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United States of America

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FEDERAL ENERGY REGULATORY COMMISSION

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1021st Commission Meeting

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Thursday, November 19th, 2015

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Commission Hearing Room

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888 First Street, Northeast

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Washington, D.C. 20426

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18 The Commission met in open session at 10:02 a.m. when

19 were present:

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NORMAN C. BAY, Chairman

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TONY CLARK, Commissioner

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CHERYL LaFLEUR, Commissioner

24

COLETTE HONORABLE, Commissioner

25

1 FERC STAFF:

2 NATHANIEL DAVIS, Secretary

3 DAVID ANDREJCAK

4 TED FRANKS

5 JAMIE SIMLER

6 ANN MILES

7 MAX MINZNER

8 ARNOLD QUINN

9 LARRY PARKINSON

10

11 PRESENTERS:

12 E2 Elizabeth Topping, OEPI

13 Accompanied by Mariano Messatesta, Eric Krall, Eric

14 Vandenberg, and Colin Beckman

15

16 A3 Todd Hettenbach, OE

17 Accompanied by Stephen Williams, Don Callow, Jamie

18 Marcos, and Demetra Anas

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20 A4 Dr. Imre Gyuk, DOE; Dr. Lorenzo Kristov, Market and

21 Infrastructure Policy Group; Mark Irwin, SoCal-Edison;

22 Kiran Kumaraswamy, AES; and Jason Burwen, ESA

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1 P R O C E E D I N G S

2 (10:02 a.m.)

3 SECRETARY DAVIS: Good morning. The purpose
4 of the Federal Energy Regulatory Commission open meeting
5 is for the Commission to consider the matters that have
6 been duly posted in accordance with the Government and
7 the Sunshine Act. Members of the public are invited to
8 observe, which includes attending, listening, and taking
9 notes. It does not include participating in the meeting
10 or addressing the Commission. Actions that purposely
11 interfere or attempt to interfere with the commencement
12 or conducting of the meeting or inhibits the audience's
13 ability to observe or listen to the meeting, including
14 attempts by audience members who to address the
15 Commission while the meeting is in progress are not
16 permitted. Any persons engaging in such behavior will
17 be asked to leave the building. Anyone who refuses to
18 leave voluntarily will be escorted from the building.

19 Additionally documents presented to the
20 Chairman, Commissioners, or staff during the meeting
21 will not become part of the official record of any
22 Commission proceeding, nor will they require further
23 action by the Commission. If you wish to comment on an
24 ongoing proceeding before the Commission, please visit
25 our website for more information. Thank you for your

1 cooperation.

2 CHAIRMAN BAY: Thank you, Mr. Secretary.
3 Good morning everybody. This is the time and place that
4 has been noticed for the open meeting for the Federal
5 Energy Regulatory Commission to consider the matters
6 that have been duly posted in accordance with the
7 government and the Sunshine Act. Please join us in the
8 pledge of allegiance.

9 (Whereupon the pledge of allegiance commences.)

10 CHAIRMAN BAY: Since the October 15th
11 meeting the Commission has had a very busy month. We've
12 issued 107 notational orders since the October meeting.
13 I should also note that this agenda has been a very,
14 very busy one; there are 60 items on it. I wish to
15 thank my colleagues on the Commission and their advisors
16 and staff for all their hard work that went into this
17 agenda. In fact, I understand that political has termed
18 or Agenda 1 that is longer than Santa's naughty list.

19 (Laughter)

20 But it clearly is much more interesting than
21 Santa's naughty list.

22 The only other announcement I have to make
23 is that I have joined my colleagues, Cheryl and Tony, in
24 entering the 21st center and have opened a Twitter
25 account. I do this with great, great trepidation. I'm

1 told I now have 40 followers all of whom are family
2 members.

3 (Laughter)

4 But I know with all the FERC-erotti out
5 there, and you know who you are, Sabrina, Jay, Collin,
6 that within a few hours I will have 44. So if anyone
7 out there has trouble sleeping at night, chronic
8 insomnia, that kind of thing, please feel free to
9 partake of the Norman Bay Twitter account. And that's
10 it for me.

11 So, Cheryl, any announcements?

12 COMMISSIONER LaFLEUR: Well, thank you,
13 Mr. Chairman. I had a couple of announcements to make
14 from a couple of the items on today's consent agenda. I
15 will not articulate whether they're on the naughty or
16 the nice list. I want to call attention to the three
17 items E4, E5, and E 31, that relates to California's
18 energy imbalance market and MV's participation in that
19 market. I was fortunate to be in California a couple
20 weeks ago for the CAISO stakeholders' summit and there
21 was a tremendous amount of discussion/excitement about
22 the energy and balance market and the potential benefits
23 it offers in balancing renewables across the West. So I
24 would like to thank staff, especially Jennifer Shipley
25 who has been working on this for years, and the whole

1 team for the many orders they put out on this. And also
2 I want to acknowledge the efforts of state regulators
3 and stakeholders who have been working on energy and
4 balance market governance.

5 Second item I just want to call out is E11,
6 in which the Commission denies -- well, proposes that
7 the Commission denies rehearing of our June 2012 order
8 regarding the MISO resource adequacy construct. I'm
9 voting for the order because I believe, based on this
10 record and in the context of the primarily vertically
11 integrated MISO region, the resource adequacy construct
12 that we have approved is just and reasonable. I've
13 often noted that we need to take account of legitimate
14 regional differences, and I think we have tried to do so
15 in this order. But I do want to comment to say that a
16 determination that a market construct is just and
17 reasonable does not mean that it cannot be approved. I
18 want to recognize that there are a lot of efforts
19 underway in the MISO region to consider reforms to the
20 adequacy construct, and I very much encourage parties to
21 stay engaged in these processes and I'll be continuing
22 to follow them closely.

23 Thank you, Mr. Chairman.

24 CHAIRMAN BAY: Thank you, Cheryl.

25 Tony?

1 COMMISSIONER CLARK: Thank you,
2 Mr. Chairman. You now have 45, I just clicked on you
3 just now.

4 I am enjoying the new sight of perspective
5 that I have here on the Commission. There's more seats
6 since the last time. I've never been accused of being
7 to the left of anyone.

8 (Laughter)

9 Here I find myself.

10 CHAIRMAN BAY: What a bad perspective.

11 Isn't it, Tony?

12 (Laughter)

13 COMMISSIONER CLARK: In moderation.

14 (Laughter)

15 I have one announcement to make that I
16 didn't anticipate. Last month I not just predicted but
17 I think I almost all but guaranteed a Chicago Cubs
18 victory by the time I just met. That didn't turn out,
19 but I was close to something, I was on to something.
20 The FERC softball team, who I wish to congratulate --
21 and this is much more impressive than the cup they've
22 been avoiding for the last seven years -- congratulations
23 to all the members of our FERC softball team who won the
24 Commissour's trophy, champion of the D.C. Think Tank
25 Softball League. They defeated AEI, who had been their

1 nemesis for the last few years. I was fortunate enough
2 to join them for their victory party; it was so much
3 that I was invited, that I smelled the barbecue
4 somewhere in the building and just crashed their party,
5 but they were kind enough to let me do that. So
6 congratulations to all the member of the FERC softball
7 team. I understand there was blood, sweat, tears, and
8 some broken bones along the way, but they brought home
9 the gold.

10 (Applause)

11 CHAIRMAN BAY: Thank you, Tony.
12 Colette?

13 COMMISSIONER HONORABLE: Thank you,
14 Mr. Chairman. Good morning everyone. It's good to be
15 here with you. Commissioner Clark, I noticed this
16 morning your beautiful purple tie. And in keeping with
17 your comment you just made you said it's a little bit of
18 red and a little bit of blue. And I said, "I really
19 like that side of you, Tony." He's sitting beside me
20 now so we'll really have to be mindful to be on our best
21 behavior going forward. But I'm delighted to sit beside
22 Commissioner Clark going forward.

23 Your comment about the softball team ws a
24 great segue for me to acknowledge one of my advisors
25 Fred Wilson, who is a member of the team, for his

1 participation in aiding the cause of the spirit of
2 excellence here at FERC. So thank you for participating
3 in that.

4 I also want to thank the FERC staff.
5 Mr. Chairman, thank you for acknowledging the hard work
6 of everyone to get us to this day; it's been quite a
7 month, but an important one. And I want to acknowledge
8 our Chairman, along with my colleagues and our
9 respective teams, for really working on getting these
10 orders out to you. So for anyone who's complaining
11 about how much you've been reading this month, it's for
12 a good cause, and we want to be responsive to your
13 requests.

14 Certainly, last but not least, I want to
15 acknowledge that my team, Team Honorable, is complete
16 with the addition of one, Michelle Brown. Michelle,
17 will you please stand? Michelle is joining me from the
18 office of Phil Moeller, so as you'll recall Commissioner
19 Moeller left us at the end of October. And the greatest
20 gift he could have ever given me and my colleagues in
21 the Team Honorable team is the assistance of Michelle
22 Brown. She's already been tremendous and I'm really
23 looking forward to working with Michelle. If you know
24 her you know she's a bright, radiant spirit and really a
25 delight to visit with on phone or in person. So thank

1 you, Michelle, and we are delighted to have you as part
2 of our team.

3 (Applause)

4 I certainly would like to acknowledge
5 LaQuisha Sims, Rose Johnson, Amanda Humphrey, and Lina
6 Norr who has really helped us hold down the fort until
7 Michelle arrived.

8 Mr. Chairman, I thought we had a pact about
9 Twitter, so I've been waiting patiently. I want to give
10 you your time to get your followers and then I will last
11 but not least certainly jump into the fray.

12 (Laughter)

13 So please stay tuned and I look forward to
14 the presentation this morning.

15 CHAIRMAN BAY: Well, Colette, if you join my
16 Twitter account I'll join yours.

17 COMMISSIONER HONORABLE: It's a bill.

18 CHAIRMAN BAY: Mr. Secretary, I think we're
19 ready to commence.

20 SECRETARY DAVIS: Good morning,
21 Commissioner. First, the Sunshine notice on November
22 the 12th 2015 has been struck from this morning's
23 agenda. Your consent agenda for this morning is as
24 followed: Electric items: E1, E3, E4, E5, E7, E8, E9,
25 E10, E11, E12, E13, E14, E15, E17, E18, E19, E20, E22,

1 E23, E24, E25, E26, E27, E28, E29, E30, E31, E32, E33,
2 E34, E35, E36, E37, E38, E39, E40, E41, E43, E44 E45,
3 E46, and E47. Gas items: G1, G2, G3, G4 and G5. Hydro
4 items: H1, H2, H3, H4, H5, H6, H7 and H8. Certificate
5 items: C2, C3, C4 and C5. I will repeat the
6 certificate items. C2, C3, C4 and C5. As to E47,
7 Commissioner LaFleur is consenting apart with a separate
8 statement. And required by law Commissioner Honorable
9 is not participating in consent items E11, E12, E27,
10 E28, and E34.

11 We're now ready to take a vote on this
12 morning's consent up agenda items, beginning with
13 Commissioner Honorable.

14 COMMISSIONER HONORABLE: Thank you,
15 Mr. Secretary. Noting my recusal on items E11, E12,
16 E27, E28, and E34, I vote aye.

17 SECRETARY DAVIS: Commissioner Clark.

18 COMMISSIONER CLARK: Aye.

19 SECRETARY DAVIS: Commissioner LaFleur.

20 COMMISSIONER LaFLEUR: Noting my partial
21 descent on E47, I vote aye.

22 SECRETARY DAVIS: Chairman Bay.

23 CHAIRMAN BAY: I vote aye.

24 SECRETARY DAVIS: The first presentation and
25 discussion item for this morning is E2, a draft order

1 concerning price formation and energy in ancillary
2 services markets operated by regional transmission
3 organizations, an independent system operator in docket
4 No. 8014-14-000. There will be a presentation by
5 Elizabeth Topping from the Office of Energy Policy and
6 Innovations. She is accompanied by Mariano Mezzatesta
7 from the Office of Energy Policy and Innovations, Eric
8 Krall and Eric Vandenberg from the Office of Energy
9 Market Regulations, and Colin Beckman from the Office of
10 the General Counsel.

11 MS. TOPPING: Good morning, Mr. Chairman and
12 Commissioners, thank you for inviting us to present this
13 morning. Item E2 is a draft order directing reports.
14 This is an another step in the Commission's price
15 formation initiative. The draft order would require RTO
16 and ISO to submit a report on five price formation
17 topics, all of which are associated at a high level with
18 out-of-market actions and associated uplift costs. The
19 five topics of fast-start resources, commitments to
20 manage multiple contingencies, look at head modeling,
21 uplift allocation, and transparency. In the report TRO
22 and ISO will provide an update on current practices in
23 those five areas on the status of efforts, if any, to
24 address each of the five topics, and respond to
25 questions on each topic.

