1 BEFORE THE

2 ILLINOIS COMMERCE COMMISSION

3 ILLINOIS' POWER METER

4 RENEWABLE ENERGY & ILLINOIS'

5 TRANSMISSION SYSTEM POLICY SESSION

6 Thursday, October 19, 2017

7 Chicago, Illinois

8

9 Met pursuant to notice at 1:35 P.M.,
at 160 North LaSalle Street, Chicago, Illinois.

10

11 PRESENT:

12 BRIEN J. SHEAHAN, Chairman

13 SADZI M. OLIVA, Acting Commissioner

14 SHERINA MAYE EDWARDS, Commissioner

15 MIGUEL del VALLE, Commissioner

16 JOHN R. ROSALES, Commissioner

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1 PRESENTATION BY:

2 MR. JOSEPH PALADINO, Senior Advisor
Office of Electricity Delivery and Energy
3 Reliability, U.S. Department of Energy

4 MR. PAUL CENTOLELLA, President,
Paul Centolella & Associates LLC
5
DR. JOSEPH BOWRING, PJM, Independent Market Monitor
6

7 MODERATORS:

8 MR. GERARDO DELGADO, Legal and Policy Advisor to
Acting Commissioner Oliva
9
MS. ANNIE McKEON, Legal and Policy Advisor to
10 Commissioner Edwards

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1 COMMISSIONER EDWARDS: Welcome back to
2 Illinois' Power Meter. I hope that everyone had a
3 great lunch break, and thanks for coming back.
4 On behalf of ICC and my fellow
5 commissioners, Commissioner Oliva and I would like to
6 thank you for joining us for the second half of this
7 very intriguing discussion.
8 Earlier this morning, you heard from
9 our dynamic panelists about the planning and
10 preparation needed to efficiently and seamlessly
11 integrate renewable energy resources at the regional
12 level. Their primary focus is on the visible
13 challenges that RTOs and transmission operators are
14 facing.
15 Our focus this afternoon is on market
16 challenges at the regional level. This afternoon's
17 panelists will provide insight on how the integration
18 of these renewable energy resources will cause new
19 challenges to the traditional market design. There's
20 absolutely no question that traditional market
21 structures do need to change, as mentioned this
22 morning, to adapt to more renewable energy on the

1 grid.

2 But what that will look like is the

3 question of what we'll get into to this afternoon.

4 They will discuss the opportunities and challenges in

5 the MISO and PJM footprints, and more specifically,

6 they'll will discuss price formation, alternative

7 market models, jurisdictional questions, and options

8 to achieve an efficient market. I am really looking

9 forward to another great discussion.

10 With that, I would like to welcome

11 Gerardo Delgado and Annie McKeon, who will be

12 co-moderating this panel's discussion.

13 Thank you.

14 MR. DELGADO: Thank you, Commissioner Edwards.

15 Good afternoon, Mr. Chairman, commissioners,

16 panelists and attendees.

17 As Commissioner Edwards shared, my

18 name is Gerardo Delgado and I'll be co-monitoring

19 with Annie McKeon on this panel which will examine

20 the effect of renewables that close on the energy

21 market as Illinois reforms and implements its

22 environmental policies.

1 MS. McKEON: Okay. Welcome, everybody.

2 Before we begin, I want to quickly

3 introduce our panelists to all of you. We're first

4 going to hear from Joe Paladino, Senior Advisor in

5 the Office of Electricity Delivery and Energy

6 Reliability at the U.S. Department of Energy. And

7 Joe's worked for most of his career in the

8 advancement of and commercialization of technology to

9 address energy and environmental issues.

10 Next, we'll be hearing from

11 Dr. Joseph Bowring, PJM Independent Market Monitor.

12 Dr. Bowring is the president of Monitoring Analytics,

13 and since 1999, he's been the IMM for PJM, which is

14 responsible for monitoring all their market

15 activities.

16 And, last, we'll hear from Paul

17 Centolella, who's the president of Paul Centolella &

18 Associates LLC. He is a former commissioner of the

19 Public Utility Commission of Ohio, and has both

20 public and private sector experience in regulation,

21 economic and energy consulting, and public utility

22 and environmental law.

1 Please join me in welcoming our
2 panelists.
3 (Applause.)
4 MS. McKEON: So each panelist will be the same
5 format as the first panel this morning. So they'll
6 each give brief remarks and short presentations, and
7 then we'll get into the Q&A.
8 So we'll start with Mr. Paladino.
9 MR. PALADINO: Thank you very much and it's a
10 pleasure to be here. Thanks.
11 At the Department, I was involved a
12 lot with smarter technologies and the deployment of
13 those technologies is a key issue with what we're
14 starting to do now. Lately, the real look has been
15 in trying to determine what the most effective ways
16 of integrating and utilizing distributed energies in
17 the system, and I want to convey some of the things
18 that we've learned through that process.
19 We're working, actually pretty
20 closely, with other commissions around the country as
21 well as utilities and trying to determine what the
22 appropriate investment strategies are to achieve kind

1 of a function -- the functional capabilities you need
2 on the grid to handle and distribute energy
3 resources.
4 So let me start. I guess I have a
5 clicker, and here we go. This is the first slide.
6 These are just a few slides.
7 You all know this. I'll briefly go
8 over it one more time. But what we're -- basically
9 one could surmise that there are basically three
10 major drivers -- forces that are happening right now.
11 The rate and scope of grid transformation, especially
12 at the distribution system level.
13 First of all, we have information and
14 communication technology. This is digital
15 technology. It's really coming into play on the
16 grid. It's really integrated now with the physical
17 grid systems. And when utilities do that, they
18 actually see a lot of that is coming the digital
19 integration to the grid. We've done a lot of work on
20 that. We'll share more information there.
21 But in addition to that, we're seeing
22 to price of electric vehicles, solar wind

1 technologies, efficient buildings, energy storage
2 technologies, and the interest in the micro grids
3 also occurring. Okay? The prices of these are
4 coming down; their adoption rates are actually going
5 up. So that's one draw, the availability of new
6 technology.
7 The second driver has to do with the
8 new entities, the new participants that are now
9 participating with utilities in the generation and
10 management of electricity. This is new. It is -- it
11 will lead to a shared space.
12 And then, thirdly, we've got federal,
13 and especially, state policies that are driving
14 through renewable portfolio standards and net energy
15 metering policy, which are transitioning and
16 changing, and mandates, et cetera. They're driving
17 the application and deployment of renewable and
18 distributed energy technologies.
19 So we've got these forces coming
20 together. When the top-down force, the policy force,
21 meets with this bottom-up force -- because the
22 bottom-up force, which is the technology

1 available -- availability as well as the new
2 participants coming into the -- into the -- the
3 operation of the grid, that bottom-up force is
4 happening organically. It's happening, even
5 regardless of policy. When you get the policy
6 combined with this bottom-up force, you've got
7 incredible acceleration of DER technologies.
8 And oftentimes, the technology -- the
9 application of the technology is ahead of the
10 capability of commissions and utilities that really
11 grew up and brought new technology investment
12 strategies.
13 The key questions there are what are
14 the roles and responsibilities of these new
15 participants, especially with respect to utilities?
16 You know, what kind of services do they provide, what
17 capabilities do they provide? But we only need to be
18 able to maintain reliability on the grid. That's an
19 essential capability that we need maintain. So we
20 need to ensure that the roles and responsibilities of
21 these new participants support that objective.
22 Secondly, the major question is, How

1 do we fairly compensate utilities and these new
2 participants? Major question. Not a lot of answers;
3 major question.
4 Secondly, I wanted to show this: As
5 we increase the level of distributed energy
6 resources, especially a mixed set of distributed
7 energy resources on the grid, we need to implement
8 more sophisticated approaches for group planning
9 operations and market operations. We're looking
10 at -- we're truly aren't going towards -- and, again,
11 this is not -- this is not happening equally across
12 the country.
13 There are lots of different business
14 models here and we totally with respect that. Okay?
15 But as we get to integrate higher levels of
16 distributed energy resources over the system, we're
17 looking at a distribution grid which is almost a
18 platform that can make what we supply in play. Okay?
19 We're potentially looking at really sophisticated,
20 ultra-complex systems. Okay?
21 So in the lower part of this graph,
22 okay, in Stage I, we're really -- we're really

