. There is a series of auctions that we have for a delivery year in the future. The majority of capacity that we procure is done in the first auction that is conducted for the delivery year, which is known as the base residual auction.

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This slide shows you our RPM structure, essentially. We have the base residual auction which is conducted in May three years prior to our delivery year. Our delivery year runs from June 1st through May 31st, and we will do base residual auctions three years in advance. And then we have a series of scheduled incremental auctions that are scheduled as we move closer to the delivery year. Those incremental auctions allow for suppliers that have made a commitment in the base residual auction that they know that they're not going to be able to deliver on that commitment for the delivery year, they are able to go out and submit buy bids in incremental auctions to try to acquire replacement capacity. PJM also can submit buy bids and sell offers in the incremental auctions which allows us to either procure additional capacity on behalf of the load serving entities or release capacity. We do that if there are either increases or decreases in our reliability requirement due to a change in the peak load forecast. Those are opportunities for PJM to either procure additional capacity or release capacity. There also is an opportunity for us to hold a conditional incremental auction, and that's only held if we need to procure additional capacity in an LDA to address any kind of reliability problem that may be caused by a significant transmission line delay.

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We consider capacity resources in RPM as generation resources, demand resources, energy efficiency resources, and qualifying transmission upgrades. The demand side resources are the demand resources in our energy efficiency resources. The demand resources are essentially those resources that are

reducing load in response to a PJM initiated load management event. They are batch whole resources, in contrast to our energy efficiency resources which are not batched whole. And I'm going to focus my conversation on just the energy efficiency resources.

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An energy efficiency installation, in order to participate in PJM's capacity market, has to meet the PJM definition of energy efficiency, and it's defined in our tariff. It has to be the installation of a more efficient device or equipment or the implementation of a more efficient process which would exceed building code, appliance standards, or any other relevant standards at the time of installation as known at the time of the commitment. So, you have to have an installation that actually exceeds the standards to be able to participate. It has to be designed to achieve a continuous reduction in electric demand. It has to be a reduction in demand at an end-use customer's retail site. It couldn't be a reduction in demand that's actually on either the transmission or just the distribution system. It has to be a reduction in demand at a retail site. It would have to be something that is achieving this demand reduction on more of a permanent basis, so it wouldn't be something that would be a demand reduction that would be achieved just due to a change in customer behavior, such as switching off devices or loads. That reduction in demand, we would want to make sure that it's not also reflected in any peak load forecasts that were prepared for that particular delivery year. We determine the value of our installations based on its value during our defined EE performance hours, so we're looking for the demand reduction during PJM's defined EE performance hours. The installation has to be fully implemented at all times during the delivery year, which means that there would not have to be any requirement for it to be a dispatch or have any kind of operator intervention. If it was dispatchable, then we would consider it as a demand resource, but wouldn't be participating as an energy efficiency resource.

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I've given some examples of some EE installations that would meet PJM's definition of energy efficiency and those that would not. Any kind of end-use customer installation that exceeds this standard, which would be examples such as retrofitting devices such as lighting upgrades, refrigerator replacements, air conditioning upgrades, motor replacements, variable frequency drives... those would be some examples of some EE installations. Building weatherization is another, along with any kind of process improvements that provide demand reduction during the EE performance hours. Those would also be considered meeting PJM's definition of EE. Those that would not meet our definition would be things like removing devices, like de-lamping, that would not be eligible. Reducing load by changing your behaviors, switching off lights, that would not be eligible. Adding generation, back-up generation, or solar or wind or co-generation at the retail site, that would not be eligible. Or switching equipment or a process from electric to gas, that does not meet our definition. As I said before, the installations have to be done at an end-use customer site. Any kind of measures that are taken at the transmission or distribution level are not eligible to participate.

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Some of the eligibility criteria, just to run through, which I've mentioned before, is essentially you have to meet that definition of energy efficiency that is provided in our tariff. The installation would have to be scheduled to be complete prior to the delivery year. It couldn't be reflected in the peak load forecast that was posted for the BRA for the delivery year which you're initially offering. It would have to exceed those relevant standards at the time of the installation, known at the time of the commitment, and it has to achieve that load reduction during our defined EE hours. It cannot be dispatchable.