1 Today's draft order focuses on these five
2 price formation topics because they have potential to
3 improve price formation. With the information from the
4 reports the Commission would have the record sufficient
5 to consider potential reforms consistent with the goals
6 of the price formation initiative. These goals include
7 providing incentives to maintain reliability, to
8 facilitate accurate and transparent pricing, to reduce
9 uplift, and for markets participants to operate
10 consistent with dispatch signals. By obtaining
11 information on these five areas, the Commission RTO's
12 and ISO's and stakeholders will also be able to compare
13 practices across state markets. Such comparisons will
14 illustrate the benefits and drawbacks of any particular
15 practice. It is identified unintended consequences from
16 any potential reforms. The information requested in
17 this draft order would not only answer technical
18 questions on each topic, but also explain the reasons
19 why each market has made its set of policy choices. The
20 first three areas of potential reform: Pricing the
21 fast-start resources, commitments to management,
22 contingencies, and look-ahead modeling should assist in
23 meeting several price formation goals. Improvements in
24 these three area would facilitate crises that would
25 accurately reflect the cost of committing resources to

1 maintain reliable operations. First, making
2 block-loaded fast-start resources eligible to scat
3 market clearing prices reveals prices that are more
4 representative of the cost of the marginal resource.
5 Second, including multiple contingency planning in the
6 market model either as a model constraint or through a
7 special reserve product to reduce the need for
8 out-of-market actions. And third, improving the use of
9 look-ahead modeling could improve operational and market
10 efficiency by better anticipating ramping and other
11 system needs.

12 The last two areas of potential reform,
13 uplift allocation and transparency, affect the incentive
14 for market participants to take actions that reduce
15 uplift costs. Allocating uplift costs to market
16 participants who cause those costs could improve
17 incentive to change bidding and operational behavior in
18 ways that potentially cause reduction, improve
19 transparency, and understanding of the drivers of uplift
20 could help limit market uncertainty and could elicit a
21 market response to address system needs when a price
22 signal fails do so. Improved transparency could also
23 facilitate stakeholder discussion about market renewal
24 reform, information on the tradeoffs between different
25 uplift allocation rules, as well as on concerns about

1 the feasibility of improving transparency would help to
2 evaluate potential reforms in these areas.

3 The draft order directs each RTO and ISO to
4 file a report with the Commission within 75 days. After
5 that the public will have 30 days to comment on these
6 reports. Again, with the information from the reports
7 and comments, the Commission would have a record
8 sufficient to consider potential reforms consistent with
9 the goals of its price formation initiative.

10 Thank you. This concludes our presentation.
11 We are happy to answer any questions you may have.

12 CHAIRMAN BAY: Thank you Elizabeth, Eric,
13 Mariono, Eric, and Colin. And thank you to the entire
14 interoffice staff for your efforts to support the
15 Commission's evaluation of price formation issues.
16 These directing reports are a second in a series of
17 Commission action to address price formation issues in
18 the energy and ancillary services markets operated by
19 the RTO's and ISO's. It builds upon the three price
20 formation workshops held last year. While we learned a
21 great deal during the workshops, the Commission
22 concluded that more information would be helpful on the
23 five complex interrelated issues identified on today's
24 order before the Commission could consider further
25 action.

1 I recognize that this order poses many
2 detailed, technical questions that I'd like to express
3 my appreciation to the RTO's and ISO's for their
4 continued engagement in this price formation proceeding.
5 I look forward to the reports from the RTO's and ISO's
6 next February and the stakeholder comments received in
7 response to the reports. Going forward, the Commission
8 will continue its work on market rule reforms based on
9 the record established in the price formation
10 proceeding. Thank you very much.

11 Colleagues?

12 COMMISSIONER LaFLEUR: Thank you,
13 Mr. Chairman. I'd also like to thank the whole team for
14 their work really over the past year on the price
15 formation effort. I think this is one of the most
16 important things we're working on, the effort to
17 strengthen price formation in the energy market. If its
18 markets are to be effective it's critical they send both
19 accurate and transparent price signals in order to
20 attract and sustain investment needed for reliability.
21 And that's always true, but especially right now when
22 we're seeing such tremendous changes in the resource
23 mix. I know there's been a lot of anticipation and even
24 impatience for action in this area.

25 As the Chairman noted, this is second in a

1 series of orders. I don't believe it will be the last
2 step we're talking but I think it's an important one. I
3 wanted to ask the team, I thought it would be useful for
4 you to explain: Given the strong need for Commission
5 action in this area, I want to ask you to explain a
6 little more about the process or vehicle that's
7 reflected in today's order. As an order directing
8 report is a somewhat unusual process, and I'd like you
9 to explain why the decision was made to proceed that way
10 rather than going directly to directing chair of
11 changes?

12 MS. TOPPING: Sure. Thank you for that
13 question. I suspect you're not the only one wondering
14 that, so I appreciate the opportunity to address that.

15 When we looked back at the price formation
16 comments and workshops, I think that there was some
17 issues where the record and the potential next steps
18 were on a relative basis a bit more straight-forward.
19 However, we realize that we needed more information on
20 the mechanics on these topics in terms of not only the
21 mechanics of some of the processes but also on the
22 advantages and disadvantages of some of the different
23 options. Many RTO's have already taken some steps to
24 start addressing these issues, and we think it's really
25 important to understand the reasons why they pursued the

1 options they have pursued. And we also think that will
2 help us identify any potential unintended consequences
3 of any potential action. Also, these topics are very
4 complex price formation topics and they're topics that
5 are interrelated. So the Commission action in any one
6 of these areas may have effects across the other areas.
7 So we thought it was important to ask these as a group.

8 And I think it's also important to note that
9 much of our time thus far has been spent trying to
10 understand the nature of the problem. We heard
11 repeatedly that we needed to get prices right and we
12 spent some time peeling back the layers and getting it
13 specifically what that means in different contexts. And
14 at this point I think we're turning to "Okay, let's try
15 to understand the nature of the solutions." We think
16 that if we get these reports they'll really help us
17 compare practices across markets, and explore also when
18 action may be more appropriate on an RTO-specific basis
19 or on a more generic basis. And I think that's pretty
20 much it.

21 COMMISSIONER LaFLEUR: Thank you very much.
22 I think that's helpful background. And I think the
23 teams did a great job spelling out really pretty
24 detailed questions that I hope will give us a good
25 record to have organized for action. Sorry ISO's and

1 RTO, Happy Thanksgiving.

2 (Laughter)

3 CHAIRMAN BAY: Thank you, Cheryl.

4 Tony?

5 COMMISSIONER CLARK: Thanks to the team for
6 the presentation and for all of work on this. I think
7 Cheryl is exactly right, it's one of the more important
8 things that the Commission is doing right now. And it
9 seems to me it presents a somewhat unique challenge for
10 the Commission in that in many ways the energy markets
11 are best performing in most mature markets. And so we
12 don't want to do things that will mess that up because
13 generally they do work. On the other hand, clearly
14 there have been some issues that have been pointed out
15 to us that maybe needed a checkup and needed tweaking.
16 So it seems to me that this is an appropriate manner in
17 which to deal with this item on an incremental basis so
18 we take it one bite at a time and that we don't have
19 secondary unintended effects if we were to act all at
20 once. This seems like an entirely appropriate way to
21 handle it, although with some urgency knowing especially
22 with some of the winter issues we've had over the past
23 few years we're likely to improve the pricing mechanism
24 in each of these markets.

25 The question that I have is, as the order

1 indicates: Some of these pricing mechanisms, to
2 recognize for example fast-start resources, have already
3 been taking place in some of the ISO's and through
4 enhanced L&P or some of the mechanisms that the enhanced
5 ISO's have been looking at. Being that fast-starting
6 resources are going to be probably such an important
7 part of the grid of the future as you get more
8 fast-start resources coming on line, I'm wondering if
9 the team had any early take-away's in terms of ISO's
10 that have already implemented, some of these enhanced
11 pricing models, when it's had an impact, when it would
12 in market efficiency that have already been able to be
13 noticed, best practices, investment patterns that have
14 happened in any of these ISO's, things like that?

15 MS. TOPPING: Thank you for that question.
16 At this point I think precise impacts on market behavior
17 are difficult to quantify. NICO has used some
18 fast-start resources for some time, and the impacts I
19 think we can talk about conceptually, we haven't had
20 data to show for instance a counter FAC general as
21 indicating what the outcomes would be without that
22 logic. If we look to New England, they recently made a
23 filing where they indicated that if they looked back at
24 last year, using new pricing logic that they proposed,
25 that would have reduced uplift significantly. So we

1 have that.

2 I do want to point out that the request here
3 isn't based on specific empirical evidence of behavioral
4 shifts. Rather, we believe that, all else constant, use
5 of fast-start pricing generally will lead to lower
6 uplift; also, more accurate prices should better result
7 in incentives to respond to real-time system needs; and
8 also inform investment decisions in the long run. There
9 are some fast start pricing reforms that you mentioned,
10 MISO's ELME and also NISO's revision which were recently
11 improved but haven't yet been implemented. Since
12 they're relatively new we'll have to wait to see. We
13 would certainly welcome some of that information from
14 the RTO's in their reports and from commenters [sic] in
15 their comments going forward.

16 COMMISSIONER CLARK: Thanks for that
17 response. And clearly we're all learning from each
18 other. I think this is perhaps get some best practices,
19 I think it's very important in regard to where this is
20 going. Thanks.

21 CHAIRMAN BAY: Thank you, Tony.

22 Colette?

23 COMMISSIONER HONORABLE: Thank you,
24 Mr. Chairman. Thank you Elizabeth and the team and
25 others who aren't sitting at the table. This has been a

1 lift of another kind, a heavy lift. And this is another
2 step on this journey of our collective work on price
3 formation. And I'm really appreciative of your work.
4 And more broadly, when you've been speaking to groups
5 around the country, I've expressed that this is one of
6 my personal priorities while here at the Commission,
7 focusing on price formation, what's working well and
8 more importantly what's working not so well. And so I'm
9 very much looking forward to what the RTO's and ISO's
10 present to us, and equally of importance what we will
11 hear from the commenters [sic]. Because as I understand
12 it, through E2 we are seeking to identify best practices
13 and the FAC general areas that are listed and the
14 Chairman alluded to. And I too recognize that the RTO's
15 and ISO's presently have procedures in place to address
16 each of these issues, but I think Elizabeth alluded to
17 this, the solutions are highly technical and even small
18 implementation details can significantly impact the
19 markets in ways we want to better understand. So I
20 really appreciate this thoughtful approach of seeking
21 additional information. Because, through it, not only
22 will we ascertain best practices but what additional
23 action needs to be taken, either collectively in a way
24 that may impact all RTO's and ISO's, but also it could
25 identify ways in which RTO's and ISO's will act in the

1 participants feel that these issues have stalled in
2 stake holder processes. While we are working I want to
3 gently ask that you continue working too. And that if
4 you identify market flaws and other issues that need to
5 be addressed, please continue to demonstrate your
6 leadership; we will greatly appreciate that. I know
7 that we all embrace the point that it's everyone's
8 responsibility to make sure ensure that our markets are
9 working as intended, and more importantly, as
10 efficiently has possible. So most importantly I look
11 forward to the information that we will get from the
12 regions and equally from the stakeholders. Thank you.

13 Mr. Chairman?

14 CHAIRMAN BAY: Thank you, Colette.

15 SECRETARY DAVIS: We will now take a vote
16 beginning with Commissioner Honorable.

17 COMMISSIONER HONORABLE: I vote aye.

18 SECRETARY DAVIS: Commissioner Clark.

19 COMMISSIONER CLARK: Aye.

20 SECRETARY DAVIS: Commissioner LaFleur.

21 COMMISSIONER LaFLEUR: I vote aye.

22 SECRETARY DAVIS: Chairman Bay.

23 CHAIRMAN BAY: I vote aye.

24 SECRETARY DAVIS: The next presentation and
25 discussion item for this morning is A3. It is

1 concerning 2015 report on enforcement. There will be a
2 presentation by Todd Hettenbach from the Office of
3 Enforcement, Stephen Williams, Don Callow, Jamie Marcos,
4 and Demetra Anas, all from the Office of Enforcement.