1 looking at known DER levels of -- the adoption rates;
2 although, there's really no material impact on
3 planning and operations. Okay? But DER's can play
4 in bulk system markets. And the issue that the
5 transition system market operators have is
6 under- -- is having visibility -- to having the
7 appropriate level of visibility to the amount of DER
8 that's available to them in the grid.
9 But at -- in Stage I, we really need
10 to take a look at -- we need to be able to forecast
11 the rate of DER adoption. You might have to start
12 taking a look at the ability of the grid to be able
13 handle those distributed energy resources, and even
14 start to look at interconnection policies and
15 capabilities.
16 PG&E looks at 5,000 D- -- PV
17 interconnections a month. Okay? So they have to get
18 in front of that to develop that capability to enable
19 that.
20 Secondly, in Phase II, State II, where
21 we have higher levels of distributed energy resources
22 in the grid, we are looking at material changes in

1 the planning and operations. We have to deal with
2 bio-directional energy flows there. We have to deal
3 with better protection and control schemes, and we
4 may start to look at -- probably start to look at the
5 value of distributed energy resources back to the
6 distributional grid. And so they provide value, not
7 only to the transition grid, but also to the
8 distribution grid at the same time, and there's going
9 to have to be an effective coordination of the
10 transition systems operators to the distribution
11 system operators to make that work.
12 To move from -- utilities are
13 basically at Stage I. They are a few places in the
14 country where we are actual at Stage II. Where we
15 see bi-directional flow. We've got an upgraded
16 system where all the available panel distribute
17 energy resources.
18 To move effectively from Stage 1 to
19 Stage 2, we really need to employ a holistic
20 grid-architectural discipline. Where we're looking
21 at structure, we're looking at the structures of the
22 system. We're looking at the structure of the

1 information and communication technology system, and
2 assessing the a control system and how the actual
3 structures of those systems work with the physical
4 grid system, and then how the market structure and a
5 business structure, even the regulatory structure,
6 all these structures that interface with us.
7 And so we really need to examine in a
8 holistic way how all these structures touch each
9 other and how they're going to affect each other and
10 integrate with -- integrate with each other over time
11 to develop a holistic strategy for technology
12 deployment so they do arrive at a coherent design for
13 the grid in the end.
14 The other thing that really needs to
15 be looked at in moving from Stage I to Stage II, is
16 to understand coordination, to develop coordination
17 framework. Because you've got a lot of players
18 involved in the system. Not only do you have devices
19 talking to each other, you've got smart devices. So
20 many of these devices are owned by other
21 participants.
22 We need to coordinate, development the

1 right way to coordinate that, and there are ways to
2 do this. Okay? But we need to develop coordination
3 so that -- so that, A, we can respect the
4 optimization that a single entity might want to have
5 local optimization as well as respecting system
6 optimization.
7 We need to be able to do those two
8 things. And we need to develop a system that can
9 scale, so that if we add more DERs in the system, we
10 don't have to completely re-change the ways -- the
11 system -- we need to be able to scale that system.
12 So architecture -- grid architec- -- this is one of
13 the discipline -- grid architecture enables one to do
14 that.
15 Stage III is where we've got
16 peer-to-peer multi-transactional processes. You've
17 heard the term "transactional energy." We are not
18 there being able to enable that capability. You
19 really have to solve Stages I and II to be able to
20 get to Stage III.
21 Okay. The next slide -- and I -- am I
22 going too slow?

1 MS. McKEON: No. I think you have time to
2 finish up.
3 MR. PALADINO: Do I have another -- okay. All
4 right. Thanks.
5 COMMISSIONER ROSALES: So let me ask you a
6 question real quick.
7 MR. PALADINO: Yes.
8 COMMISSIONER ROSALES: Regarding changes, on
9 that timeline, what are you envisioning when going
10 from Stage I, Stage II, to Stage III?
11 MR. PALADINO: So Stage I going -- Stage II is
12 really sort of a -- the rule of thumb is, is when
13 you've got enough DER in your system where you've
14 got -- you're really beginning to impact peak demand
15 and you're really impacting -- DERs actually
16 represent -- generation coming into the system
17 represent, maybe, about five percent of being able to
18 address the capacity need at peak. Then you're
19 really starting to come -- coming -- you're actually
20 moving into Stage II. We've got a lot of distributed
21 energy resources on the system, and you've got to
22 plan and operate those appropriately.

1 Places in Hawaii, certain feeders in
2 California are in Stage II or are seeing
3 bi-directional flows, et cetera.
4 Stage 3 is really far away. It's
5 really, really far away. And I don't have a timeline
6 in terms of years or anything like that. It's really
7 a function of how much DER you have on the system and
8 your ability to forecast not only load over time, but
9 DER adoption over time. And it's not easy to do
10 this. It's not easy to determine -- to develop
11 accurate forecasts.
12 I don't know if that helps you. I
13 don't have a time, like, it's going to be ten years
14 from now when we do Stage III. It's really a
15 function of the utility; it's a function of the
16 jurisdiction; it's a function of adopting DERs.
17 COMMISSIONER ROSALES: Okay.
18 MR. PALADINO: And then on this last slide, I
19 wanted to show this integrated planning process.
20 Because we're going to be, depending on the level
21 distributed energy resources on the system, we're
22 looking at instituting plan processes that

1 effectively integrate the transition system operators
2 and distribution system operators, and customers and
3 third parties. These processes need to be
4 transparent enough to be able to enable customers and
5 third parties to actually participate in the planning
6 process if they would provide guidance in the system.
7 Okay?
8 Now, on the upper left-hand part of
9 that graph, it says, "Multiple Scenario Forecast."
10 This gets into your question, Commissioner, where
11 it's really, really important to undertake --
12 forecast distributed energy resource growth as well
13 the load growth. And this is not easy because there
14 is a great deal of customer and consumer behavior
15 that affects these forecasts. I mean, we do not have
16 the tools right now, or not really quite adequate
17 tools in terms of what the DER forecasts are going to
18 be. But there is work that's happening in this area,
19 but the ability to forecast is going to be really
20 important. Okay?
21 The growth of DERs and the system of
22 forecast needs to be fed into the planning at the

1 transmission system level. It also needs to be fed
2 into planning at a distribution level. Okay?
3 Because those DERs normally are difficult to manage
4 because they present issues to the control and
5 operation of the system. Okay?
6 But on the other hand, they provide
7 value to the system. And so you want to be able to
8 design a system that can manage them in an
9 operational way, but you want to be able to extract
10 value from them, if possible, and that's where
11 markets and things like that come into play.
12 On the left-hand part of this, in that
13 blue box area, basically, that's -- what's going on
14 there is, is the analysis of the distribution system,
15 how capable of it -- is to actually host distributed
16 energy resources. Do we upgrade the system to be
17 able to handle it, or do we actually have hosting
18 capacity? Could we host more distributed energy
19 resources without significant upgrades? So -- and
20 then how does that kind of analysis play into the
21 ability to provide interconnection of the distributed
22 energy resources?