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An EE resource is defined and essentially modeled in RPM as EE projects or portion of projects in a zone that represents installations during the defined periods of time from June 1st to May 31st. So it's important to remember how we model EE resources. It has to be done by installation period and by zone. And there's a minimum demand reduction value of 0.1 MW that is required for an EE resource for it to participate in an RPM auction. So if someone is trying to aggregate EE installations across a zone and across an installation period, the aggregation must be at least equal to 0.1 MW in order to participate. Only a PJM member may offer an EE resource into an auction, so membership is required. So you might want to consider whether or not it is cost-effective for you to become a PJM member and take on some of the obligations as a member. As opposed to becoming a PJM member you may want to contract with another party who is a PJM member who would offer that EE installation into the market for you.

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This slide gives you a list of the installation periods and the delivery years that that installation period is eligible to participate. For example, if you have an EE installation that took place during the June 2009 through May 2010 installation period, it would have been eligible for the 11/12, 12/13, and 13/14 delivery years. And the only remaining auction opportunities for that installation would be the 13/14 third incremental auction, which is scheduled to be held in February of 2013. This chart can give you an idea based on when your EE installation was completed and installed, what delivery years it would be eligible to participate in, and which auction opportunities are still remaining that you could participate in. The EE resources are only eligible to receive capacity market revenues for up to four consecutive delivery years, so we don't allow participation for the life of the measure. PJM only allows participation for up to four consecutive delivery years.

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Some of the EE resource requirements: an EE provider would be responsible for submitting a measurement and verification plan prior to the RPM auction. They would have to establish credit with our credit department prior to the auction. Submitting a post-installation M&V report prior to the delivery year that that EE resource was committed. And you would have to be willing to permit a post-installation M&V audit by PJM or an independent third party.

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With regard to measurement and verification, all our measurement and verification requirements are covered in a PJM manual that's posted on our website. It's manual 18B. Essentially with the measurement and verification plan, you are telling us the methods and techniques that you're going to use to determine and verify the nominated EE value of the EE resource. So you're essentially verifying the nominated UCAP value of that EE resource. What is the demand reduction value that that EE resource is going to provide during those EE performance hours? You will be describing those methods and techniques that you're going to be using to validate what the nominated EE value is. An initial measurement and verification plan is required to be submitted no later than 30 days prior to the RPM auction in which the EE resource is initially offered. Then there's a requirement to submit updated plans no later than 30 days prior to the next RPM auction in which you intend to offer that EE resource. PJM reviews those plans, and we would approve the nominated value that the EE resource provider would be allowed to offer into the RPM auction. With the post-installation M&V report, you are giving us the results of your actual measurement and verification activities prior to every delivery year that that EE resource is committed. That post-installation M&V report has to be submitted no later than 15 business days prior to each delivery year that that resource is committed, and PJM would review those post-installation reports and determine and approve the final nominated EE value for that delivery year.

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I discussed what the nominated EE value of an EE resource is. It's essentially that average expected demand reduction during those EE performance hours. Our hours are between the hour ending 15:00 EPT and the hour ending 18:00 EPT during all days from June through August inclusive that is not a weekend or a recognized holiday. The nominated EE value is essentially considered the ICAP value, and it equates to what the ICAP value is of a generation resource. In our capacity market, the common terminology we use is either ICAP, installed capacity, or unforced capacity. All our auctions we clear are done on unforced capacity terms, so you need to know how to translate your ICAP value of your EE resource into an unforced capacity.

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Essentially the unforced capacity value of an EE resource would be calculating this nominated EE value and multiplying that by what we call a DR factor, a demand resource factor, and multiplying that by a forecast pool requirement. The DR factor and the forecast pool requirement are posted prior to each RPM auction. And then, at the third incremental auction, the value that is posted for the DR factor is forecast for requirement at the time of the third incremental auction is the final DR factor or forecast for requirement that is used for the actual delivery year. The DR factor is produced by our planning department and is used to determine what the reliability benefit is of the demand resource product. The forecast pool requirement is just our installed reserve margin, which is approximately 15 percent, and it's just the installed reserve margin but expressed in what we call the unforced terms. So if we had a nominated EE value for an EE resource that was 100 MW, once you plug the DR factor and the forecast pool requirement that is applicable to the auction, that EE resource would have a value of, in this example, 103.4 MW.