5 MR. HETTENBACH: Good morning, Chairman Bay
6 and Commissioners. Today the Office of Enforcement is
7 releasing its annual report on enforcement which
8 provides the public with information on the activities
9 of fiscal year 2015 in all four OE divisions: Analytics
10 and surveillance, audits and accounting, energy market
11 oversight, and investigations. It describes both the
12 public and nonpublic enforcement activities, including
13 audit reports, market reports, market surveillance and
14 data analysis, Commission-approved settlements,
15 investigations, and self reports. Enforcement staff
16 prepared this report recognizing that a substantial
17 amount of our enforcement work is nonpublic and the
18 Commission's regulations and sound public policy
19 generally require that we keep information regarding
20 network. While this makes good sense, it certainly has
21 merit as a policy matter, the lack of complete
22 information may give the public and regulated entities
23 an incomplete view of the Commission's enforcement
24 program. For example, while the public can easily learn
25 about the cases in which staff has found wrongdoing and

1 has recommended further enforcement proceedings, it may
2 not learn about the many others in which staff has found
3 evidence justified to disclose in its investigation.
4 Accordingly, the public may not know that the
5 enforcement poses the majority of its cases at a
6 relatively early stage. This is an important context to
7 consider when OE decides to pursue a potential
8 violation. We have attempted to provide greater
9 transparency regarding the Commission's enforcement
10 activities through the OE reports. As in previous
11 years, staff has provided information regarding the
12 investigations and self reports that the Division of
13 Investigations, or DOI, decided not to pursue in some of
14 the specific factors that contributed to those
15 decisions. We also have included some examples of
16 actors that led us to expend an investigation. Every
17 case is different of course, but we hope that this
18 information is useful for regulated entities and the
19 general public.

20 In addition to information regarding
21 investigations, the annual report also discusses the
22 division of audits and accounting's efforts to ensure
23 that jurisdictional entities that apply with applicable
24 laws and tariff provisions and its recommendations to
25 enhance such compliance in a going-forward basis. The

1 report also provides details regarding the Division of
2 Analytics and Surveillance, or DAS, on investigations.

3 Finally, the report discusses the market
4 analyses that the Division of Energy Market Oversight
5 performs through its assessment of the competitiveness
6 and the efficiency of the wholesale energy market. As
7 the annual report explains, OE's priorities have not
8 changed over the past few years. We have focused and
9 will focus on four distinct areas: Fraud and market
10 manipulation, serious violations of the reliability
11 standards, anticompetitive conduct, and conduct that
12 threatens transparency in the regulated markets.

13 Enforcements staff in 2015 generally addressed these
14 four areas and its accomplishments reflect that work.

15 I will now turn to those accomplishments,
16 starting with DOI. As you know, in recent years the
17 Commission has assessed several penalties against a
18 number of companies and individuals for violating its
19 anti-manipulation rule, and DOI staff filed actions in
20 Federal District Court to enforce those penalty
21 assessment orders. In fiscal year 2015 staff litigated
22 six such actions in Federal District Court, seeking a
23 total of more than half a billion dollars in civil
24 penalties and disbursement. DOI also continued its
25 investigative work in fiscal year 2015. It opened 19

1 new investigations and closed 22. The majority of new
2 investigations involved potential violations with the
3 Commission's anti-manipulation rule and half of those
4 investigations resulted from referrals from DAS or the
5 RTO's or ISO's. Six investigations that were closed
6 were closed through settlements. The most significant
7 settlements related to investigations by FERC and NERC
8 staff into the 2011 outage in the Southwest that left
9 millions without power. DOI resolved that investigation
10 in fiscal year 2015 by settling with four of the
11 remaining companies and closing the investigation as to
12 the fifth. These settlements, along with two
13 settlements approved last year, resulted in the total of
14 \$13.9 million in civil penalties, much of which was
15 offset by the company's agreement to make investments to
16 improve the reliability of the grid. Accordingly, the
17 civil penalties will directly help to ensure the
18 reliable operation of the western interconnection,
19 afitting use of the money and afitting end to the
20 Commission's investigation.

21 Moving to the other divisions, the Division
22 of Audits and Accounting completed 22 audits of oil
23 pipelines, public utility natural gas companies in
24 fiscal year 2015, generating 360 recommendations for
25 corrective action and directing refunds and recoveries

1 totally \$26.3 million. This reflects a substantial
2 increase from fiscal year 2014 during which staff
3 conducted 19 audits and directed \$11.7 million in
4 refunds and recoveries. The Division of Energy Market
5 Oversight continues to monitor wholesale natural gas and
6 electric markets in the fiscal year 2015 to identify
7 market anomalies and inadequate or flawed market rules.
8 It also prevented the Commission's annual
9 state-of-the-market report and seasonable market and
10 reliability assessments, prepared briefings for people
11 inside and outside of government, contributed to the
12 Commission's agenda items and rulemaking, and reviewed
13 compliance of Commission's filing requirements including
14 the electric quarterly reports.

15 Finally, in fiscal year 2015 DAS analyzed
16 market and other data in more than three investigations.
17 It continued to exercise and enhance its market
18 surveillance capabilities. In particular using large
19 trader data from the CFTC, data provided by the RTO's
20 and ISO's under order No. 760, E-tag data provided under
21 order 771, and other sources, staff performed daily and
22 weekly, and monthly training of the wholesale natural
23 gas and electricity markets to identify trading
24 anomalies. It then analyzed those anomalies by using
25 other tools and information provided directly by the

1 market participants and referred sufficient market
2 conduct to DOI. In addition to this analytic
3 surveillance work, DAS also developed a notice of
4 proposed rulemaking regarding a collection of connected
5 entity data that, if adopted as a final rule, will
6 enhance its screening in investigative activities and
7 reduce the number of informal inquiries staff must make
8 based on false surveillance screen trips.

9 A copy of the annual report is now available
10 on the Commission's website. This concludes our
11 presentation, we are happy to answer any questions.

12 CHAIRMAN BAY: Thank you, Todd. And thank
13 you everyone, and everyone in the Office of Enforcement
14 to work as reflected in the annual report. As you
15 noted, the annual report allows the Commission to
16 provide valuable transparency into our enforcement
17 efforts. The report provides the public important
18 insight into the work the Commission performs to ensure
19 the integrity of the markets and it is an equally-useful
20 tool for market participants. The annual report can
21 assist regulated entities in developing a culture of
22 compliance. And it also provides useful insight into
23 the issues that are audits and accounting focuses on the
24 compliance audits, and the report includes a section on
25 compliance alerts, recurring issues that staff and the

1 division of audits and accounting has identified during
2 a course of their work over the year. So I would
3 encourage everyone in the industry to review the report.

4 Colleagues?

5 COMMISSIONER LaFLEUR: Thank you very much,
6 Mr. Chairman. And thank you, Todd, and everyone at OE
7 for this excellent report. Certainly, transparency in
8 our enforcement work is very important, I think that's
9 increasingly true as our work has ramped up and matured
10 over the last few years. Every year I hold up a copy
11 the report, so I'll do it again.

12 (Laughter)

13 I do think it's required reading. Unlike some of
14 the things that I talked about yesterday, it easily fits
15 in your briefcase and is a substantive read. I also
16 want to give a shout-out to our Government colleagues at
17 the CFTC, the information-sharing under our Memorandum
18 of Understanding, which was just renewed for a second
19 year several months ago, has been important to our work
20 and I'm happy that's going forward.

21 I want to ask a couple questions just to peel the
22 onion a little more here: A few years ago it seemed
23 like most of the market manipulation cases that came all
24 the way through the process seemed to relate to trading
25 in the physical markets to benefit the financial

1 markets, or kind of cross trade, and it seemed like we
2 have seen different sorts of cases more recently. Can
3 you comment a little on any trades you're seeing in
4 manipulative conduct and the cases you're taking on?

5 MR. HETTENBACH: Yeah. Thank you for that
6 question, Commissioner LaFleur. I think it was
7 certainly the case that in some of our earlier
8 higher-profile manipulation cases they were what we
9 think of as cross-market manipulation. The Amreneth
10 (phonetic) case comes to mind, and there are certainly
11 others. And certainly some of the more recent cases
12 that we've seen are more of the gaming-type manipulation
13 cases, the Up To Congestion [sic] cases being an example
14 of that. It's difficult, though, to trend from the data
15 because certainly we've had a mis of manipulation cases
16 all through process. Perhaps there was a bit of a focus
17 on the cross-market manipulation cases earlier, and
18 based on various circumstances we may have some more of
19 the gaming-type cases now. But we still have some
20 cross-market manipulation cases today that the Twin
21 Cities settlement at the Commission approved last year,
22 one example of that. So I don't know that there's
23 necessarily a trend in changing the type of manipulation
24 that we're seeing. Certainly, the Commission, the
25 Office of Enforcement, is continuing to look at all

1 different types of manipulation and looking at merging
2 perhaps types of manipulation.

3 One thing that I will say, though, is that
4 we have had a strong referrals from our ISO and RTO, and
5 that I think contributes to some of what we're seeing in
6 the gaming area. If that continues, and I expect it
7 will, we may see more of that.

8 COMMISSIONER LaFLEUR: So do you think with
9 the ramped-up activities of the Division of Analytics
10 and Surveillance and your work with the IMM's, you're
11 having more cases about the actual markets that we
12 regulate directly rather than cross markets?

13 MR. HETTENBACH: I wouldn't draw a
14 distinction between the markets that we regulate versus
15 cross markets. But what I would say is that the mutuals
16 that our Division of Analytics and Surveillance has has
17 worked wonders in our ability to identify emerging
18 manipulation trends and emerging manipulations. What we
19 tend to get, speaking as someone who works in the
20 Division of Investigations, we tend to get better
21 referrals, we tend to get them earlier, and we tend to
22 have a lot more information to work with when we start.

23 COMMISSIONER LaFLEUR: Well, that leads to
24 my second question, which I told you that I was going to
25 ask. So I don't want to disappoint.

1 (Laughter)

2 I know you get information from a lot of
3 different sources, the RTO's and the IMM's and your own
4 work and complaints that people bring in the hotline.
5 Is there any breakdown of kind of where you get the
6 referrals that lead to your investigations?

7 MR. HETTENBACH: Well, since you've pulled
8 back the curtain, I can look now at the numbers.

9 (Laughter)

10 In 2015 the largest source of referrals that
11 we got were from the ISO's, and the market monitors.
12 But in that year, as well as in previous years, we got a
13 steady treatment from refers from DAS, and that's in
14 addition to any of informal discussion that we might
15 have with DAS, they sit down the hall from us. Last
16 year we had more Commission referrals than we have in
17 the past, we had four of those. Those are our biggest
18 categories. Beyond that, we'll normally have a few from
19 various categories. Hotline, self reports, other
20 government agencies, other Commission program offices,
21 sometimes staff will look at the newspaper and see
22 something. So it's a variety of sources beyond that.
23 We do encourage, as always, members of the public or
24 regulated entities to report any conduct that they see.
25 COMMISSIONER LaFLEUR: Well, thank you very

1 much, both for doing the work to get that answer and for
2 your presentation.

3 MR. HETTENBACH: Thank you.

4 CHAIRMAN BAY: Thank you, Cheryl.

5 Tony?

6 COMMISSIONER CLARK: Thanks, Mr. Chairman.

7 Thanks to all the members on the team for the
8 presentation today. This is always a good opportunity,
9 as my colleagues noted, to highlight the work at the
10 Office of Enforcement, and through the report, gain some
11 insight to the public and market participants on the
12 work that you all do. I am going to commit the ultimate
13 Commissioner faux pas and ask a question that I didn't
14 prepare. It occurred to me as Cheryl was asking hers,
15 and it's this: Commissioner LaFleur had asked about any
16 trends that you had noticed in market manipulation
17 enforcement cases, anticompetitive behavior, things like
18 that. I'm wondering if a similar question could be
19 asked about the reliability side of things or
20 reliability investigations such that it tends to be
21 whatever just happened to be on the plate on that
22 particular year. So, for example, the Southwest, some
23 of the settlements seem to dominate this particular
24 year's activities. But I wonder if there's any greater
25 trend that could be identified in terms of reliability

1 work?

2 MS. MARCOS: Thank you, Commissioner Clark.
3 I think I'll help Todd out on that one having been one
4 of the folks involved in the Arizona-Southern California
5 reliability settlement. We do continue to have some
6 reliability matters. The Commission has a strong
7 program in the Office of Electric Reliability, as well
8 as the duties of NERC with respect to addressing
9 compliance issues early on. And so I think those two
10 groups start and are the initial backstop on a lot of
11 the reliability compliance issues. And we tend to see
12 the more substantive larger ones in the Office of
13 Enforcement.