1 That's what's going on in that lower
2 box, an understanding of distribution system and the
3 capability of it to be able to integrate and utilize
4 distributed energy resources.
5 The green box on the right, which I
6 think this panel is really trying to get at, deals
7 with understanding the value of distributed energy
8 resources and developing mechanisms to utilize that
9 value, okay, especially at the distribution system
10 level.
11 So that box on the left that says,
12 "Locational Value Analysis," that's an analysis to
13 determine what the value of a DER would be on a
14 distribution system with respect to reducing capacity
15 requirements: deferring substation upgrades, building
16 substations, or not having to upgrade systems with
17 continuous protection and control schemes, not having
18 to put larger wires on systems. That's the capacity
19 side of distribution systems we can actually defer if
20 you actually apply DERs into the system.
21 So -- and then beyond that, once you
22 determine that they can provide value, then the next

1 step is: How do I source these DERs? There are
2 different ways to source these DERs. There's
3 pricing -- coupled with the theory of these pricing
4 programs and procurements. Okay? Those mechanisms
5 are available to actually utilize distributed energy
6 resources at the distribution system level.
7 So low hanging fruit, perhaps? And
8 this is where a lot of folks are focused, is to, A,
9 let's just maximize the efficiency -- the
10 effectiveness of our energy efficiency and demand
11 response programs. Let's just see -- let's extract
12 as much as we can out of those system- -- those
13 programs which have treated us all right. Okay?
14 Numb- -- there are ways -- there are ways to do that.
15 Number 2, indeed, is the pricing
16 effort. In New York, they're really looking hard at
17 the value and different kinds of value steams of
18 distributed energy resources could provide to the
19 system. And they're actually looking at rates that
20 would factor the locational path that's helped those
21 distributed energy resources.
22 You can -- there is a staff report

1 that was written -- it was written -- it's a staff --
2 it's called a staff report on the value of DER. If
3 you're interested in pursuing that, you can that it
4 off the Web. You may have taken a look at it
5 already. But the concept of value streams -- and
6 they call it the energy -- the value stack they're
7 looking at is energy value --
8 I can't read anymore. My glasses
9 aren't working. Sorry about that.
10 -- installed capacity value,
11 environmental value, demand reduction value, and
12 locational system relief value.
13 So they're looking at these value
14 streams, and they're thinking of aggregating
15 distributed energy resources and providing a
16 different tariff to that aggregated set of
17 distributed energy resources that will be valued
18 against these different value streams.
19 And then finally, the final thing I
20 just want to say is, in terms of procurements, there
21 are pilots around the country including the
22 Brooklyn-Queens Demand Energy Project, where they're

1 actually -- have procurement mechanisms that are
2 working with aggregators, basically, that are
3 applying energy efficiency practices: solar, combined
4 with batteries technologies, demand response
5 practices. And they're actually -- they were
6 actually brought on board through an auction
7 mechanism. And they're actually able to provide
8 about 22 megawatts of capacity to the Brooklyn-Queens
9 system, and that has enabled -- that has enabled
10 con- -- Con Edison to defer the building of a major
11 substation. Okay?
12 So they're using, through the
13 procurement mechanism, which uses less -- auction --
14 and auction it, they're actually able to apply DERs
15 to reduce the capacity that ConEd has to actually pay
16 on the system.
17 Finally, there are other examples of
18 these kinds of pilots around the country. And in
19 California, especially -- I think this is a good
20 reference -- there's a competitive solicitations
21 working group who developed a set of documents, which
22 get into things like procedures and protocols and

1 even terms and conditions for these DER service
2 providers to work effectively with the utility and to
3 be able to extract value from the DERs.
4 So that's all I have to say. Thanks
5 very much.
6 MR. DELGADO: Thank you, Mr. Paladino.
7 We'll now hear from Mr. Centolella.
8 MR. CENTOLELLA: All right. So I want to thank
9 the Commission and Staff for inviting me to
10 participate in this dialogue today. I am looking
11 forward to the discussion.
12 What I want to do in these
13 introductorial [sic] remarks is to highlight four
14 significant reforms of wholesale markets that could
15 improve the efficiency significantly and how we
16 integrate, particularly, distribute renewable
17 resources.
18 First, you know, looking at improving
19 the granular of the time, location, and product
20 prices in these markets.
21 Secondly, thinking about how we deal
22 with reliability, and actually pricing reliability

1 from a customer's perspective as opposed to relying
2 primarily on capacity mechanisms to deal with
3 resource adequacy.
4 Third, is to think about how we
5 integrate smart devices, and particularly how we do
6 that in terms of demand response programs or don't do
7 in the demand response programs, and in our forecast.
8 And finally, to touch on pricing Carbon.
9 So one of the things -- what I would
10 like to start with is looking at this question of how
11 granular pricing should be. So on this chart, what
12 you see is the green line is the average hourly zonal
13 price in the ComEd zone on the peak day in PJM 2016.
14 The -- that -- those are the prices that are seen by
15 customers, by load-serving entities, and by every
16 non-aggregated DER in the system.
17 The red line is the maximum LMP at any
18 of the load nodes in the system, and the blue line is
19 the minimum LMP. So you had seven hours on this peak
20 day where the difference between maximum and minimum
21 energy price in the ComEd zone was more than $1,000 a
22 watt-hour.

1 No customer saw that differential.
2 They didn't have an opportunity to respond. We hide
3 those differentials by using average zonal hourly
4 pricing. These are also hourly averages. If we had
5 the interval prices, one might expect that
6 differential to be even larger.
7 And that has, you know, some
8 significant impacts in terms of if customers or DER
9 have the opportunity to see those prices. One, we
10 would expect them to respond; we would expect some
11 customers to shift load to a lower pricing period; we
12 would expect other customers to use more and actually
13 save money; and the differentials would decline and
14 overall cost of the system would decline.
15 So beginning to understand the
16 variances in the value of distributed energy
17 resources at a cost-observing load will be critical
18 to beginning to understand the valuation of
19 distributed resources. And this is something we
20 don't do today and need to pay attention to.
21 Secondly, we are going to face an
22 issue eventually about do we take this consideration

1 of value differential further down into the
2 distribution system. So when you think about an A/C
3 power grid, there are essentially three products that
4 you have: You have real power; you have reactive
5 power -- this is the voltage that allows the power to
6 flow through the system; and you have various kinds
7 of reserves.
8 Those are really the only three
9 products or variations of those products that you
10 have. And if you're a distributed energy resource,
11 for any given unit of capacity, you really can only
12 be providing one of those at any time.
13 So for a distributed energy resource,
14 the trick is how do you ultimately trade off between
15 providing those different resources. Well, the
16 question that you will eventually face is, Does it
17 matter, or how much does it matter? Is it
18 cost-effective to begin to think about the expressing
19 these variations and costs as you move further down
20 into the distribution system, away from, you know,
21 moving just to the load node at the bulk transmission
22 level or substation level. And at least in some

1 cases, it certainly can matter.

2 I've put up here a couple of charts

3 showing the distribution level, LMPs, for an

4 illustrative distribution period that we did as part

5 of the study from New York REV. And if you begin to

6 expose those kind of prices to EVs, to commercial

7 buildings that have some thermal inertia and the

8 ability to move some of their demand, and even to

9 forth a tax, we begin to see some real savings

10 whether you are one of those customers, and even see

11 savings if you don't change your demand profile at

12 all.

13 So this is something that you'll have

14 to evaluate. You may decide eventually to go to this

15 kind of very fine grain granularity; you might decide

16 on something simpler such as beginning to reflect

17 marginal losses in distribution pricing or DER, and

18 maybe even for load-serving energy -- entities. Or

19 you might decide to stay at a level of granularity

20 that represents the substation that connects the

21 distribution and transition system, those load nodes

22 that I showed on the prior slide. But this is the

1 question you will eventually face.

2 The other thing that I think is really

3 important to recognize is that there is no single

4 distribution value for distributed energy resource.

5 This is very much time, location, and product

6 specific. And -- you know -- and figuring that out,

7 particularly if you're trying to do this in a

8 planning or a procurement setting, is extremely

9 difficult. The complexity of planning and

10 forecasting on a distribution system is significantly

11 greater than trying to plan or forecast for central

12 station generation or transmission to the parties.

13 You're talking about a much larger

14 system with many more nodes; you're talking about

15 having to deal with things like VARs and ampere

16 power. You're talking about having to deal

17 three-phase balance; you're talking about protection

18 systems. You're talking about systems where there's

19 much greater variation in both load and resources

20 down at the distribution level than you would see at

21 a -- at the transmission or a bulk power system

22 level.