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During the actual delivery year we measure what we call commitment compliance. We determine whether or not you have enough UCAP value on your resource to meet all your UCAP commitment that you made through RPM auctions for that delivery year. So if the final UCAP value of that EE resource is less than the UCAP that you committed in RPM auctions, a daily capacity resource deficiency charge would be assessed for the shortfall, unless you did acquire replacement capacity. If an audit was conducted during the delivery year and, as a result of the audit, we find a UCAP value for your resource that's less than the UCAP value that you supported by your post installation measurement and verification report, we would also assess a daily deficiency charge for the incremental shortfall. We would assess that retroactively through the start of the delivery year. The daily charge is the shortfall times the daily deficiency rate, and the daily deficiency rate would be the EE provider's weighted average resource clearing price for the EE resource plus the higher of 20 percent times the provider's weighted average resource clearing price or \$20 per MW-day. The weighted average resource clearing price just recognizes that maybe that EE resource provider cleared capacity, and part of the resource may have cleared with the RA, and another part of the MW from the resource may have cleared at incremental auction. So we create some blended price which would represent the price that you received for that resource for the delivery year. If you are short and you do get hit with a capacity resource deficiency charge, the EE resource provider would still receive the auction credit throughout this delivery year. On their bill, they would receive the credit for the resource that cleared and then another separate line item on the bill for the daily capacity resource deficiency charge.

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This slide essentially shows all the energy efficiency that has cleared in RPM auctions so that you can get a feel for the level of energy efficiency participation in RPM auctions. For the 15 and 16 base residual auction, which is the last base residual auction that we conducted, there were 940 MW of EE resources that offered into the market, of which 923 MW cleared. So those resources that cleared were offering in sell offer prices which were less than whatever the relevant resource clearing prices were. They were the ones that were considered economical.

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And here I just listed, to get a sense for, on a zonal basis, the energy efficiency resources that offered and cleared in the 15/16 BRA. So we have the breakdown by zone, by MW amount offered, and MW amount that cleared for each of those zones that encompass the PJM region.

[next slide]

With regard to the RPM auction clearing prices, I provided you with a list of the RPM auction clearing prices for any RPM auction which has already been held where EE resources were eligible to participate. So you can get a flavor of the clearing prices that are resulting from PJM's auction. And they've provided the resource clearance prices for the annual product type. Energy efficiency resources are considered annual product type so that they would receive a price that corresponds to that product type. There's

other product types, which is when the DR product type and extended summer DR product type and those prices associated with those blended more limited DR products may be lower than the actual annual product type prices. But if you're an energy efficiency resource, you would be interested in the prices that were staying in the PJM market with regards to the annual product type. And that product type classification did not get recognized by PJM until about the 14/15 delivery year.

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What is a cleared EE resource paid, essentially? An EE resource, as I explained, you're receiving the annual product resource clearing price and you're receiving the price for the location in which that EE resource resides. So if they're clearing a resource, you would assess daily auction credits we're paying you and giving you revenues, during the actual delivery year. You may participate in clearing the auctions three years in advance of the delivery year, but actual payment of revenues doesn't start until the actual delivery year. Auction credits are essentially billed weekly throughout the delivery year. So for example, if we had an EE provider that cleared 10 MW of unforced capacity from an EE resource located in the PECO zone, which would be part of the Eastern MAAC LDA in the 15/16 BRA, they would receive an annual product resource clearing price in Eastern MAAC. They would receive that price that corresponds to that resource clearance price in Eastern MAAC, which is \$167.46 per MW day. We would give them a daily auction credit of 10 MW times that resource clearance price, so we would pay \$1,674.60 per day. And then over the entire year, they would be receiving an annual credit which totaled \$612,903.60 for that entire year.