14 COMMISSIONER CLARK: Thank you very much.

15 CHAIRMAN BAY: Thank you.

16 Colette?

17 COMMISSIONER HONORABLE: Thank you,
18 Mr. Chairman. Thank you for your work in putting
19 together this report which is reflective in a very
20 transparent way of the very, very busy year that you've
21 had. I think it also serves to highlight some of the
22 Commission's priorities, as well as -- which I think is
23 equally of importance for stakeholders and in particular
24 people that interact with the Office of Enforcement --
25 maybe why you chose not to pursue matters in certain

1 cases, I think that's very instructive and very helpful.
2 And I, too, commend the report for stakeholders because
3 it's valuable reading, particularly for those who are
4 trying to understand some of the trends and some of the
5 enforcement actions that have been taken, and if not why
6 not? I also appreciate that this report highlights a
7 number of objectives that the Office of Enforcement
8 meets to ensure the integrity of the markets, to ensure
9 reliability. And more importantly from my perspective
10 there is a strong consumer protection component to your
11 work. So I want to thank you for that because it means
12 that consumers are getting our very best work. I, too,
13 learn so much from the report, this having been my first
14 year here, and certainly working through the dockets
15 this year I've gained a greater appreciation for your
16 work and I look forward to the work that we will do
17 together to protect markets and ultimately consumers.
18 Thank you very much.

19 CHAIRMAN BAY: Thank you, Colette.

20 Mr. Secretary.

21 SECRETARY DAVIS: The last presentation and
22 discussion item for this morning is A4, concerning
23 energy storage panel. There will be a PowerPoint
24 presentation. Presenters are Dr. Imre Gyuk, energy
25 storage program manager Sandia Labs, Department of

1 Energy; Dr. Lorenzo Kristov, principal, Market and
2 Infrastructure Policy Group, California Independent
3 System Operator; Mark Irwin, director, Technology
4 Development, Advanced Technology, Southern California
5 Edison; Kiran Kumaraswamy, director, energy storage U.S.
6 Market Development, AES energy storage; and Jason
7 Burwen, Policy and Advocacy director, Energy Storage
8 Association.

9 CHAIRMAN BAY: Well, thank you very much for
10 being here today. We very much look forward to hearing
11 your presentation. And I believe it begins with Dr.
12 Gyuk. And, by the way, I have to give a shout-out for
13 Sandia Labs which is located in my hometown of
14 Albuquerque, New Mexico.

15 DR. GYUK: Well, I am very glad to
16 acknowledge Sandia Laboratories, along with Pacific
17 Northwest Laboratory and Oakridge. However, I am not
18 part of Sandia Labs. I have projects there.

19 I'm going to offer a few somewhat casual
20 remarks: Energy storage and where it seems to be going.
21 Energy storage, when we got involved in this field about
22 12 years ago, was the realm of a handful of dreamers.
23 It meant nothing to utilities; there was no real
24 industry; it was just a thing that we thought ought to
25 be done. So since then this has developed into one of

1 the hottest topics in the electricity work, along with
2 smart grid and a few others. And it gives me great
3 pleasure to be here at the Federal Energy Regulatory
4 Commission and be able to be at the state of tremendous
5 development of this industry.

6 So, anyway, I am the program manager for the
7 energy storage program at the Office of Energy. And the
8 first thing I was asked to do was chat a little bit
9 about types of energy storage: What do we have in our
10 arsenal? Well, first of all, we have of course lithium
11 ion. Lithium ion is a convenient solution: It's
12 compact and it's tied into the DV development which is
13 something else that is rapidly moving into the field.
14 And the hope is that, with large employment of electric
15 vehicles, we are going to innovate/piggyback stationary
16 applications on the development of these batteries.
17 Lithium ion batteries are readily available, most are
18 ready from the other side of the Pacific Rim, which is
19 something that concerns me a little bit. There are also
20 safety issues which also concern me. In fact we have
21 started three safety working groups which have about
22 nine people working in them to consider various aspects
23 of safety and develop appropriate codes, standards,
24 outreach activities, and further research into safety
25 and such. The other problem is that there is really no

1 recycling of lithium ion, and we would like to see
2 something either in reuse or eventually recycling. Then
3 there is lead acid, and in particular advanced lead acid
4 is a form of lead carbon, sometimes called "sleeping
5 giant" because it's a huge industry and it's still the
6 most common one, has an excellent safety record, and is
7 98 percent recyclable, some say 99, it's astonishing.
8 In fact, we led the industry with function because there
9 simply isn't enough lead being mined.

10 And then we have flow batteries. These are
11 true-energy batteries, unlike lithium ion which is
12 basically a power battery. In particular I'm interested
13 in the vanadium batteries, but these are not the only
14 ones, and we have managed to reduce the cost by one
15 half, and they're about 10 megawatts being deployed
16 nowadays. The trouble is vanadium, vanadium I'm is still
17 tied to the commodity markets because it deals with
18 metals.

19 Then there is the frontier: There are
20 sodium batteries; there are batteries with molten metal
21 being developed at universities, and what we intend to
22 get into strongly is Atrua's (phonetic) soluble organics
23 because when you're dealing with organics it's your own
24 ingenuity and engineering of materials out of carbon and
25 oxygen, what have you, and you are not tied to mining

1 metal. The graph shows what we have done with this
2 radium battery. It's been a steady decrease in cost
3 over five years and increase in efficiency. Now, the
4 temperature stability is 80 percent greater, the energy
5 density is 70 percent greater, and the system costs some
6 down to about 300 hours of kilowatts per hour. And we
7 have licensed this, this was mostly developed in Pacific
8 Northwest Laboratory. We have licensed to five
9 different companies and it's now in the market. An
10 example in the picture. And the point is, Okay, where
11 do we go next? Because, as you can see, it's beginning
12 to bottom out. And that's why we intend to be
13 developing Atria's soluble organics and get our next
14 decrease in cost.

15 So where does storage play? It's a question
16 of what the business cases -- you always have to
17 remember that storage can do many different things. And
18 the more of these benefits screens that we can put on
19 top of each other, the greater the value is, and the
20 value has to eventually balance the cost. So one of the
21 markets, which is an established business case, is
22 frequency regulation. And we owe that to a 20 megawatt
23 beacon power plant which we helped construct in the
24 early entry of FERC to establish pay-for performance.
25 People were astonished that FERC caught on immediately

1 and did the right thing, but it established the market.

2 (Laughter)

3 But of course it's understood they have to
4 see something, and that's why we have built this 20
5 megawatt plant. In the course of the stimulus program
6 we have garnered about \$85 million, which is not very
7 much, but I managed to get cost share of the order of
8 \$580 million. And that allowed us to do quite a number
9 of interesting constructions in various places,
10 including California, and that provided the basis to
11 some degree of the 1.3 gigawatt mandate in order to
12 ameliorate the fact curve, which you probably heard
13 about, that is developing because of the large
14 development of solar energy in California. So there's
15 lots of activity there.

16 Some questions about how effective is it
17 really in meeting what it was meant to be, which is a
18 ramping in morning and afternoon, I will give these to
19 my colleagues to convince you of. Encouraging the solar
20 industry is becoming increasingly friendly and willing
21 to incorporate storage. I would like to see storage as
22 a peaker because it could really be effective that way
23 because you can use it for all kinds of things, but then
24 you can throw it in and it doesn't make sense to have
25 100 megawatt fossil fuel peaker that you only use every

1 now and then. Behind the meter market is quite active
2 but I have serious doubts to the effectiveness of what
3 it actually does. I'm not sure it actually does all
4 that much for the utility and I'm not exactly sure what
5 it does for the user, but it does provide an interesting
6 battery which you can install. And if you do it right,
7 it can probably be quite useful. Resilient microgrids
8 are big, particularly when you consider all the disaster
9 that is around. I see interest in resilient microgrids
10 in almost all states, and we're doing our best to help.
11 And in particular, smaller states are becoming involved.
12 California, New York Texas got involved very early on,
13 and I can brag that I introduced both California and New
14 York to energy storage with a very early MOU, which we
15 have.

16 So, how do we do this with the smaller
17 states? As an example, we work with the multiple
18 service department. We started with basically a town
19 meeting and some presentations. We put in a very little
20 bit of money, we don't have more than a little bit of
21 money. We put in the point solicitation. We got Green
22 Mountain Power to snap it up, and they have now built a
23 resilient microgrid, which is an economically-depressed
24 community. They built it on a ground field area; it has
25 all kinds of good social implications and it's formatted

1 on storage-integrated two megawatts of PV. And if under
2 emergency conditions were island-able, it will serve an
3 emergency center. But otherwise it will be open to the
4 grid, the PV will provide main power to the grid.

5 Storage is a surprise: We were counting mainly on the
6 value and on the ancillary services. It turns out that
7 you can make a mint using it for demand charges. They
8 are figuring that they can make a million dollars per
9 megawatt per year, which will be a fantastic payback.
10 But of course this depends on your local grid structure.
11 So we did this, we commissioned it in September, and
12 it's now going through testing and monitoring. And we
13 are already considering having a followup, another
14 project, this time fielded by private industry.

15 And the final example: Washington State.
16 Every state is different so we have to work in a
17 different way in every state. In Washington there was a
18 solicitation for \$50 million and there were three
19 projects selected, two of them happened to include the
20 lithium battery that I told you about before. But that
21 wasn't our only contribution, we also have P&L working
22 directly with the utilities to evaluate the use cases
23 and the cost benefit. We have already moved on to
24 Oregon where we've had a solicitation. And last weekend
25 we made the decision of the project that we'd going to

1 do work and it's going to be in Eugene, Oregon and it
2 will be a microgrid there too.

3 So the thing is we have developed new
4 technology -- and by "we" I mean the department, Energy
5 and the industry involved -- so we have developed new
6 cost effective technologies; we have opened new benefit
7 screens, we have seen big mandates like California,
8 Hawaii, and Ontario, and now a little on everything,
9 Oregon. We have worked directly with both major states
10 like California and New York, and small ones like
11 Vermont, Washington, Oregon, I just came back yesterday
12 from talking to the secretary of energy of Massachusetts
13 that we are trying to get them going on energy storage.
14 And in our energy storage database, which we established
15 which is open to the public, we now have a thousand 400
16 projects listed. And that's it. Thank you very much.

17 CHAIRMAN BAY: Thank you, Dr. Gyuk.

18 Dr. Kristov?

19 DR. KRISTOV: Good morning, Mr. Chairman,
20 Commissioners. Thank you very much for the invitation
21 to be here. I will give you some of California's
22 perspective on storage and start with some of the
23 general observations, and then move into some specific
24 things that we're doing in our markets to better
25 accommodate storage. Basically the context that we're

1 in is California's very ambitious environmental goals,
2 I'll characterize generally as de-carbonizing the grid.
3 And it's recognized that solar PV is having a major
4 impact and it will continue to: The prices keep going
5 down, it's scalable, it keeps getting more efficient.
6 But from an operator's perspective solar, large volumes
7 of solar, create challenges that are well-known from a
8 common water valve that is pictured in cartoons. System
9 over-generation in the middle of the day, we have many
10 instances of our prices going negative in the springtime
11 simply because demand is low and there's lots of solar
12 energy. It displaces flexible generation: Marginal
13 cost is cheap when it generates. It creates backflow on
14 distribution feeders; this is now something that has
15 become a hot topic, and in California because utilities
16 were developing distribution resources plans.

17 And I'll mention the distribution side, I
18 know the Commission's interest were probably primarily
19 on grid-connected resources. But what we're seeing in
20 California is what's happening on distribution doesn't
21 stay on distribution anymore, it is having impacts on
22 the grid and so we're trying to think "whole system".
23 How does the whole system involve when there are changes
24 both at grid level and on distribution? And then of
25 course the output of solar starts to fade out in late

1 afternoon as the peak is coming up in the late summer.
2 So there is that bit of mismatch between the demand peak
3 and the actual peak of solar. Storage may be the
4 game-changer in all of this, conceptually certainly it
5 has the capabilities of addressing all the problems I
6 just identified. It's scalable and it can meet the
7 challenges of high-volume PV. Particularly charging at
8 low negative over-gen prices in the middle of the day is
9 a place for that excess supply to go, in addition to
10 other uses being considered now like making hydrogen or
11 desalinating water. It can collocate with photolabile
12 pays on the grid to smooth th output of the resources
13 onto the grid, who are in fact subject to those negative
14 prices if they're generating in the middle of the day
15 and they can't curtail. It can discharge to mitigate
16 the steep ramp, the peaker idea that was mentioned in
17 the late afternoon peak. It can provide two-way demand
18 response: Frequency response, regulation in combination
19 with PV. It can start to address that backflow problem
20 on the distribution system, and the notion of managing
21 local variability locally and flattening load profiles
22 to some extent. And this is an area really where value
23 hasn't been monetized yet or estimated yet, but when we
24 think about peak as a driver of infrastructure, what
25 happens if the penetration of storage to a large degree

1 starts flattening out the overall load shape.