1 So this becomes quite complicated, and
2 even if you take a relatively successful project like
3 the Brooklyn-Queens project that Joe just
4 referenced -- you know, I put up here a graph that
5 is -- what the plan that ComEd put out for what they
6 were going to procure for the Brooklyn-Queens
7 project. And it shows the breakdown of different
8 types of technologies they were hoping to procure as
9 well as the black line shows their need.
10 But the interesting thing is their
11 procurement plan included buying some distributed
12 generation, which would operate continuously, even in
13 hours where there wasn't a need for resources on that
14 distribution circuit. So one of the things to pay
15 attention to is how are you going to rebate a
16 distributed generator or how are you going to procure
17 a distributed generation when you're using it to
18 offset a distribution?
19 What you may want to think about is
20 does your statute permit you to have a variable
21 rebate based on the actual resources that are
22 provided by a distributed generator, and rebate that

1 ex-post rather than a fixed rebate upfront where
2 you're trying to guess at what the value of that
3 distributed resource would be.
4 If you're talking about a procurement,
5 do you procure a fat contract or do you procure an
6 option contract that allows the distribution system
7 operated to then dispatch when that distributed
8 resource actually operates so that it operates when
9 it provides value to the grid. These are the kinds
10 of questions that you have to deal with as you think
11 about variations in the value of distributed energy
12 resource.
13 A second area that you ought to be
14 thinking about is how do you value reliability. And
15 valuing reliability and recognizing the value that
16 resources bring providing reliability is also time
17 and location specific. They will have some
18 significant impacts. It has an impact in -- for
19 example, you may have a distributed energy resource
20 that contributes in some significant way to
21 maintaining reliability much of the time, but yet
22 can't meet, you know, the annual always-on

1 requirements of capacity performance in a PJM market,
2 for example.
3 You also buy value, meaning
4 reliability, when and where it's valuable. Begin to
5 have some differentials in energy prices -- which, in
6 turn -- I'll come back to it -- can begin to animate
7 responsive demand that, in turn, can help offset the
8 ramping rates and variability of renewable and
9 distributed energy resources.
10 So we know how to do this; we're doing
11 it right now in the ERCOT market in Texas, where they
12 have a market that is an energy market plus a very
13 significant operational and reserve demand curve.
14 And you see that, you know, illustrated in the graph,
15 where the part of the curve to the right represents
16 the value of reliability to customers times a
17 probability that at different levels of reserves
18 service might be interrupted. And the high value of
19 about almost $9,000 a megawatt hour that you see over
20 to the left represents the Texas Commission's view of
21 the value of uninterrupted service to customers.
22 So we have a way of doing this based

1 on customer value. We don't do that today in PJM.
2 In MISO, we have reserve demand
3 curves, but the effect -- their effect is largely
4 needed by another element, and that is how we deal
5 with capacity. So you will hear discussions about
6 capacity markets, and we need them for the, quote,
7 missing money problem. What part of the missing
8 problem is what I just talked about. We're not
9 pricing the time- and location-specific value of
10 reliability.
11 The other part of it is how we
12 understand what the level of capacity is that we
13 think the market needs, and this is based upon -- the
14 engineering eristic goes back at lease to the 1940s,
15 if not earlier. Nobody remembers quite where it came
16 from, but it's what was called the loss of load
17 expectation requirement. This is not directly
18 related to the quantity of megawatt hours that might
19 be interrupted at any time or the value of those
20 megawatt hours, but it is the planning we've
21 utilized.
22 This tends to produce higher levels of

1 reserves or capacity, which in turn tends to mute out
2 the time- and location-specific pricing and
3 reliability in the energy market.
4 And what you see in the green bars
5 there are the results of a study that was done over a
6 couple of years for the Texas Commission and the
7 ERCOT Reliability Center, where they looked -- you
8 know, they looked at and compared, you know, the
9 middle bar, which is their operational reserve demand
10 curve and energy market, to something that would be a
11 one in ten loss of load expectation, which is the
12 green bar on the right, both of which are -- you
13 know, produce reserves in excess of that five-nines
14 reliability standard, which is the green bar on the
15 left.
16 What you see in the red bars and blue
17 bar are where we are today in terms of reserve
18 margins for both MISO, Zone 4, and PJM, and they're
19 both substantially above where you would be at even
20 with a one in ten loss of load expectation. So we
21 really have kind of muted out the entire
22 location-specific price and reliability in these

1 markets.

2 A third area that I want to talk about

3 is one that Joe touched on briefly, it was touched

4 one a little bit this morning, is what will happen

5 over the next few years in terms of smart devices.

6 We are seeing a rapid growth in deployment of smart

7 devices in buildings that have thermal inertia that

8 can act like batteries -- in fact, much more cost

9 effectively than batteries -- to shift demand from

10 high-price periods to low-price periods. And we're

11 seeing the beginning of cost competitiveness of

12 electric vehicles, which are another form of flexible

13 demand.

14 This has a couple of significant

15 impacts. One is it's something that we need to pay

16 attention to in terms of our wholesale pricing and

17 wholesale settlements. Because ultimately, our

18 objective ought to be the competitive retail

19 suppliers and utilities work with their customers, to

20 help their customers manage the usage of smart

21 devices to better time their demand and reduce their

22 overall costs.

1 And secondly, once you begin to do
2 that, you fundamentally change how demand
3 participates in the market because what a smart
4 devices will do is will continuously seek to optimize
5 relative anticipated real-time prices. Now, that's
6 great in terms of it providing greater reliability
7 and greater efficiency. It is not so great in terms
8 of how it interplays with our existing demand
9 response programs.
10 The existing demand response programs
11 we have in the market have two important
12 characteristics. One, they're event-based and
13 dispatch when the system operate. So if we're now
14 talking about literally millions of smart devices,
15 maybe tens or hundreds of thousands of electric
16 vehicles with flexible charging, that's simply beyond
17 the computational capability of a central system
18 operating with emission dispatch.
19 Secondly, because these devices are
20 going to be continuously optimizing, you run into a
21 problem with the way you calculate the response and
22 demand response program, which is relative to load in

1 a baseline period. Well, you know, the baseline
2 period if the devices are working without trying to
3 play -- game the system, we're already below in
4 similar hours, so you're not going to get much by
5 paying that demand response program.
6 The worst case is that the smart
7 devices aren't trying to game the demand response
8 program, but increasing the abilities to show
9 baseline period, and then artificially cutting that
10 down when they peak the demand response.
11 So we need to pay attention to this.
12 The way you pay attention to it is by building
13 something into the forecast. However, when we look,
14 for example, at PJM's forecasting process, you know,
15 they -- PJM did a study earlier this year that looked
16 at what would happen if you took the ten peak days in
17 PJM, you reduce your demand on those ten peak days,
18 and you did that for 18 consecutive years. What they
19 found was that only 50 percent of that reduction
20 would be reflected in their forecast for their
21 capacity market, because of the way they do their
22 forecasting and -- you know, and their weather call

1 in this issue.

2 So this is a real problem that needs

3 to be addressed. Now, eight years ago, I wrote a

4 paper with Andy Ott when I was on the Ohio Commission

5 and he was the Senior VP at that point at PJM, and we

6 had a very simple proposal for addressing this.

7 We said incorporate the predictable

8 responses of price response in your demand forecast,

9 have a significant operational reserve demand curve,

10 your price reliability, and then only require your

11 load that is price responsive to carry brawn capacity

12 for what they would be doing at, and then begin to

13 respond to prices.

14 Well, unfortunately, we were not able

15 to push that through the stakeholder process, and we

16 ended up with a price responsive demand mechanism

17 that we have today that imposes on price response and

18 demand many of the same kinds of responsibilities

19 that a supply resource has in the capacity market,

20 even those price responsive demand doesn't get paid

21 influencing the market. So this is another area that

22 needs attention.

1 The final area I want to mention is
2 pricing carbon. Pricing carbon will be more cost
3 effective in meeting your environmental objectives
4 than hardly any technology-specific, you know,
5 incentives. And there are ways to do it.
6 I think based on some of the work that
7 I've seen, you know, coming out of New York and other
8 places, it will be possible to do it for only some
9 states within the RTO and not for others. But one
10 needs to do that with a one-pass methodology and not
11 the two-stage methodology that's been proposed for
12 California.
13 And I'll stop there. I know I've
14 thrown a lot out. I'm sure you'll have an
15 opportunity to discuss.
16 COMMISSIONER ROSALES: Sorry. Just to clarify,
17 a one-stage versus two-stage, can you say that again,
18 please.
19 MR. CENTOLELLA: Sure.
20 So the current proposal in the
21 California and western Energy Imbalance Market is to
22 have a kind of two-step way of addressing what they

1 call leakage or resource shuffling. And, you know,
2 the way in which it is done would, you know --
3 propose to be done. It's on the way. The way it
4 will propose to be done would allow resources to
5 alter their bids so that they wouldn't be dispatched
6 in the first pass, but would be dispatched in the
7 second pass, and that could fundamentally undermine,
8 you know, efficient dispatch in that market.
9 So, one, there are other approaches.
10 You know, there are approaches that we talked about
11 in New York. There's a recent paper by -- Bill Hogan
12 from Harvard that talks about how you might approach
13 that in a one-stage process that wouldn't allow that
14 kind of inefficiency to be had.
15 COMMISSIONER ROSALES: Thank you.
16 MS. McKEON: Thank you, Paul.
17 We'll have Dr. Bowring present last.
18 DR. BOWRING: Thank you. I will -- I'll be
19 brief. There's questions -- there's some intriguing
20 questions in there, some provocative questions. I'm
21 looking forward to in participating and responding to
22 some of those.