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I'll throw out some of the challenges and risk related to energy efficiency. Essentially one of the challenges is the infancy of energy efficiency resources in PJM markets. PJM and our EE resource providers have been learning as we go. PJM has only had about two delivery years' experience with actually evaluating post-installation measurement and verification reports, so you as an EE resource provider may not get immediate responses to questions, especially questions regarding EE measures or installations that PJM has never evaluated in the past. So there is a learning curve for both us and the participants, and we have to just be aware of that. It may take us a little bit of time to answer all your questions. Another big challenge for EE resource providers has been the cost of the measurement and verification activities. We've heard from some EE resource providers that say that the cost of the measurement verification activities is too prohibitive, so they choose not to participate. It can be a challenge to actually forecast what the cost of those M&V activities are going to be, but I think it's important for the EE resource providers to reflect that cost in their offer price. You won't want to clear in the auction unless you are making sure that you're receiving enough revenues which would at least cover those measurement and verification costs.

With regard to credit requirements, the credit requirements are pretty high. We post our pre-auction credit rate prior to the actual auction. For example, the pre-auction credit rate for 15/16 BRA was a little over \$35,000 per MW, so the credit requirement by some may be considered pretty steep. With regards

to audit cost there is a potential for any EE resource providers to be audited. We don't have any history of audit costs. PJM has not conducted an audit or asked a third party to audit any of our EE providers yet. That's kind of an unknown—what the level of those costs may be. We are required to provide you with the cost of the audit no later than two months after the audit is conducted. But a risk that you may want to consider is the fact that audits cost, but we don't have a history of them. You're definitely exposed to deficiency charges if the EE resource provider is not able to deliver the UCAP value that they committed to in the auction, and they don't specify replacements, so those deficiency charges are steep. You're returning the revenue you received plus paying an additional penalty on top of that. There is the expense of replacement capacity if you look back at all the resource clearing prices that I've provided you for our auctions. You can see them. In the past, in those cases, the incremental auction resource clearing prices have been lower than the base residual auction clearance price, but there's no guarantee that that will always be the case. If you looked at the resource clearing price in the BRA for the 14/15 delivery year in PS North, for example, the resource clearing price was \$225 per MW-day. But the incremental auction resource clearance price was \$410.95 per MW-day. So there is the risk that the resource clearing price in the incremental clearing auction could actually be higher than the resource clearing price that you're receiving as a result of clearing in the BRA, so you have to take that into account.

And the final one I just wanted to mention is market rule changes. You have to recognize that there is that potential for market rule changes. Sometimes residual changes you may consider positive, other times they could be negative for you. So you always have to recognize that there is that potential for the market rules to change.

And that's all I had today. Thank you very much.

SW: Thank you so much, Terri, and thank you Doug and Terri for leading today's presentation and for sharing your expertise in the forward capacity market. As you can perhaps attest to, folks, there's a lot to learn about forward capacity markets and with regards to energy efficiency as a revenue stream. It's quite impossible to cover all of that in a 90-minute time frame. But, you know, I'd like to at least assure our Better Buildings Program partners that if there's anything that you're interested in out of today's webinar, please let me know. If you're interested in further exploring the opportunities or information about forward capacity markets in PJM as well as New England ISO. Those are the two regional transmission organizations that we covered today, along with some basic definitions, scheduled pricings and such. There are other regional RTOs in the country—we did not really go over those, so for those who are interested in learning more about them, definitely let me know.

As a reminder before we open up for questions and answers, we will be posting today's presentations and recording on our Better Buildings Neighborhood Program website, so please check it out very soon. We have received about four or five questions online, and I guess there's one very generic here in nature, I believe it's for Doug or Terri. "Is the forward capacity auctions process the same across the country, or is it different for a different RTO?"