2 But storage is not exactly generation; it
3 comprises a diverse array of technologies, some of which
4 you just heard about but we also have projects in
5 California with, for example, rail storage that does a
6 kind of pump-storage, gravity-based resource that
7 doesn't use water. And it's scalable to fit diverse
8 applications. And as we're seeing, the charging
9 component of it is in many ways just as valuable of the
10 discharging because it's an aspect of flexibility when
11 we have excess generation. Not all the revenue values
12 are identified but aren't necessarily developed.

13 And, then, what I would really say is there
14 really is a paradigm shift because we have a system that
15 was designed, the whole electric system, based on the
16 premise that you can't really store electricity. So if
17 that becomes a more significant player in the system,
18 then we got to think about different ways of thinking
19 about the system. For example, valuing what's not just
20 kilowatt hours or kilowatts, thermal storage and
21 buildings, decarbonizing transportation, reducing the
22 need for flexible generation, the idea of decentralizing
23 reliability, microgrids improving cyber security and
24 resilience by combining storage devices with small-scale
25 generation.

1 And importantly, something I mentioned to
2 state regulators often as well, is that the change to
3 the system now is being driven as much bottom-up as
4 top-down. Simply, customers are deciding to adopt
5 things, and customers at all levels: It could be
6 industrial, it could be commercial buildings, it could
7 be communities, residential subdivisions. All of these
8 entities at different levels simply will make decisions
9 to take more control over their electricity choices, and
10 in so doing there is what you might call an unstructured
11 change that is happening, it's just decisions at the
12 bottom level. So regulators are not completely in
13 control of that process, it's not a purely top-down much
14 like in the '90's where structuring was driven so much
15 by federal law. This really has the other side to it,
16 which we are just recognizing is happening and we have
17 to figure out how to accommodate.

18 So, a little bit about the ISO market
19 pathways that we have. The first thing is that with
20 that announcement of the 1.3 gigawatts mandate in the
21 state, we had in our interconnection beginning in 2014
22 about 3,500 megawatts of storage projects coming in,
23 grid-scale, mostly large-scale battery storage. But
24 that's a generator interconnection problem. So a
25 process, service was asking, "What are you going to do

1 with storage? It's not exactly a generator." So we
2 essentially devised under the structure and flexibility
3 of what's allowed under our tariff to say, "Well, if you
4 behave like a generator but you could have negative
5 output and some times, and 'behaving like a generator'
6 means you're bidding into the market even when you want
7 to discharge, you're bidding into that negative energy
8 and you look like a wholesale resource and you signed a
9 participating generator agreement and if you're charging
10 behavior is causing a problem we're going to give you a
11 curtailment instruction and you'll obey that
12 instruction." So essentially it looks like a generator
13 except at some times it had negative output. And that's
14 working well, that's enabled projects in the
15 interconnection queue to go forward.

16 We also have a model that we created a
17 couple years back called NGR, Non-Generator Resource,
18 that was designed specifically as a market participation
19 model for resources that can both consume and supply
20 energy, and there's also a version of that which can
21 supply regulation service under a pay-for performance
22 kind of model and also NGR resources could be local on
23 the distribution system as well and be participating
24 generators in the wholesale market. And then we also
25 have the PDR model, Proxy Demand Resources, which

1 enables storage. And we see projects coming along this
2 line, storage being located behind the NGR and the
3 storage devices being aggregated over a number of
4 different locations that are providing PDR resource that
5 offering energy and the reserves into the demand response.

6 We have some initiatives in progress and
7 we're planning to expand in 2016 two things the
8 Commission will see coming to it, probably in first
9 quarter: One is something called distributed energy
10 resource provider. Again, mentioning distribution
11 because storage is playing a big part in this and these
12 resources want to be wholesale market participants. So
13 this DERP -- unfortunate acronym, it sounds kind of
14 silly -- but the basic idea is that an aggregator can
15 combine a whole diverse set of resources; they don't
16 have to be uniform. It could be storage and photovoltaic
17 paybacks and battery vehicle charging station that are
18 aggregated into a single virtual resource we see at a
19 specific location. And it's metered under our schedule
20 coordinator and either end can be approached, so the
21 aggregator has the responsibility to be the resource
22 operator, respond ISO dispatch instructions and so on.
23 We're finalizing that now for filing early in 2016.

24 We have another initiative in progress,
25 Energy Storage and Distributed Energy Resources, the

1 actual ESDER, also finishing up now for filing sometime
2 in first quarter. And one of things that we did there
3 was we're adopting additional metrics for the Proxy
4 Demand Resource where we always use the pretty standard
5 baseline type of model when you're looking at load only
6 now with other devices behind the meter we needed to
7 expand the repertoire based on the NESBY categories of
8 different types of base lines you can use. We will
9 start a phase 2 of this ESDER proceeding, initiative
10 rather, in early 2017. And a couple of things that have
11 really been brought to us by developers that they're
12 really interested in. Enhancing PDR to allow two-way
13 dispatch and regulation. It could still be a demand
14 response resource, but let's have the ability to
15 dispatch it to consume more and to allow it to provide
16 regulation. Right now those resources can't provide
17 regulation services.

18 There's also a lot more growing interest in
19 what we call multiple-use configurations. I'll say a
20 little bit about that more now because this is an area
21 where there's a lot of interesting issues where we're
22 talking with the Public Utilities Commission as well
23 because they're state and ISO market kinds of issues
24 that need to coordinate. So distribution level served,
25 this has become really important, storage on the

1 distribution system on the utility side or even behind
2 the meter can provide real-time operational services:
3 Voltage support, power quality. But these things are
4 not monetized yet, these things are not well-defined and
5 we don't have the performance specifications. So many
6 of the resources want to be in the wholesale market
7 because that's where the opportunities are. We have
8 well-defined ancillary services. So it's going to be
9 really important to develop those kinds of uses. And in
10 multiple-use applications there's a recent report that
11 came out by the Rocky Mountain Institute that created a
12 little diagram with 13 different services that storage
13 and other types of distributed resources could provide.
14 And basically they said, "Well, if you're located on the
15 transmission grid you're only able to provide a small
16 set of those, you can provide services to the wholesale
17 market and the distribution grid. If you are located on
18 the distribution system now there's a wider array of
19 services. But if you're located behind the customer
20 meter that's the widest array of services." And the
21 notion, for example, of managing demand charges for
22 commercial customers, that's a very valuable service
23 that storage can provide; at the same time it can also
24 be supporting reliability on distribution and bidding
25 into the wholesale market.

1 So I started with the word "barriers" but I
2 chose to use "open questions" instead because these are
3 all discussions that are happening, there's work in
4 progress on nearly all of these issues, multiple-use
5 scenarios really being one of the biggest topics, and
6 some of them having to do with wholesale versus retail
7 rates. So if a battery is charging and it's behind the
8 customer meter and it's offsetting demand charge and
9 it's in the wholesale market, how do you allocate which
10 portion of it is charging as a wholesale resource versus
11 charging as a customer side? And other things about the
12 different ways of categorizing use type. How could
13 storage be operated and compensated as a transmission or
14 distribution asset and also participate in the wholesale
15 market? There have been some parties that have come
16 forward with that in the past and it's been a challenge
17 just because the market impact of generating at certain
18 times that would not be appropriate for a transmission
19 asset. So more open questions, and the top one is
20 really one of the reasons why I mention distribution
21 side resources so much, is because the notion of roles
22 and responsibilities at the transmission distribution
23 interface I think is one of the big challenge. There
24 will be so many distributed resources, and simply by
25 their behavior there will be impacts back on the ISO

1 grid. We'll see a different load shape, we'll see a
2 different system load shape because of their presence.
3 At the same time, with lots of these resources being in
4 the wholesale market, we modeled them as if they're at
5 the transmission distribution substation, we don't see
6 distribution circuits, we don't see their actual
7 locations. So what happens in a local distribution area
8 if there are several of these resources? We give them
9 dispatch instructions. We may not know what response
10 we're going to get because we don't see our impact on
11 distribution. So part of what we're beginning now to
12 get into in California is talking with the utility
13 distribution companies and thinking about what kind of
14 coordination effort do we need to move in to this new
15 world?

16 Finally one thing I mentioned is the notion
17 of volatility, and volatility is a driver of reliable
18 operation, certainly with renewables and with a whole
19 variety of devices that are part of the system now.
20 Just being able to manage this interval-to-interval
21 fluctuation becomes a driver of reliable operation. Can
22 we think about ways to structure charges for
23 distribution service, for transmission services, that
24 take into account an entity's impact on volatility on
25 the system? If you're a resource that's adding

1 volatility, well, maybe you should pay more for the
2 service that you're getting. If you're an entity that's
3 having a flat interconnection from interval to interval
4 with the ISO maybe you'll pay less. If you can help
5 mitigate volatility then maybe you get paid for that.
6 That's an idea that's being discussed now; it doesn't
7 quite exist yet. But those kinds of pricing structures
8 could potentially create incentives to combine
9 resources, put a storage device with your wind resource
10 and smooth that interconnection because you'll avoid
11 some charges, some costs. So that's the basic idea, and
12 then just to enable the recognition that bottom-up
13 change is happening and customers will do things and we
14 need to think about maintaining a reliable efficient
15 system. Thank you very much.

16 CHAIRMAN BAY: Thank you, Dr. Kristov.

17 Mr. Irwin?

18 MR. IRWIN: Thank you. Good morning,
19 Mr. Chairman. Good morning, Commissioners. Thank you
20 very much for the opportunity to present to the
21 Commission today. I'm from Southern California Edison,
22 I'm Mark Irwin, and I'm going to give an overview of our
23 program and how it fits and try to give you some
24 perspective. I think we've got two great practices, and
25 mine's a little bit different, to share our experiences.

1 So first you heard a lot about the mandate
2 in California and where want to talk about what the
3 mandate is and then I'll talk about how we're going
4 about working with that mandate and then I'll go a
5 little bit deeper into one piece. So the mandate, our
6 portion of the mandate, is 580 megawatts. The overall
7 state mandate for these three IOU's is 1.3 gigawatts.
8 It is broken down into pieces. We have some flexibility
9 across those pieces, but they're transmission
10 distribution and customer. And it's not the
11 functionality of the device, it's where it's connected.
12 So it's very simple, there's not a lot of judgement
13 about functionality, it's really about where does it
14 connect to fit in the mandate calculation. Up to half
15 of this can be owned by utilities, so we have an
16 opportunity to have up to the half of the megawatts
17 owned as utility assets, and I'm going to talk in more
18 detail about that further. And the last piece is large
19 pump storage is really not part of this mandate. I
20 think pump storage over 50 megawatts would not be
21 something included in this mandate. So when you think
22 about it is it's really small to medium, starting to get
23 to large size of devices, but not extremely large
24 prices, which I think is an important piece. We have
25 procurement pieces by a certain timeframes, but all

1 operational by 2024. So we've done a lot in the
2 procurement space, at least at Southern California
3 Edison. We still don't have many -- I don't think we
4 have any third-party resources online yet; they'll start
5 being online over the next few years. So we're still in
6 a learning process.

7 So our approach to compliance has been to
8 focus on three different areas: One is market-only
9 basing resources, and we've procured those really in
10 what by call the transmissioner [sic] distribution
11 bucket primarily, although we've gone a little further,
12 or the transmission distribution bucket. We've got
13 market-facing resources, we've generally acquired them
14 under what walks and talks like a tolling agreement or
15 maybe under an RA purchase agreement where we're just
16 purchasing resource adequacy or capacity. We've been
17 active in that, we had a number of things that obviously
18 made the press when we signed a number of contracts a
19 years ago. That's because we had a some local capacity
20 needs and we had a structure around doing that and we
21 selected storage for a pretty good piece of that.

22 And behind-the-meter side, so customer-side
23 connection, we have some existing utility programs, as
24 well as some new-third party procurement we've done for
25 demand response resources to meet our local capacity

1 requirements. So they are low-capacity acquisition; we
2 had a substantial activity there and I think we've kind
3 of filled up that bucket from our perspective at this
4 point.

5 And then the last piece is distribution
6 based resources, so distribution that the fundamental
7 primary purpose is to solve a challenge and avoid some
8 type of build or support the distribution system. So
9 I'm going to focus there more. That's where we're
10 focused with our utility-owned initiative we've got
11 going. So we're thinking that the utility being able to
12 substitute storage instead of another wires build is a
13 good opportunity. It still gives us a chance to
14 understand and maintain that reliability and target
15 where we need the resource on a very -- I won't say
16 "last-minute" -- but later stage of the process.