1 So first of all, I'm the market
2 monitor to PJM. And so to be clear to the PJM people
3 here, I cannot speak for PJM. Even though I say
4 that, people sometimes still think I do. I cannot
5 speak for PJM on the competitive market, so don't
6 blame PJM for what I'm about to say.
7 So I'm going to monitor my remarks a
8 little bit given what we just heard. So -- well,
9 first is the beginnings of this tension which
10 underlies the issues you're facing, and that is --
11 and I forgot to thank you all -- I'm sorry -- for
12 doing this. Thank you.
13 The tension is between planning and
14 markets. That's it in a nutshell. And the tendency
15 of engineers, always want to plan everything out,
16 tell everyone how to do it, figure it all out ahead
17 of time. And the market side is exactly the opposite
18 from what Paul was talking about, was one of the
19 market dynamics. How do you get prices right so you
20 get the response right?
21 So why do people want to do DER? Do
22 they want to do DER because it's cheaper, more

1 efficient, or for some other reason? I'm not --
2 never quite sure. I've heard lots of conversations
3 about microgrids and people who are opposing
4 microgrids really couldn't justify it on an
5 accounting basis. It was some other basis. I'm not
6 quite clear what it was, but it wasn't economics.
7 So the purpose of markets is to
8 provide energy to customers at the lowest possible
9 price. That is the entire purpose of the market.
10 It's the purpose of the enterprise. It's not to
11 invent new or cooler ways to do it, it's to provide
12 power the lowest possible cost by relying on
13 harnessing the independent individual actions of
14 market participants responding to price.
15 So at PJM, we've been through -- over
16 the last five or six years, we've been through a very
17 dramatic transformational market. We've had real
18 cheap gas. We've have the introduction of even more
19 efficient life cycles. You've got down below 6,000,
20 even 5,000 e-rates. When you translates that cost of
21 gas, you've got e-rate, we all know it's cheaper than
22 a coal unit. So AESOP doesn't mean anything anymore,

1 or MISO means what it's always meant, which is what's
2 the unit that's most economic that runs all the time.
3 The life cycles run all the time.
4 They are almost always cheaper than coal. The only
5 thing you remember about gas is that it's volatile.
6 But nonetheless, that's -- the dynamic is that we all
7 know it's a career to be accounting that. Low energy
8 market prices have made a huge impact on every
9 element of the market.
10 The capacity market prices, which
11 are -- capacity revenues are a relatively small part
12 of the overall revenues, less than 20 percent, but
13 also they're incredibly moderate. The result has
14 actually been an increase in diversity and an
15 increase in -- in fact, an increase in reliability.
16 Combined cycles are profitable. No coal plant or
17 nuclear power plant in the market because they're
18 simply not economic. Life cycles are profitable, and
19 that's why we gave up building.
20 So without going into any more length
21 for the moment, the bottom line there is that PJM
22 markets are working. They're dynamic; they are

1 resilient, and they are reliable. We have a reserve
2 margin well in excess of what's actually needed.
3 People have to pay for that. We don't really need a
4 ton; a few can act as reserve margin and provide
5 countless solutions -- actually Paul and I have much
6 to say in this, the possible solutions.
7 There really isn't, in my view, a
8 fundamental market design problem that needs fixing.
9 DOE did adopt, notwithstanding; price formation
10 generally contrary, not withstanding; capacity market
11 redesign, not withstanding. There isn't an
12 identified problem that needs fixing. So that's the
13 question I always ask of people who offer solutions,
14 exactly what problem is it that you are you trying to
15 solve.
16 The markets needs to be
17 self-sustaining, by which I mean the revenues from
18 markets have to provide adequate incentive to provide
19 new power. The demand side of the DER, whatever it
20 is, have to provide power, and also have to provide
21 right signals to exit.
22 And The PJM market is self-sustaining,

1 I believe. The MISO market is not. The MISO
2 market's actually not a market when you think about
3 it. It is dispatch -- it's a very efficient LMP
4 dispatch, which is great, on top a service
5 regulation. That model can absolutely work. You can
6 substitute for PJM at any point, but it's a different
7 choice. And when we think about market, you just
8 have to think about what that choice is.
9 Again, I'm not saying one's right or
10 wrong, just they are different, and the PJM model
11 relies on markets for the entirety of the revenue
12 stream whereas MISO, California, do not, as BP is
13 very similar.
14 And so thinking about markets, we need
15 to think about whether we want them to -- we really
16 want them to be self-sustaining, and that's where
17 we're getting price signals or not.
18 So, again, the tension between the
19 desire to do planning and IRP type approaches to
20 things, and figuring how to get the prices right so
21 we really get bottom-up. So you mentioned bottom-up,
22 you mentioned detailed price signals. I agreed that

1 that's how you get a response. That's an innovation,
2 that's the stuff that we can't even dream of today;
3 someone else will come up with tomorrow. You get
4 good pricing down -- as Paul pointed out, know, I
5 mean, people think about PJM as normal price. It's
6 really not. There's no price in generators. It's
7 not nodal pricing on load. It is a -- it is
8 zone-wide pricing. It's astonishing when you think
9 about it.
10 I've had -- almost had things thrown
11 at me, and say, well, the process only suggests we go
12 with nodal pricing. I think -- if you really want to
13 be serious about DER, if you want to be serious about
14 demand-side, if you want to be serious about
15 customer-side participation, you need to think very
16 carefully about that.
17 Now, don't mistake what I'm saying,
18 because it can be very -- you can cause dislocations.
19 It could cause you, on one side of the street, have a
20 very different price than your neighbor on the other
21 side of the street. It can cause big manufacturing
22 facilities to suddenly have to pay a lot more than

1 they were. It could cause others to pay a lot less.
2 You have to be careful about transition.
3 But if gives people the right signal
4 of where to locate. You actually want the new
5 factory, a new center for data handling to be in a
6 low-cost area, not in a high-cost area, on the right
7 side of the street, not the wrong side of the street.
8 The only way you get there is by doing pricing long
9 months away, what Paul was talking about.
10 So markets are, as we've heard, and I
11 think correctly, market -- and don't ever
12 misunderstand that I think they are perfect. Markets
13 are not perfect; PJM markets are not perfect.
14 One inattention was highlighted by, in
15 a way, is the tension between transmission right now,
16 transmission and generation. When you think about
17 it, they're actually substitutes. If you have a
18 reliability problem, you can solve it many cases by
19 extending transmission or by building a generator.
20 In the olden days, you'd jump through IRPs. Someone
21 did the calculations and decided which was cheaper,
22 and did one or the other: built a local generator

1 which now would be local market power, or built the
2 transmission line if it was cheaper.
3 But the markets don't deal with that
4 choice. They really don't deal with it very well at
5 all. One in one thousand is a very, very small step
6 in that direction. But the problem is that we now
7 talk about tradeoffs between DER and the need for
8 substations and the need for distribution-level
9 investment. That's another area where the markets
10 don't work very well at the moment.
11 But to go back to what Paul said, that
12 no pricing -- dynamic pricing, scarcity pricing --
13 pricing that actually reflects the minute-to-minute
14 value of energy is ultimately the way to give people
15 signals in which they can respond and will respond
16 effectively, economically and in dynamic ways that we
17 can't imagine.
18 So just -- so now I'm going to tic
19 down very quickly my list of things that are -- I
20 think, are critical today in the markets that
21 continue to work well.
22 One is if you believe that carbon are

1 a fluke, the efficient way to do it -- I think every
2 economist in the universe agrees -- is to have a
3 price. Doesn't even matter what it is, you need a
4 price. I've encouraged PJM, in the spirt of trying
5 to get PJM or its members across all states to think
6 about it and do their -- to run their models, to show
7 everybody what the impact would be if they're
8 different models a price. Choose your price, it
9 doesn't really matter.
10 What would be the impact on the units
11 and each individual state? What would be the impact
12 on the revenue to the state, as carbon prices create
13 revenues for states well. Just ask anyone that's
14 involved. As you know, there's a lot of money that
15 flows to states that are participating. There are --
16 there is a solution there somewhere, but member
17 states, member representatives can't be expected to
18 accomplish solution. Particularly states without
19 understanding what the real facts are, and you all
20 don't know. States don't know.
21 States need to know, so I would
22 encourage PJM to do that just to see if there is a

way across the entire footprint to do carbon pricing. I actually don't agree it's costs are from carbon pricing in one state or two states. Some are trying to talk about how to do that, but it's very difficult to see how that really works. It clearly would be ideal to do it at the very least at the level PJM thought of that.