DH: I can answer by saying there are only two regions in which an energy efficiency program can participate in the wholesale capacity market: New England and PJM. Only those two. There are other regions that have capacity markets or wholesale markets at least, but those don't yet allow energy efficiency to participate. It's the six New England states and all or part of 13 states in the PJM region. And as Terri and I showed, there are some things that are very similar—I think our definitions for energy efficiency are very close to each other, the process of an auction that occurs three years in advance that you have to qualify for. There are a number of things that are similar, but I think there are also some differences between the two.

SW: Thank you. And something related to that—and I guess this is for both Doug and Terri—is: How have energy efficiency resources' reliability stacked up, if you will, against other resources such as generation and demand response resources? And is there a percentage cap on energy efficiency resources in your systems?

TE: With regard to PJM, there's no cap currently on the amount of EE resources that may participate in our market. In terms of whether or not or how they are performing, the performance is essentially measured by the results of their post-installation M&V report and whether or not they are achieving the demand reduction that they committed to. In the RPM auctions, I don't have these stats in terms of the number of EE resource providers that met their commitment compliance and those that didn't kind of gave me a sense for whether or not they've been able to deliver. I know that we have, for some resource providers, assessed deficiency charges, so there are those that have come to the delivery year short of meeting their requirements. But it has been a small number of MWs, nothing that would give us cause for concern.

DH: I can answer that question for New England as well. The ISO publishes on a pretty regular basis the reliability statistics for generation resources, demand response resources, and energy efficiency resources. Those numbers can vary for the other two types, but for energy efficiency, it's effectively considered 100% reliable. So when the ISO plans out into the future—transmission planning or reliability planning or around a particular generation—they assume that the energy efficiency resources are a 100% reliable. As far as how much cleared in the auction and how much was actually delivered years later, I think my answer is the same as Terri's. By far and away, all six New England states that have state-funded energy efficiency programs that all participate in the FCM, to my knowledge all of them have met their commitments—if not immediately on time. (Perhaps they had to shed some of their obligations for a few months or a year and then make it up a little bit later.) Indeed, most of our energy efficiency programs, because of some uncertainty with the initial market rules, did not bid into the FCM auction all of the energy efficiency that they could provide. So I think it's fair to say that they've actually been over-delivering the capacity that they actually cleared in the FCM market. The last thing I will have to say on it is, because of the way that we measure energy efficiency, and in particular hours, much like PJM, I think their performance hours and New England's summer performance hours, some choose to be on-peak resource exactly the same—from 1 pm to 5 pm on summer afternoons, weekdays, non holidays, in that kind of a situation, you're actually averaging the performance across a number of hours that are not your actual peak load hours. If you have a Wednesday afternoon in June that happens to be a little cool and rainy you still have to average the performance during those hours into your overall

nominated value or demand reduction value of the market when indeed something like an air conditioner program during the actual peak hours will be providing a lot more than that. I think the reliability is marginally above 100%.

SW: I think folks can also raise their hand if you'd like to ask questions. But I have two more here that I'd like to raise. One is: "Assuming energy efficiency was already planned as part of a resource plan by a utility company or a utility, how do you avoid double counting if that utility then bids in that same energy efficiency?"

DH: I know in New England as soon as the forward capacity market started, they started putting into—I forget the name of the actual document—some form of contract that gets signed with the end-use customer who was agreeing to be provided with an incentive to do the energy efficiency measures, whatever they are, there's a line in that contract that says "We the utility who is providing you with these incentives own the capacity rights for that." So for those measures, it's been made clear to the end-use customer. How aware each end-use customer is of that, I imagine it may be a piece of fine print that they skip over, I'm not entirely sure. But one clear way to do that would be to figure out who provides which, whether it's a state energy efficiency utility, like Efficiency Vermont or Efficiency Maine, or whether it's a local distribution company that's doing energy efficiency work in that area where the facility is located. I think it would make sense to contact them. Especially if a customer knows that they have participated in this process.

TE: Yeah, and with regards to PJM, it is the responsibility of the EE resource provider, making sure that they confirm with the end-use customer that the end-use customer doesn't have any explicit agreement with any other party to offer that EE installation at the market. So that's how we are trying to avoid the double-counting of EE resources in our markets. If we determine as a result of post-installation M&V report submittals that there were two different EE providers that are claiming the same end-use customer installations, PJM would request documentation (either a contract, utility tariff, rider, some kind of letter) from the end-use customer that would support the EE resource provider's claim to the capacity rights to that installation. So based on the documentation that's provided to us, PJM would make a determination on who is able to claim that EE installation and their post-installation M&V report.