17 So, again, the primary purpose of the
18 distribution asset is to support the circuit. I'm going
19 to talk in more detail about the work we're continuing
20 to do. But the real first purpose is really to look at
21 plan overloads or temperature overloads that we might
22 see in our system. So that's the known value, we can
23 see that that overload or planning violation is going to
24 occur, and we can see what storage device we have to
25 build to avoid that violation, and we can get that value

1 by looking at just the asset. But I think there is more
2 and I think Dr. Gyuk made some great comments earlier,
3 and listened to looking at, "How do we compound these
4 values?" And I think that's a lot of what we're chasing
5 is: How do we compound these values? It's starting
6 with the distribution.

7 Now, what we also see today is that those
8 distribution system/plan/violations occur, varying
9 frequently, limited number of days and hours through the
10 year. So the question, then, is: If we're maximizing
11 the value of the device, how do we do that? And I think
12 we're of the view that we're going to do that by having
13 the asset participate in the market when it's not able
14 to work on the distribution system. Now, from a timing
15 standpoint and what we're going about in our approach,
16 out initial assets that we're putting in the
17 distribution system will be distribution-only. We won't
18 be in a position from a communication and control and
19 market structure for a couple of years to be able to
20 deploy what we call dual-use assets, but we're heading
21 in that direction. And it's because it enhances the
22 business case, and that goes back to storage devices are
23 not inexpensive devices and you need to stack the
24 benefits to make the business case.

25 So with that, I'm going to talk about some

1 of the dual-use storage values that we're pursuing. I
2 would be remiss in not mentioning some of the programs
3 that Dr. Gyuk spoke of earlier. Southern California
4 Edison was the beneficiary of a number of demonstration
5 projects being funded by DOE and has allowed us to go
6 through what I call -- or we're still getting through --
7 a demonstration phase and really moving to a deployment
8 phase. So where we're headed now is into what we're
9 calling a pilot deployment phase. It's getting a few
10 devices out there and testing them and trying to get a
11 detail. From a demonstration standpoint, we were
12 showing the devices could work; from a pilot standpoint,
13 we're making the system need to rely on those devices,
14 so the level of reliability and capability of the system
15 has to be much higher than thought.

16 So on the distribution system, as I talked
17 about before, the well-defined or identified value is
18 deferring a distribution upgrade. We talked about
19 either a plan loading violation or maybe a temperature
20 violation. Also, some values that we've identified but
21 we haven't yet been able to value is equipment life
22 extensions. So instead of being able to manage the life
23 of a piece of equipment by not loading it as heavily.
24 We've also identified voltage support as an opportunity
25 for value from energy storage devices. And we haven't

1 actually put one out there to do that and try to value
2 that whole support. Those are things we see in front of
3 us as values that are achievable but we haven't been
4 able to calculate and we haven't been able to actually
5 demonstrate them doing multiple things at once. Unknown
6 values that we think are potentially out there but we're
7 not yet to where we identify them and we understand
8 where we can use them and then we have to value them, is
9 our quality improvement. My colleague also talked about
10 distributed energy resource, integration enhancement,
11 reactive power compensation, potentially whether we get
12 reliability value and particularly when people talk
13 about microgrids or pieces being able to island,
14 obviously if that reliability had value to people that's
15 potential value opportunities. And then there's I would
16 say other things that we haven't really identified but
17 we believe are out there. So this is really a knowledge
18 chase at this point still; we're out actively in that
19 activity. The market participation values are really --
20 we think that their structure is out there and moving in
21 place both from a state regulatory standpoint but also
22 from an ISO standpoint. And so we think the
23 predictability may not be there today but we think
24 they're on course to be able to capitalize on some or
25 all of those opportunities.

1 So what are some of the challenges of
2 dual-use? And I've talked about some of them in getting
3 value on the distribution system. Also, the challenge
4 is -- and I think my colleague from the CAISO talked
5 about the unique characteristics that storage allows of
6 multiple classifications, whether that's generation,
7 whether that's grid apparatus, and whether that's load
8 -- as I talked about the assets that we're applying
9 today, the only things we're thinking are going to have
10 a hybrid or a dual use are going to be a primary purpose
11 of grid apparatus, and that's critical if we're looking
12 to have the distribution system rely on it and that
13 continues to be the primary purpose. And I said we
14 believe we have a regulatory path to be able to
15 accomplish that with our state jurisdictional structure.
16 The PUC has encouraged us to come to them with a
17 proposal for how we have cost recovery on these dual-use
18 assets. We have an opportunity to do that next March in
19 our biannual filing for the storage compliance
20 activities. So I would not be surprised if we or the
21 utilities choose to take that opportunity to actually
22 put a regulatory proposal in front of the PUC.

23 But I think the issue on the classification
24 is limiting the classification. And I think that's
25 really the challenge for storage is how do we get enough

1 pieces to make the business case make sense? Our states
2 foresaw a need for storage 10 years out or so a lot of
3 work that had been done with the conductor. We're
4 heading towards that as fast as we can. Our Commission
5 decided for us to be -- we needed to be there in two
6 years, we're starting today. And I applaud them for the
7 decision, what it stands to make things operational.
8 And I think we're headed that direction. But that means
9 the business case will be challenged along the way and
10 we're having to develop it a long the way. And so we're
11 going to move and be out on the cutting edge, which is a
12 great opportunity but also the information is more
13 limited.

14 So I think as I mentioned the optimum
15 framework allows for the same storage system to operate
16 as a grid asset, participate in the wholesale market,
17 and act as load. And having the regulatory framework to
18 accomplish that could enhance the value. So thank you
19 very much for the opportunity today. I'll pass it on to
20 my next colleague.

21 CHAIRMAN BAY: Thank you, Mr. Irwin.

22 Mr. Kumaraswamy?

23 MR. KUMARASWAMY: Thank you, Mr. Chairman
24 and Commissioners. I appreciate the opportunity to
25 participate in developing project across the world and

1 sharing our perspectives on what we see is valuable for
2 market participants to realize the value. Just as
3 background eight years start as one of the first IPP's
4 in the U.S. and is now a major supplier of electricity
5 across the world. Nearly 80 years ago we brought
6 together a group of power engineers and commercial
7 developers to work on applying advanced power technology
8 in the electric sector. As we began in 2008 we focused
9 on validating solutions and meeting customer needs to
10 establish commercial sectors that are familiar in in our
11 industry. After many years and multiple generations of
12 storage projects and investing over \$150 million in
13 development and our commitment to meeting customer needs
14 is the center of what we have currently.

15 Just last week, like you see in this slide
16 up there, we commissioned around a storage facility
17 that's located in Maryland which will be providing
18 recommendation services in the PGM market. With that
19 facility we are right now at 192 megawatts of storage
20 resources that have been commercial operations globally
21 across the world. Collectively we have delivered nearly
22 \$3 million megawatts powers of service, being the most
23 comprehensive and established in the world.

24 One of the benefits energy storage brings to
25 the table is that it's a highly cost affective resource,

1 one that some of my colleagues have mentioned here,
2 we're unmatched to flexibility where the operators
3 balance the system and bring integration into the
4 system. And this could happen when the existing
5 generation actually faces a lot of problems in terms of
6 sustaining operations in the future. Just as an example
7 I thought you'd be interested in seeing that Bloomberg
8 estimates that the U.S. alone will need 13 gigawatts of
9 capacity by the year 2020. Given this context, it's
10 important for us to consider the delivery of existing
11 capacity in light of the conflicts full value of the
12 service that is provide by energy storage.

13 Although we have reached a point that
14 technical and cost advancements have occurred in the
15 storage industry, the storage facility will participate
16 in regional capacity markets. The existing capacity
17 markets do not directly value the flexibility of
18 resources. This is an important issue that the
19 Commission should consider. In addition, creating clear
20 rules that establish the characteristics and other
21 functional requirements, like the duration required for
22 qualification as a capacity resource, are important
23 issues and those that can help developers like AES for
24 both reliable and efficient and cost capacity. The main
25 effect of enabling an energy storage capacity markets

1 will lead to significant savings. Much like the savings
2 realized by introducing storage into the frequency
3 regulation market through swift Commission action four
4 years ago. We also see energy storage as a critical
5 link to a transition to a clean-emerging future,
6 integrate high levels of energy into the system. The
7 energy storage also needs much-needed resiliency to the
8 electric grid; it brings us closer to breaking the
9 unbreakable grid, which is a vision we share here at
10 AES. Our system is vulnerable due to large central
11 station generation and long transmission lines, building
12 grid scale multiple portions of the grid can
13 significantly enhance the resiliency of the grid.

14 To illustrate an example of energy storage
15 providing peaking capacity, I wanted to highlight our
16 experience in the Southern California market. Mark, I
17 mentioned this earlier, for eight years was actually one
18 of the beneficiaries of the Southern California Edison
19 Foundation, they won a contract for 100 megawatts of
20 interconnected capacity, which is 100 megawatts of
21 capacity which is the equal of hundred one megawatts of
22 flexible capacity. What you see up there is a rendering
23 of the storage facility that you would have in Southern
24 California. In this case our system was designed for
25 the four hours of duration and would be connected to the

1 grid while not consuming any water or producing any
2 emissions at all. This is exactly the type of capacity
3 resource that can be beneficial to resource markets
4 across the country. For years we have had the
5 capability to develop systems of longer duration, like
6 four hours for instance, the one that we're doing in
7 Southern California. But the cost of lithium ion
8 batteries have reduced significantly in the last few
9 years, that makes this particular capacity application
10 much more attractive now. Cost for complete system have
11 fallen by 80 to 90 percent from the first project that
12 we did in 2008 to the ones we are commissioning now.
13 Developing clear rules for our energy storage resources
14 and capacity markets and creating rules that value
15 flexibility are a part of the Commission should
16 consider.

17 One of the other issues we face, which has
18 been mentioned by other analysts here, is the
19 qualification of energy storage, as a resource storage
20 provides benefits across all functions. For example, as
21 a transmission resource storage can be called upon to
22 reduce peak command to a station for a certain number of
23 hours. That's a limited set of hours, 30 or 40 hours in
24 a year. This is a key function and one that can help
25 you through this, displace expensive transmission

1 upgrades that are needed for the system. Having the
2 capability for storage to provide ancillary services in
3 capacity for the system, remainder of the 8,000-plus
4 hours that it sits in the system connected is a critical
5 thing for project economics and commercial reliability.

6 At AES, even within the last six months, we
7 have engaged in conversations with several large
8 companies across the country by looking at applying
9 energy storage; they know it will benefit the system.
10 But the issue of having the capability to monetize all
11 the streams, and those opportunities being on the
12 generation and the competition price, are creating some
13 value. I strongly engage the Commission to create a
14 regular framework, all energy storage resources be
15 participating and providing these benefits across all of
16 these functional categories.

17 Finally we ask the Commission to act on the
18 issue of third-party provision of service. AES's
19 storage projects in Europe, particularly Netherlands and
20 northern Ireland we are currently developing, are
21 designed to provide response. Some of the European
22 nations, particularly the Netherlands, Germany, Austria,
23 and Switzerland, have a market for procuring primary
24 control of those for PPI which are functionally very
25 similar to the combination of reconsidered response and

1 reserves in the context of the U.S. markets. Energy
2 storage can provide high-quality, significantly-enhanced
3 system reliability. Providing a market mechanism for
4 storage devices to participate can provide this,
5 essentially grid service, can help across the country.
6 In addition, the help, relief for those breakers and
7 having a scale-back their output by proving a response
8 and help them better meet the energy needs of the
9 system.

10 With that, thank you for the opportunity to
11 provide these remarks and look forward to working with
12 the Commission in the future. Thank you.

13 CHAIRMAN BAY: Thank you, Mr. Kumaraswamy.
14 Mr. Burwen?

15 MR. BURWEN: Great. Thank you, Chairman
16 Bay, thank you Commissioner LaFleur, Commissioner Clark,
17 Commissioner Honorable for convening this discussion
18 today. On behalf of the Energy Storage Association I
19 appreciate the opportunity to speak on the next steps
20 for energy storage to participate in organized markets.

21 I have not done you the disservice of a
22 boring PowerPoint. In case you're unfamiliar us, ESA's
23 nearly 200 member companies comprise a diverse group
24 electric stakeholders, including energy service
25 companies, electric utilities, Independant power

1 producers, technology developers, and component
2 suppliers. ESA members operate both transmission- and
3 distribution-connected energy source projects using a
4 variety of technology.