So carbon pricing, improved scarcity pricing, and I agree with what Paul said about that. I agree we want to -- reevaluating long-time reliability standard hasn't really looked at it in quite some time. There are all, in terms of resilience and reliability, something that was mentioned that we need to make sure we address all the gas reliability issues, gas supply issues, which are critical.

But I also agree with Paul on the demand side. The demand-side is an incredibly flexible resource. It is now being constrained, as Paul pointed out, by the rules of the capacity market, which are actually resulting in the less dynamic, less available than it could be were it

1 outside the market.

2 Again, I agree with Paul that we need

3 to figure out where we're heading. The unfortunate

4 thing about 18 years is it's true, and it just means

5 that the forecasting process is not dynamic enough so

6 that demand-side customers don't see the price and

7 can't react quickly enough, and can't get paid

8 immediately, and then see the impact on demand and

9 overall pricing. That's the way it should work. We

10 need a much more dynamic demand side. The rules

11 about how demand participates in the markets have to

12 change to permit that.

13 And something else that Paul talked

14 about here with, and it's a real tough thing. So

15 I've worked for emissions and done rate design.

16 Retail rate design -- when we talk about having to

17 price it under the retail rate design, that's a state

18 level issue; that's very difficult to do it. And it

19 having dynamic redesigns would be a really dramatic

20 change from what happens now in most states. I think

21 it's very important to do and think about it, but we

22 shouldn't underestimate how difficult it is to do

1 that.

2 Let me stop there, and I look forward

3 to a conversation and any questions to take.

4 Thank you.

5 MR. DELGADO: Thank you, Dr. Bowring.

6 So we'll now move on to our Q&A

7 portion of our panel. And I'll begin by asking a

8 question for Mr. Paladino.

9 So Illinois is about to receive an

10 influx of renewable energy, particularly wind, solar

11 through the Future Energy Jobs Act. And you

12 mentioned the different phrases and Commissioner was

13 also mentioned as far as the timeline. It seemed to

14 me that there are signals that tell you how to you

15 evolve through those different phases.

16 So in light of the integration and

17 distributed energy resource that's supposed to happen

18 here in Illinois, how will that impact the regional

19 and local markets, or what consideration should be

20 made within the markets?

21 MR. PALADINO: All right. I'm not sure if I

22 can completely answer that question, but -- you know,

1 I -- and I haven't done a complete analysis yet, or
2 people I work with haven't.
3 There's this -- going back to our
4 discussion here, there is this -- and maybe there's a
5 tension. I don't know how to resolve that. There is
6 a belief that markets can solve everything, right?
7 Right? And --
8 DR. BOWRING: More than planners, let's put it
9 that way.
10 MR. PALADINO: Excuse me?
11 DR. BOWRING: More than planners.
12 MR. PALADINO: More than planners. Okay. That
13 was -- I would agree with that.
14 But I think the part that needs to be
15 really thought about diligently is you have to
16 design -- you have to design the system to be able to
17 enable the -- and manage frequency, power flow
18 voltage, et cetera. And however the market is
19 created, you've got to have a system that can
20 function and maintain that reliability, et cetera.
21 So I haven't fully thought through
22 this, but you can develop markets, but as you develop

1 those markets you really need to under- -- you need
2 to also understand what the structure of that center
3 of physical system needs to be to maintain that,
4 right?
5 So given that then, as you bring on
6 more DERs, right, there probably is a proportional
7 phase strategy to build out that system and to
8 actually advance the markets, right, and it's really
9 a phase approach for doing that. I'm not sure what
10 that is. Okay? But a stage strategy that respects
11 both the markets as well as the system that needs to
12 be built out. It's one of the best responses I can
13 give you right now. I don't have more milestone
14 objectives.
15 DR. BOWRING: Yeah. So I would just add that
16 clearly, this is a -- I mean, a difference in the
17 markets creating changes that might not occur as a
18 result of the market, but -- unless the market
19 doesn't have to adapt to it.
20 So, of course, the system has to be,
21 you know, the standards you discussed, and that's the
22 point about transmission distribution planning. You

1 have to be able to meet all the various electrical
2 engineering elements that you want to remain
3 reliable.
4 But we also have to be able to think
5 about -- and I was talking about this morning, a
6 little bit about the information that flows up and
7 down. But to the extent that DER's behind the meter,
8 it's going to affect -- it's going to affect
9 forecast. It's going to affect how PJM manages; to
10 the extent that it can be transparent at PJM, that's
11 good.
12 But I think it will also provide an
13 ongoing reality check to see how -- whether the DER
14 that's being implemented is truly economic. Whether
15 it really makes sense. Whether it's the most
16 sensible choice, and whether there are more effective
17 ways to -- for customers to spend money to maintain
18 reliabilities of these costs than doing predesigned
19 DER programs.
20 MR. CENTOLELLA: So I'm going to -- do a little
21 bit to perhaps pile on and extend what Joseph said.
22 (Laughter.)

1 MR. CENTOLELLA: And, you know, so I do think
2 that there is -- that this clearly is a very
3 important challenge, both from an RTO level, but also
4 within the distribution system. Distribution
5 facilities today often have very limited visibility
6 into the low voltage side of their distribution
7 system where there is a great deal of volatility
8 going on. And so that's an additional visibility
9 challenge.
10 Beyond that, you know, I think it
11 becomes very important to think about system
12 architecture, and in particular what is the
13 relationship between, you know, the bulk power system
14 and the distribution system, and ultimately the
15 distributed resource? It becomes very tricky if you
16 have sort of third-party aggregators out here going
17 around the distribution system operator, begin to
18 pull in distributed energy resources into bulk power
19 system without clear rules and communications about
20 how those layers interact.
21 The final point I would make here is
22 that I think as you get a much more responsive

1 demand; as you get, you know, response of EVs; as you
2 think about how you control voltage in the
3 distribution system, you're going to be thinking
4 about this in ways that are different from the way we
5 manage bulk power system. You simply are not going
6 to be able to have centralized security constraints
7 dispatch every distributed resource on the system,
8 particularly when we start talking about responsive
9 demand of electric vehicles.
10 So what that means is that there's
11 probably some combination of dispatch of some things,
12 where they matter and where they're large; having
13 some form of localized market that begins to provide
14 price signals and coordinates many of these other
15 devices; and then, particularly on the lower voltage
16 side of distribution where there's a lot of
17 volatility and it's a very vast sub-cycle power that
18 begins to manage those disturbances. This is one of
19 the areas in which ELV has some ongoing research to
20 try to think about what do those future control
21 systems look like. I don't think we fully have the
22 answer, but my hypothesis is you probably need some

1 combination of those three.

2 DR. BOWRING: I agree with both those points.

3 The first one about aggregation, as we

4 talked a little bit at the beginning, but I didn't

5 hear as much as I think we should. It's come up some

6 DER working right now, but it was a precedent and a

7 purpose that said that you can't pretend that you

8 serve the customers down the road even though you're

9 an -- a generator. If you do, you have to go through

10 the transmission system and be treated like a normal

11 generator.

12 Now, we're talking about the same

13 thing, except its all behind the PJM meter.