DH: If I could add on a little bit, I agree with Terri that it's entirely up to the market participant to provide that information. It's your responsibility to do that, not the responsibility of PJM or the ISO. And there are situations where this gets slightly trickier. Imagine you wanted to do energy efficiency measures for a particular facility and a merchant demand response provider also contacted that customer and signed them up on a contract. So now you've got two different entities, one providing energy efficiency, another providing demand response at the same facility. In New England, to date, to my knowledge, the ISO does not allow both entities to declare the same measures for both facilities. And I think theoretically it's entirely possible—you could have demand response and energy efficiency from different entities at the same facility—but to date I think just because of the confusing nature of it the ISO has not allowed that. So you also need to think about other entities besides energy efficiency

providers or merchant demand response providers that might be providing demand response assisting a customer.

SW: Well, with regards to time, we have less than five minutes, but I do have one question for us to take away, and I guess this is for both Doug and Terri. It's a good question, too. What should a Better Buildings program or retrofit program that is interested in participating in the forward capacity market do? What are some of the clear steps or recommendations that you can provide to them today that they should consider for now?

TE: With regard to PJM, I think one first step would be to decide whether or not, or to make sure that, the installation actually meets our requirements and actually does provide demand reduction during the EE performance hours. That would probably be the first step I would take is to figure out whether or not the installation is actually eligible to even participate. And then once you figure out whether it's eligible to even participate, you need to decide on how you want to participate. You may not want to participate as a PJM member because there are application fees to become a PJM member and annual membership fees, and there are certain requirements of PJM members. So you have to decide whether or not that is an avenue you want to pursue or whether or not you would want to get into a contractual arrangement with an EE resource provider who is already a member. So they would offer that installation in the auction for you, and in return, give you a portion of the revenues that come out as a result of the auction. So I think that would be my first steps: to figure out whether or not the installation is eligible and how you would want to participate, whether as a PJM member or working through a contractual arrangement with another member. And if you get that far in the process, then start thinking about how you're going to do the measurement and verification, and contact PJM if you have any questions about what an acceptable measurement and verification method might be for the type of EE installation that you have. And start thinking about the costs of those measurement and verification activities and whether or not they are too prohibitive for you to even participate or want to get an understanding of those costs so that you can make sure that that is considered in your offer price that you make into the RPM auction.

SW: And I believe there is a bunch of information that we can find on your website as well, and I would definitely like to put together some information in terms of websites, resources available out there, that we can direct our program partners to go to through our website at some point. Thank you Terri. Doug, would you like to add anything to that?

DH: I agree with everything Terri said. The only thing that I would add is that you should absolutely, if you're working with other partners and any of those partners you think might be participating in the market already, you should get in touch with them because they may already be participating in the market and they may already be claiming the projects that you're thinking of. If not, then talk to the end-use customer and make sure that there aren't any contracts with some other provider that you're not aware of. And after that, I agree with everything Terri said. Make sure that it's eligible, make sure that you have studies that are current, that can prove—especially if you're doing anything out of the ordinary, any innovative type programs—you'd want to make sure that those types of activities have been done for long enough and kind of study enough to prove your savings. And as Terri said, if they're

applicable, great, then figure out if the revenues justify the cost of participating. If not, talk to a local ESCO who might already be participating who you can aggregate your measures with.

SW: Great. With that, well, thank you so much for Doug and Terri and obviously ERG and others who supported and put this webinar together. We'd definitely like to thank you all for joining us. Again, the information will be posted on our Better Buildings Neighborhood Program website. Please check it out for all the information. And like I said, we like to highlight everything possible and will inform you as we go along. If you have any questions or anything that you need from us, from DOE, please let me know. And my name is Subid Wagley. Thank you. This concludes today's webinar.