5 Previous orders issued by the Commission
6 have been necessary steps in lowering barriers to energy
7 storage in organized markets. Order 890 was critical
8 for enabling non-generating resources, including
9 storage, to participate in the frequency regulation
10 market. Order 755 allowed payment for frequency
11 regulation with a value provided by fast-responding
12 resources such as energy storage. And order 792 reduced
13 uncertainty for storage interconnection by assigning it
14 the rules for generators. So pursuant to these
15 Commission orders, some ISO's and RTO's have introduced
16 market changes, they created the first competitive
17 opportunities for enhanced energy storage.
18 Specifically, PGM has implemented a market for
19 fast-responding regulation resources, in which now over
20 200 megawatts of advanced energy storage operate. Since
21 PGM implemented that fast regulation market, overall
22 territory-wide regulation procurement has decreased from
23 30 percent, from one percent peak load to .7 percent of
24 the peak load. And indeed we see this outcome as
25 evidence that energy storage can enable more efficient

1 existing grid assets where it is used, improving both
2 the competitiveness and efficiency of organized markets.
3 Despite this, the most significant remaining barrier to
4 energy storage is uncertainty stemming from the lack of
5 clarity in organized market rules. So rules for
6 participation in ancillary services products beyond
7 frequency regulation are not clear in most RTO's and
8 ISO's, and at least one market, even participation in
9 regulation, is still unclear.

10 Additionally, aspects of interconnection,
11 metering, and management are unclear in a number of
12 markets, owing to a lack of specific rules for storage
13 resource. Rules on station power for storage resources
14 are defined in some markets but not in others. And
15 rules for tariff treatment in distribution-connected
16 storage do not exist anymore, creating additional
17 uncertainty. In addition, organized markets lack a
18 consistent construct for aggregated behind-the-meter
19 storage participation and the metering telemetry
20 requirements are essentially not appropriate at this
21 time. My colleagues remark barriers to energy storage
22 acting in capacity. And so I'll simply echo the point
23 that while capacity markets don't specifically preclude
24 storage from participating at this time, uncertainty and
25 certain design choices and existing rules make market

1 participation unattainable. Without rules explicitly
2 for storage, RTO's and ISO's typically default to a
3 generation of storage, but then have to tailor their
4 application to the account for charging. This creates
5 confusion for storage developers and operators in the
6 potential difference across different projects. As
7 such, resulting this lack of clarity and consistency is
8 a matter of RTO and ISO implementation.

9 ESA respectfully encourages the Commission
10 to address this implementation gap. For example, by
11 directing RTO's and ISO's to clarify their tariffs to
12 ensure energy storage can participate in markets on a
13 comparable basis with other resources. Not unlike Order
14 719 which direct RTO's and ISO's to enable demand
15 response resources to participate in ancillary services
16 on a comparable basis to other resources. In
17 particular, ESA sees a natural progression from the
18 comparability to Order 719 and Order 890 to extend
19 non-generating resource participation into capacity
20 markets, and we respectfully encourage the Commission to
21 consider this approach.

22 Another barrier to storage is that markets
23 are not often designed to capture the value storage.
24 For example, as you heard in discussion earlier today,
25 shut down generators are not typically included in

1 locational marginal prices but rather paid through
2 non-market payments. By devaluing the locational
3 marginal price, uplift payments effectively leap to
4 under-compensating resources with low or no startup
5 cost, such as storage. Similarly while fast-responding
6 resources have made grid operations more efficient and
7 reduced frequency regulation, procurement for PJM for
8 example, several RTO's and ISO's do not incorporate the
9 dispatch into regulation or for that matter been a
10 non-standing reserve. So that performance value to the
11 system cannot be captured. Ensuring markets capturing
12 their prices, the value the performance resources like
13 storage can provide would enable certainly greater
14 participation.

15 And there are still some rules in the market
16 that, while not specific to storage, meaningfully limit
17 our participation. For example, in most RTO's and
18 ISO's, there's not a net zero interconnection policy in
19 which two resources are allowed to jointly manage
20 production behind a single point of interconnection.
21 This restricts the useful pairing of energy storage with
22 existing generation behind interconnections. Another
23 example, there are limitations on net injections with
24 energy from behind-the-meter resources in wholesale
25 markets. For that matter, hourly scheduling across

1 organized markets is an impediment to fully realizing
2 the intra-hourly capabilities of energy storage,
3 particularly in the ancillary services. While these
4 rules may serve important, technical, or
5 market-facilitating purposes, they are worth examining
6 for ways to enable useful storage operations that
7 preserve the larger intent of those rules.

8 And to talk about functional classification,
9 I will try to keep my remarks fairly brief since many of
10 my colleagues have touched on it already. Certainly,
11 storage has a fit inside a generation transmission
12 distribution despite being honestly a separate request.
13 Order 784 one of the last discussion of the topic at the
14 Commission and where the Commission came up with
15 accounting rules for a storage line item in each of the
16 generation transmission and distribution categories.
17 Yet, storage is a resource that can provide multiple
18 services, it's not a holy grail or silver bullet or a
19 holy grail full of silver bullets.

20 (Laughter)

21 But it is certainly a uniquely flexible
22 resource. Realizing the value of the full array of
23 services provided by storage will optimize utilization
24 of existing grid assets. And that will maximize
25 reliability and economic benefits to ratepayers. With

1 that opportunity, we merit the Commission's
2 consideration how to incorporate storage into all
3 aspects of grid reliability. To the extent that
4 existing classifications are suitable, storage would
5 best be utilized by both the primary classification for
6 its many function, as well as suitable secondary
7 classification for additional third rendering. We know
8 that storage can act as a generator and contract out
9 capacity as transmission reliability; we know that
10 storage can act as a transmission asset and offer
11 wholesale market products. We can envision storage
12 assets in fact switching to their classification as the
13 highest-value services to the system change over time
14 with the conditions of the system. And so we can
15 envision a future where storage meets transmission
16 reliability needs and perceives a regulated rate of
17 return only for that specific part of this operation,
18 while also providing useful, wholesale market products
19 and doing so without inversely impacting reliability.
20 That future is one that increases system flexibility
21 from grid operators and lowers costs to ratepayers. By
22 resolving this issue of classification, the Commission
23 would have yet another tool to ensure the least-cost,
24 reliable, and sustainable electrical service. I thank
25 you all for your consideration of these matters and look

1 forward to your questions.

2 CHAIRMAN BAY: Thank you, Mr. Burwen. And I
3 want to thank all of you for your very informative
4 presentation. Given the lateness of the hour, I just
5 have one question. You know, in the trade press I read
6 from time to time, I think "varying estimates about the
7 way in which the price of energy storage systems are
8 predicted to decline over the next few years." Do the
9 people on this page have any sense for what's happening
10 with those prices or what would be your best estimate
11 about the cost of energy storage systems?

12 MR. GYUK: Just a quick remark: One of --
13 there's a lot of different ways in which people talk
14 about cost, particularly when you read it in press
15 releases and newspapers. It is often the cost of a
16 single cell sitting in the lab with a desktop and it's
17 incredibly low. The actual cost should always be in
18 terms of the system produced at reasonable quantity.
19 And those costs are much, much higher than the costs.
20 And, yes, indeed prices are going down, lithium ion is
21 going down, the flow batteries are going down, factors
22 of one half or even a quarter are entirely reasonable to
23 assume. But most technologies, if you take single
24 technologies, do eventually bottom out because you're up
25 to the materials or the manufacturing process.

1 MR. KUMARASWAMY: Chairman Bay, from the
2 developer perspective, I can tell you that the cost is
3 certainly going down. We actually received forwards for
4 the lithium ion batteries from some of the people we
5 work with. And I can tell you that the cost of
6 installing the system by the end of next year,
7 installing the system end of 2017 and 2018 are
8 significant. And so we do see that in the
9 forwarding-looking process for the entire system. And
10 even after responding to the fact that the batteries are
11 getting cheaper, we are focusing some of our concerns on
12 producing the balance of the plan. So if the batteries
13 get cheaper, how will we make the entire system be sort
14 of like going down in cost? And that's what we're
15 actually spending a lot of our focus on.

16 MR. IRWIN: So similar comment but a little
17 different. So DOE has published actually an effective
18 decline curve of storage prices, which is very dramatic
19 and very substantial. I think we have seen antidotal
20 evidence from some reason procurement where we have seen
21 responses below that curve. And I think that curve has
22 a reduction in the next, you know, five to seven years
23 at 50 percent or so. So I think material reaction, I
24 think Kiran, he's seeing more data than we're seeing,
25 but I think we're seeing sufficient data to validate

1 both: We're seeing the price reduction, we're seeing
2 the roadmap, we've talked to manufacturers about what's
3 your roadmap for cost production? We validated those
4 roadmaps. We've seen the steps they're taking. We see
5 the new generation of technology that's coming and the
6 improvement in that generation. So not only are we
7 seeing the data, we're seeing the forecasts, we're
8 validating the forecast, but we're seeing the right
9 manufacturing actions that would validly lead you to
10 expect that continued decline.

11 MR. BURWEN: I should just add, Chairman:
12 That Lazard Managing Firm just released yesterday their
13 costs for storage estimate, which they look at specific
14 applications. Because you have to ask: What is the
15 storage trying to do? And certainly one of the things
16 we find interesting here is that when you compare
17 storage on a non-subsidized basis on today's costs with
18 that particular plan for frequency regulation or for
19 incapacity, that it's already competitive. The extent
20 to which we consider costs should always of course be
21 focussed on the application, the value that you expect
22 that storage to provide, because that will ultimately
23 justify what the market is capable of.

24 CHAIRMAN BAY: All right, thank you.

25 Colleagues? Cheryl.

1 COMMISSIONER LaFLEUR: Thank you all. That
2 was very interesting. It's great to have people who are
3 really moving this market. I will also limit myself to
4 one question. I want to focus in on, what our
5 Commission can do in payment storage to help participate
6 in the wholesale market. Of course we've had storage of
7 the market for decades in the form of pump storage and
8 hydro that's been paved as generation. There's been
9 several references to the frequency regulation rule.
10 And Dr. Kristov talked about aggregating storage behind
11 the meter as energy, which are was hearing echoes of
12 order 745, which is interesting.

13 But if you could specifically, Mr. Burwen,
14 you rattled off many things the Commission could do. I
15 really welcome any suggestions as to what would be the
16 most useful thing we could do, whether we should do
17 something generic across the market on ones that have
18 made a lot of progress, should we be focusing on
19 ancillary services or energy? I just welcome anymore
20 thoughts.

21 MR. BURWEN: Sure, Commissioner LaFleur, I'm
22 happy to answer that question. Because we see that a
23 lot of the barriers are really barriers implementation,
24 that this effort to have comparable treatment, and so
25 why I bring up order 719 as a precedent, is because in

1 that manner the Commission ensured that tariff language
2 get clarified across the ISO's and RTO's, at that point
3 in the demand response. You can envision, perhaps not
4 identical, but at least similarly-oriented approach to
5 ensuring storage has clarified tariff treatment across
6 the ISO's and RTO's.

7 And certainly the other reason why I
8 mentioned Order 890 is because that focused on
9 non-generating resources and energy ancillary services.
10 It's an exceeding natural progression to extend that to
11 capacity as well.

12 COMMISSIONER LaFLEUR: Thank you, that's
13 very welcome.

14 Anyone else? You don't all have to answer
15 but I just want to give you an opportunity.

16 MR. KUMARASWAMY: I'll probably be brief,
17 thank you, Commissioner LaFleur. I want to echo what
18 Jason said and also think about the capacity and the
19 flexibility aspects of energy storage. It's a very
20 important issue and past regional markets actually have
21 a forward-looking view as to what the capacity should
22 be. I think it's extremely important for the Commission
23 to think about the flexibility aspects of what the
24 resource portfolio should look like and sort of not
25 having the consideration of what flexibility and ramping

1 issues that you may have at the level of the new
2 improvement, the lack of new generation you would have,
3 but actually create a situation where you have capacity
4 that's not designed in the most cost-effective matter
5 you would want it.

6 COMMISSIONER LaFLEUR: You would to it in
7 the capacity market, not call ramping and ancillary
8 service.

9 MR. KUMARASWAMY: You could do it in
10 multiple different ways. But I think the broader
11 concern is that both the capacity and the energy markets
12 inhouse is that there's a lack of valuation on the
13 flexibility, and so the energy storage.