14 Effectively, it's not officially within the

15 distribution system. And really the same logic

16 should apply. You have to be very careful about

17 letting, as you said, aggregators use the

18 distribution system and transition system and not pay

19 for it and not be subject to all the rules that apply

20 to the use of those systems.

21 And I would say I absolutely agree.

22 It goes without saying. You cannot send to dispatch

1 tens of millions of general resources. That's not
2 how markets work, but of course you're not going to
3 dispatch even the price signal doesn't respond, and
4 your system's going to have to be dynamic enough to
5 be able to adjust if you need enough frequency,
6 control enough, reactive enough, regulation enough
7 that you can adapt to all that. But it's also a big
8 complicated -- a big complicated system which will --
9 which you don't have to cont- -- you don't have to
10 offset every little thing, but it will result in it's
11 own equilibrium.
12 So I think those are both very good
13 points -- the whole point about aggregation's really
14 tough. It's a tough question for you all and also on
15 the PJM level.
16 MS. McKEON: Thank you very much.
17 We've gotten a lot of information
18 here. Also, I want to check in with the
19 Commissioners to make sure that there's no questions
20 from you all.
21 CHAIRMAN SHEAHAN: Yeah. I'm wondering if the
22 panel could address the impact of the integration of

1 DERs on a wide basis, you know, reflected in the
2 expression of the RPSs by a lot of states, and what
3 the threshold of that impact would be on the
4 wholesale markets where you think it would begin to
5 have, you know, a significant or material impact.
6 MR. CENTOLELLA: So it really is a question of
7 "it depends." So, you know, it's hard to give you --
8 it's not -- so I can start by saying PJM did an
9 analysis earlier this year where they said if we
10 essentially keep the, you know, the level of
11 resources in the market, add a kind of projected
12 baseline level that beats 1 in 10, we don't have
13 transmission, we don't have storage, we don't have
14 demand response, and we put in lots of PV and wind,
15 you know, then we would have a reliability problem.
16 Well, you know, that's fine, except
17 that's not the way the PJM market works. PJM market
18 has a capacity system that maintains 1 in 10 LOLEs so
19 that you would, in fact, add more resources if you
20 were getting into that -- that situation.
21 So you can do a market that's very
22 heavy in the rules, yes, but it's going to be a more

1 expensive market than if you had other things to
2 offset the variability.
3 So it's really a more -- I think a
4 question of efficiency than anything else. You know,
5 you certainly have people who have made very bold
6 claims about how far you can go with renewable
7 energy. I'm not sure I buy all of them. But at a
8 minimum, if you're going to go with very deep
9 renewables, you're going to need a lot more
10 transmission, you're going to need a lot more
11 capacity, and you're going to need some storage or
12 something else to offset.
13 DR. BOWRING: I would say we're at the point
14 right now -- so we have about a little than five
15 percent of renewables in PJM, if you have a broad
16 definition of renewables. I think we're at the point
17 where it's beginning to effect price and will
18 continue to effect price. Clearly, it's a much
19 slower integration at PJM than it is elsewhere. In
20 California it's the opposite extreme.
21 But it raises the question about the
22 RPS program. So in our latest iteration of our

1 proposal in the famous PJM staple or CCPPSDF -- I
2 can't tell you want it stands for, but it has to do
3 with redesign of capacity market. In that, we made
4 our proposal using a piece of that (inaudible).
5 But after talking to renewable folks,
6 at some length, the states, we added an exception for
7 RPS. But we -- what we're suggesting is in order to
8 be exempt, RPS shouldn't be purely competitively.
9 So, I mean, ideally -- ideally,
10 ultimately renewables -- and I think we're close to
11 that -- we can't compete with everybody else. The
12 cost of solar, for example, it's got to be down.
13 We'd be able to compete with everyone else in the
14 market.
15 It's always a question about
16 subsidies. I mean, you have to subsidize over the
17 years, you have a sublease to other resource types.
18 Considering renewables are so -- are not -- it makes
19 sense to do that. They bring -- they bring new
20 technology to the market. And your question, is at
21 what point -- really, at what point do you all want
22 really do that? I think we're in that transition

1 stage.

2 One question to ask of the RPS program

3 in particular is what's their design hope? So if you

4 take the penalty price in New Jersey, for example,

5 for extracts, you transition over carbon price for

6 roughly $300 a ton, which is a 100 times higher than

7 some other parts of the world, and many times --

8 probably six times higher than what people think is

9 the social price of carbon.

10 So if the idea is to produce carbon,

11 then that's not a very cost effective way of doing

12 it. If it's another purpose, then -- I mean, if

13 anything, it's always better to be explicit about

14 what the purposes are.

15 So the short answer is it's right at

16 the point where it's affecting markets. My view of

17 it is the more we can bring renewables into the

18 market, the better off we are. Renewables clearly

19 are going to be part of the future. I mean, the

20 study that I think Paul's referred to, or a part of

21 it, pointed out that PJM would survive just fine with

22 85 percent gas and the rest renewables.

1 I mean, people have thought about gas
2 as a transition fuel to a more heavily renewable
3 future for a long time. I think that makes sense.
4 We have to figure out how to integrate rules a little
5 more so it doesn't destroy market signals for others.
6 And as Paul said, we have a balance, the thermal
7 necessary for balance renewables, and renewables are
8 cost effective for customers.
9 MR. PALADINO: I'll just add one that note
10 here. I think it's -- we don't have rules that we
11 really should, but I think it's really important to
12 look at load curve because -- you know when I talk
13 about load curve, we're talking about how much demand
14 we have over a day. And that curve changes a lot.
15 That curve changes when you all of a
16 sudden -- and all of a sudden we're shifting where
17 peak demand is. If you add energy storage to that
18 system, all of a sudden the loads curve changes. If
19 you add time of use for rates on top that, the load
20 curve changes.
21 And so if you have electric vehicles,
22 you can start timing on all this distributed energy

1 resources, and that's going to impact the shape of a
2 load curve, and that's going to impact -- that's
3 going to impact how much generation capacity you
4 actually even need. And so we need to have a
5 capability to understand how we're impacting the load
6 curve and how policies can actually influence the
7 shape of that load curve. You institute a tunnel,
8 you write them off, right?
9 So technology associated is really
10 complicated, and part of it is looking at how these
11 technologies actually impact the dynamic.
12 DR. BOWRING: So I would say markets help you
13 get there, right? As load changes, the price
14 changes. Paul was talking about the DERs, in fact,
15 it has a different job, a different location, and a
16 different time from one minute to the next. If you
17 let the prices get there, then you don't have to do
18 forecasting to figure it out. It's an integrative
19 process between prices and other people.
20 MS. McKEON: Thank you all very much.
21 We had a question tweeted to us from
22 @CUB Illinois about subsidies, so it's not straying

1 too far from what we discussed, I'm sure. Don't
2 worry.
3 So @Cub Illinois writes, "States have
4 expressed preferences for certain types of generation
5 to meet various needs, including public health,
6 environmental policy targets, et cetera.
7 Do you think such preferences are
8 inherently illegitimate? If not, explain how you
9 would draw line and differentiate between good
10 subsidies and bad subsidies.
11 DR. BOWRING: So that's not an complex
12 question, right?
13 No, it's -- right. That's what it's
14 all about. So of course I don't judge what peoples'
15 preferences are. People have different preferences,
16 but my preference is to let the market work. I
17 think -- I mean, if -- not -- I mean, I'm not even
18 saying that you can say that all subsidies are bad.
19 There are a million subsidies. There are taxes and
20 local things.
21 So where I would draw the line is
22 between purely local, as in the sense a state versus

1 federal. So if the federal government -- hopefully
2 they won't go repealing over -- but if the federal
3 government does production tax credits, for example,
4 or does renewable requirements or something like
5 that, it applies the same for everybody. I can
6 understand that. I don't think the market can work
7 with different subsidy levels in different states. I
8 think that one should be taught -- or let the market
9 work as much as it can.
10 So the problem with the markets is
11 they're actually really tough. They're are a lot
12 tougher than planners are, simply because they -- you
13 know, they don't have feelings. They just -- if the
14 prices are low, the markets are going to retire. It
15 retires, and that's usually the end of it. So that's
16 what the market says, and then -- so you can counter
17 that, at some extent, with public policy. But I
18 don't think there's any public policy that's going to
19 change the basic economics for coal units.
20 There are coal units at PJM are still
21 economic doormates [sic]. So -- but they're 27,000
22 megawatts retired because they were 50 years and