14 COMMISSIONER LaFLEUR: Thank you very much.

15 DR. KRISTOV: I would just add a couple of
16 things from the ISO perspective. We are working on a
17 flexible ramping capacity that is an ancillary service
18 potentially but it would really compensate with an
19 AES-type capacity payment for that service. We also
20 worked with the PUC. We don't have a central capacity
21 market, but to get flexible capacity incorporated in RA
22 requirements where the qualifying capacity of a resource
23 takes into account its charging capability, as well as
24 its discharging capability, for the flexibility
25 attribute. So these are kinds of things that I think

1 expand the known paradigms of resources for one that has
2 the kinds of capabilities that storage has, and perhaps
3 the Commission wants to consider an exploration into:
4 Well, what is this new thing about and how do we have to
5 test the boundaries of our existing paradigms?

6 COMMISSIONER LaFLEUR: Thank you very much.

7 CHAIRMAN BAY: Thank you, Cheryl.

8 Tony?

9 COMMISSIONER CLARK: Thanks to everyone on
10 the panel for a really good discussion. I've enjoyed
11 this. And, Dr. Kristov, thank you in this case using
12 the word "game-changer". Usually I kind of roll my eyes
13 when I hear the word "game-changing" because it's used
14 so often. But I think energy storage actually is a true
15 game-changer in the energy industry, so I think it's
16 entirely appropriate that was used here.

17 I just have one question, but it has two
18 parts. How's that?

19 (Laughter)

20 So part number one: A lot of the big
21 projects that we heard about here today, maybe with the
22 exception of some things EAS is doing on the grid side,
23 it seems that it's focused on states that are still
24 vertically regulated by their state utility commission.
25 And I'm wondering if that is a coincidence or not or is

1 it a function of at least up to this point whether it
2 comes to some of the energy projects or the storage
3 projects we're talking about, it's taken a sort of a
4 normal listing view of a utility working with their
5 regulator to project out into the future and say this
6 might not be at this present point in time, if you're
7 using just purely market signals, which you might
8 choose. But in terms of like planning a grid, is
9 through more part of an integrated planning process, is
10 that what has allowed some of these initial projects to
11 take place. And is there a potential that it could,
12 that there's an opportunity for states to restructure do
13 some of these things in the future?

14 MR. IRWIN: So thank you for the question in
15 part. I guess if you think about the types of things I
16 talked about in my presentation of seeking that
17 distribution value, it's not known today, people haven't
18 proven it today. So it's hard, we as utilities
19 generally don't want to pay people for services that we
20 can't value. Obviously you guys have a lot to do with
21 regulating that process. But I think that is one of the
22 holdbacks today for those other folks. I think as the
23 markets that are utilizing the policy of the state, and
24 in our case our state regulators around integration and
25 renewables, are using that policy to actually go out and

1 push through this frontier and create game-changers and
2 not just a belief of a game-changer but a known
3 game-changer, which is when you get known values. Then
4 I think we'll see other markets much more easily follow
5 that because there'll be a path that's been laid.

6 COMMISSIONER CLARK: Okay, thanks.

7 Anybody else?

8 DR. KRISTOV: I would just add that in
9 California there's a state policy around
10 environmental-related policies that's been a huge driver
11 of some of the changes that didn't have clear monetary
12 value before that. So for example in transmission
13 planning we didn't have a category for public policy
14 transmission, but suddenly you have to develop
15 portfolios and you have to connect renewable resources
16 in new areas so we created a new transmission category
17 which nor allows that to be approved. I think the same
18 thing with the mandate for storage, it's really driven
19 by the state environmental policies that suddenly say,
20 Okay, now we need these other things if we're going to
21 achieve those policy goals.

22 COMMISSIONER CLARK: : Part 2. So the next
23 big change, the next big evolution in this market, that
24 really moves energy storage even move into the
25 mainstream of our operations, any predictions? Is it

1 going to be a big technological breakthrough, the
2 regulatory entries are going to increase these barriers
3 to entry and things for those specific ideas before
4 ether Commission in that regard? Or is it going to be
5 just the cost of economics of it that eventually the
6 cost drops will be free of -- it will be too
7 economically advantageous to not have energy storage?

8 MR. IRWIN: Thank you for that question. I
9 think it's all of the above. I think without all of the
10 above you'll find that, if you think about some of the
11 things that storage can do, in very high RPS penetration
12 markets we have some peakiness [sic] that creates some
13 opportunities. Storage does really well in peaky
14 operations; that's one of its better opportunities. But
15 I think unless we do all of the above I don't think
16 we'll see the value being able to see a lot of the
17 cleanliness of storage as we all expect. It has to be
18 all of the above, it's an additive process for storage.

19 COMMISSIONER CLARK: Thanks.

20 Dr. Gyuk?

21 DR. GYUK: I think we really have to keep in
22 mind: It's never just a question of bringing down the
23 cost; that's something people tend to glum onto. But
24 you have to bring up the value and the costs down. And
25 both sides, the push and the pull, are equally

1 important. And the cost, as has been mentioned, isn't
2 just the storage device, it's the power electronics, the
3 storage device, and the balance of plant. They're
4 almost equal in their contribution and they all have to
5 be decreased to decrease the cost. The value in
6 particular hinges, and in some states more than others,
7 on monetizing what you get. I would appreciate any help
8 in monetizing resilience, for example, and emergency
9 preparedness. We know it is essential, but it's
10 difficult to tie numbers to it and say, "Well, it's
11 worth this much."

12 COMMISSIONER CLARK: Thank you.

13 Anyone else? Jason?

14 MR. BURWEN: I would just add, Commissioner
15 Clark, sort of an echo. What we've seen is that, going
16 on Dr. Gyuk's point about value, the ability to access
17 those multiple value streams is critical to the economic
18 storage. We don't believe storage needs any substance.
19 If you can have the market structures to be able to
20 enable it to capture all those value streams, it should
21 be able to function economically in markets today. Even
22 if you have very cheap storage right now, it's unclear,
23 for example, how it could participate in capacity
24 markets without suffering extremely undue liability. So
25 I think in resolving that, you can very much expect that

1 those additional value streams for storage we would be
2 able to have will enable it to be a much larger part of
3 the energy system than it is today.

4 CHAIRMAN BAY: Thank you, Tony.

5 Colette?

6 COMMISSIONER HONORABLE: Thank you. This
7 has truly been both a fascinating and exciting
8 discussion. And I'm pretty pleased to have it today
9 because it gave us an opportunity to reflect upon what I
10 call your missionary work.

11 Dr. Gyuk, your reference to what is
12 happening across the country, what's happening in
13 laboratories, your work, I first wanted to say thank you
14 to each of you. This we see it is going to be and has
15 been and will be a game-changer. And it really allows
16 all of us an opportunity to get around the table
17 together and look at what's working well, what needs to
18 happen. And, Mr. Kumaraswamy, thank you for referencing
19 work happening around the globe because it really gives
20 us an opportunity to keep an eye on what's occurring.
21 Both Dr. Kristov and Mr. Irwin of SoCal-Edison -- give
22 my regards -- you guys really are on the forefront. And
23 I have been watching what is happening with the
24 California PUC and in particular Commissioner Peterman's
25 oversight of the portfolio of developing the first

1 mandatory program for energy storage procurement and
2 also the framework for the implementation for that
3 process. So hats off to all of you who are
4 participating. We are watching and we need and want for
5 you to succeed because you are laying the necessary
6 groundwork for further work that will enable storage to
7 get to the marketplace and people. I appreciate the
8 steps, the subjects for steps that we can take.

9 Turning to state regulators, are there any
10 -- quick in the interest of time -- preliminary steps
11 that other states can take that are interested in
12 forging ahead in their work on storage? Sorry, he had
13 his hand up.

14 DR. GYUK: I agree it's really important to
15 bring the states in this. We have 50 of them and we
16 have 3,000 utilities. Things are different everywhere.
17 And you know, we purposely reach out, knock on wood, to
18 states to the utility commissions. For example,
19 recently we did a two-day workshop with the utility
20 commissioners of the Northwest: In Oregon, Washington,
21 Idaho, and Montana. You have to prepare the groundwork
22 so when they get cases in front of them they will know
23 what this is about and why they should act the way they
24 should.

25 COMMISSIONER HONORABLE: Thank you, that's

1 very helpful. And I want to give a special shout-out to
2 DOE for their consistent technical assistance. It's
3 very important.

4 Dr. Kristov?

5 DR. KRISTOV: Thank you. I would mention a
6 couple of things that I think are important that states
7 can do. And you mentioned Commissioner Peterman's
8 oversight of the storage proceeding. That's going to be
9 starting at track 2, that's going to be asking and
10 addressing some of the policy questions related to
11 multiple uses. And I think there are some really
12 state-specific kinds of regulatory things: The retail
13 rate versus wholesale; the metering questions when it's
14 serving multiple purposes; defining uses on the
15 distribution system that could compliment services to
16 the wholesale market. Those things I think are very
17 important for state commissions to start looking at.
18 Even if they don't see this happening immediately, they
19 can start to create the ground for that, as well as then
20 interconnection policies. Because one of the stumbling
21 blocks seems to be the challenge of interconnection
22 where the rules are not quite set up for storage devices
23 because there's this load side as well as this
24 generation side, so both of those.

25 COMMISSIONER HONORABLE: That's excellent.

1 Mr. Irwin?

2 MR. IRWIN: I think what other states can
3 do, what we've seen at least across the country, is as
4 they think about what their policy is and where they're
5 going, is to see how storage fits and actually start
6 learning. And I think Dr. Kristov mentioned policies
7 and other things that I think we've also seen on other
8 utilities to go about a rigorous process of actually
9 going out and learning. And one of the things we found
10 is vendor consistency in the area hasn't been what we
11 would like to see. And that's not surprising when you
12 find new vendors in a space that you have some vendors
13 who are quite good and quite consistent and have a good
14 product and other people who are just trying to enter
15 the space and don't have that kind of reliable product.
16 So one of the important things when people dip their toe
17 in the water is to dip their toe with some knowledge and
18 some forethought when they go about doing that. But
19 they also need the regulator support to do that;
20 utilities don't go spend money on trying to demonstrate
21 money without a lot of regulatory support.

22 COMMISSIONER HONORABLE: I think that's a
23 great segue to you.

24 MR. KUMARASWAMY: I actually want to be
25 extremely brief in answering that question, Commissioner

1 Honorable. One other key things from the AES
2 perspective that I can say that the states can really do
3 is something that Commissioner Clark actually mentioned:
4 We can actually prove that energy storage is the most
5 cost-effective resource for peaking capacity. We've
6 been saying that for awhile, that it's really heartening
7 to see external third parties come up with the same
8 conclusion. And the way the prices are actually
9 projected to fall is actually is going to make this
10 application more effective. So if you're a state
11 regulator trying to do IRP's at the state level and
12 looking at this through the IRP, you have to ask the
13 question of: Did you consider all of the technologies
14 available? Without being more restrictive in terms of
15 coming to the conclusion that it should be a gas
16 commercial engine to meet the needs of customers. So
17 that's the one aspect that I have of state regulators.

18 COMMISSIONER HONORABLE: Last but not least,
19 Mr. Burwen.

20 MR. BURWEN: I was just in your neighborhood
21 last week, you remember, your domicile. And speaking
22 about the shared experiences, so valuation certainly is
23 clear one that states are grappling with. Not just your
24 integrated resource planning, that has been referred to
25 which Commissioner Clark discussed, but also the design

1 of you RFP's and your ability to do, for example, all
2 those RFP's; it's something that we think is
3 significant.

4 Additionally, we're seeing different states
5 starting to take on how they might create competitive
6 capacity. Certainly California and New York both have
7 projects right now where there's competitive bidding
8 capacity. We've seen states take the lead with respect
9 to distribution planning frameworks, and this is
10 particularly important for distribution-connected
11 storage on both sides of the meter, figuring out what
12 role that will play in distribution system planning.
13 Certainly we've also seen a number of states, colleagues
14 duly mentioned, Washington, other states that have
15 investment funds for setting up initial projects.
16 California, New York of course have put in place
17 specific incentives for peak load reductions or self
18 generation from storage.

19 And, finally, the concept of getting your
20 feet wet, as it were. There are states who are
21 considering demonstration projects, and I think we've
22 seen -- we have several hundred megawatts of in-storage
23 operating, some of it well over five years. There's a
24 track record, they're very leading utilities like Edison
25 that have taken the plunge here. And we think that

1 states can certainly learn from the existing projects
2 that are out there and that when they demonstrate they
3 should be demonstrating not necessarily the technical
4 feasibility per se but their own regulatory processes
5 and how they're going to go about doing this.

6 COMMISSIONER HONORABLE: Thank you. That
7 was my one question.

8 CHAIRMAN BAY: Thank you, Colette. Thank
9 you again panelists. With that, this meeting is
10 adjourned.

11 (Whereupon at 12:17 p.m. on Thursday, November 19th,
12 2015, the 1,021st FERC Commission Meeting is adjourned.)

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