1 weren't economic through the age. There's another
2 12,000 that are at risk for the same reason.
3 So I really can't tell -- I'm not
4 trying to tell people what their values should be,
5 but what we're trying to do is protect markets from
6 intervention so that people's preferences can be
7 expressed through markets.
8 And every time you retain an old
9 technology, there's an opportunity cost. So if you
10 retain an old technology, you keep all the coal, pay
11 costs of service. That means that we don't have the
12 need for DER, we don't have need for wind, we don't
13 have need for solar. We don't have need for the
14 other technologies. Another person might have never
15 thought of about including DER.
16 So I'm looking forward to follow-up
17 questions, but that's my --
18 MR. CENTOLELLA: I'll take a slightly, if you
19 will -- on what Joe said, I guess.
20 So one of the things I would say is
21 that if you're going -- all of reforms I've talked
22 about, they all involve some socialization of cost or

1 investment risk or environmental words, and they're
2 being done by an RTO which is not, you know, an
3 elected body, and they're -- yes, they're being
4 approved FERC, but they're being approved by FERC
5 under a statute where FERC is obligated to approve
6 tariffs that are proposed that are just and
7 reasonable -- within the zone of reasonable. So it's
8 not really a totally independent decision by FERC to
9 do this.
10 So I find that problematic as a -- you
11 know, as a process. I would much rather see the RTO
12 stick to doing efficiency and reliability through
13 efficient market mechanisms.
14 Now, where I think I may start with a
15 slightly different point than Joe starts with,
16 because I do think, you know, there are some market
17 values in terms of the value you incorporate carbon
18 and other environmental in markets. And I recognize
19 that states are in a hard place because the right
20 answer would be to have a single economy-wide carbon
21 cost, which we don't have. And so I'm, perhaps, more
22 sympathetic than I suspect Joe is to what Illinois

1 did in terms of the zero-emission standard, where
2 they were trying to protect some units that would be
3 cost effective at a reasonable carbon price, but may
4 not have been cost effective at the time that this
5 statute was passed.
6 But that's -- you know, I think that's
7 sort of a prequel of the edges, but, you know, I look
8 at it, I guess, from a little bit more long-term
9 perspective of what will it take to eventually get us
10 to market sh- -- market, recognizing the political
11 limitations that we'll all have to deal with.
12 MR. PALADINO: I'll just say that when it comes
13 to subsidies, there are a lot of our social
14 objectives reflected in those. And so, for instance,
15 the subsidies that we had on solar and things like
16 that, right, I mean, obviously that -- those
17 subsidies were based upon a desire to increase the
18 level of renewable energy, right? And to get that
19 technology further accelerated into the marketplace.
20 So the subsidies help to accelerate getting that
21 technology into the marketplace, right?
22 I think purists -- and I don't mean

1 that in a derogatory way at all.

2 (Laughter.)

3 DR. BOWRING: I'll take it that way anyway.

4 MR. PALADINO: Okay. It's not a --

5 DR. BOWRING: I know, I'm teasing.

6 MR. PALADINO: Would rather not have subsidies,

7 right?

8 But, you know, when it comes to how

9 we -- when it comes to how we value the reliability

10 and the environment, et cetera, sometimes there's a

11 little much that's created because we have certain

12 social objectives. We want to make sure that they

13 happen.

14 So sometimes there are intangibles

15 that have to be factored into the system to reach a

16 desired social situation. And social decisions are

17 really local decisions. They're local decisions. So

18 that social set of desires is really based upon a

19 local -- whatever that local population community

20 really wants to achieve.

21 MR. CENTOLELLA: I'm going to raise one small

22 quibble with this gentleman as well. And that is,

1 you know, with respect to the value of subsidies in
2 terms of bringing technology into the market.
3 Yes, I would agree that there are
4 learning by doing benefits from deploying technology
5 and actually doing it. But when you look at some of
6 the literature, and that begins to take apart those;
7 improvement incurs with technology over time. You
8 know, that's really a relatively small component.
9 If you were, for example, wanted to
10 solve the problem, which is a very serious problem of
11 how do we get technologies that could be adopted on a
12 global scale to bring down our carbon emission, it
13 would be much better to spend more of that money
14 doing research, develop a demonstration so that you
15 make the breakthrough that actually makes renewable
16 energy as attractive as having a cell phone. You
17 know, that's the way you'll get developing countries
18 to begin to do clean technology much more quickly
19 than spending money for the --
20 DR. BOWRING: So you're including the United
21 States, and a month ago they had a (inaudible.)
22 (Laughter.)

1 DR. BOWRING: So, I mean, carbon prices is a
2 great example of a social policy that is a rational
3 decision. You think carbon's a pollutant; we want to
4 reduce it. What's the best way to do that? Have a
5 price. I don't regard that as a subsidy. I regard
6 it as pricing externality, of course you have to do
7 that. I mean, I'm not -- I mean, that is -- that's a
8 part of economics; that's a part of the way the
9 markets work.
10 That's very different than saying I'd
11 like that power plant -- that power plant's going to
12 help me reduce carbon. Because it may not be the
13 cheapest way to reduce carbon. And the advantage of
14 market is -- again, the point is to get the cheapest
15 possible solution for customers, whatever the goals
16 are.
17 Of course the social goals are
18 relevant. Of course they have to be incorporated.
19 I'm not sure what the goal of renewable energy is
20 other than it reduces carbon. You don't have to go
21 to it because you don't like renewables. The idea of
22 it is for some actual real reason. You just have to

1 identify the reason and make sure we're pricing it
2 right. If the reason is to reduce carbon, we price
3 is different. If there are other reasons, I'm not
4 sure what they are, but we can price those too.
5 MR. DELGADO: Thank you.
6 We heard about the need of a holistic
7 approach.
8 Can you share a final thought on the
9 future of integrating DER as we close the session.
10 COMMISSIONER EDWARDS: And, in fact, this could
11 be a very quick lightning round.
12 DR. BOWRING: Yeah. I promise. I promise.
13 MR. PALADINO: Okay. Well, I'll just start.
14 This concept of great architecture is
15 really, really important. Because if we're going to
16 have a lot of nodes on the system -- these
17 intelligent nodes on the system, we're talking about
18 distributed energy resources, participants, grid
19 assets, et cetera, and they're allowed to coordinate,
20 they -- they -- we actually need to look at the
21 systems that will enable the effective coordination
22 of these. Okay? And that's going to require a

1 holistic way of looking at all of the different
2 structures, determining how the interface will
3 coordinate, and to make sure that we enable the
4 design -- the design of the system to enable the
5 coordination we really need. There's almost always
6 new intelligence.
7 MR. CENTOLELLA: A couple of quick thoughts:
8 One is get prices right, and that means prices are
9 going to have to be more dynamic than what we have
10 today. And a lot of that can be done, you know, in
11 wholesale pricing. It doesn't all have to be in
12 retail in a sense that you can have a wholesale
13 supply or competitive suppler. It helped customers
14 manage their load. In return, gave them a lower flat
15 pricing then if they were in -- providing that
16 assistance.
17 Second point is pay a lot of attention
18 to distributed intelligence in demand, in electric
19 vehicles, and in smart power electronics to deal with
20 the volatility that you're going to create with the
21 distribution system.
22 DR. BOWRING: If the price is right, let the

1 markets work.

2 I told you I'd be fast.

3 MS. McKEON: You did.

4 Please join me in thanking all of our

5 panelists today.

6 (Applause.)

7 MS. McKEON: I will turn us over to

8 Commissioner Edwards to close us out.

9 COMMISSIONER EDWARDS: Thank you so much again

10 for coming back. Thanks again to our panelists and

11 great moderators. We know how busy your schedules

12 are and we do appreciate you being here.

13 On behalf of the ICC and my fellow

14 Commissioners, I can say that you gave us all a lot

15 to think about moving forward. Thank you again.

16 That concludes today's session. Have

17 a great rest of your week.

18 (Whereupon the above

19 matter was adjourned.)

20

21

22