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MANAGING TRANSMISSION LINE RATINGS

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TECHNICAL CONFERENCE

Day 2

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Federal Energy Regulatory Commission

888 1st Street NE

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PANELISTS

Panel 4

Adam Rousselle Sr., Alternative Transmission Inc. (ATI)

Sean Morash, EnerNex

Brett Wangen, GridSME and Western Interconnection Regional Advisory Body (WIRAB)

J.T. Smith, Midcontinent Independent System Operator, Inc. (MISO)

Aaron Markham, New York Independent System Operator, Inc. (NYISO)

Garrett Crowson, Southwest Power Pool, Inc. (SPP)

Panel 5

Carlos Casablanca, American Electric Power Company, Inc. (AEP)

Dennis Kramer, Ameren Services Company

Devin Hartman, Electricity Consumers Resource Council (ELCON)

Michelle Pivach Bourg, Entersy Services LLC

Michael Kormos, Exelon Corp.

Joe Bowring, Monitoring Analytics

Michael Chaisson, Potomac Economics

P R O C E E D I N G S

MR. KOLKMANN: Good morning. Welcome to day two of the Managing Transmission Line Ratings Technical Conference. As I mentioned yesterday, this Conference will explore what transmission line rating and related practices might constitute best practice, and what, if any Commission action in these areas might be appropriate.

We have two panels this morning, Conference Panels 4 and 5. Like yesterday, we will allow up to 5 minutes for opening statements from each panelist, followed by questions and answers. All materials received from speakers have been posted on the calendar page of ferc.gov and will also be posted on e-library under Docket Number AD19-15.

In addition, on August 23rd, staff issued a paper on managing transmission line ratings to help frame certain issues in this Conference. That paper is also available from the calendar page. Today's first panel, Panel 4, will discuss the Ability to Accept and Utilize Dynamic Line Ratings in Operations and Markets.

This panel will feature industry experts discussing the ability of RTO ISOs to accept and utilize dynamic line ratings, and whether the inability for RTO ISOs to accept and utilize dynamic line ratings could be a barrier to their implementation.

Panel 4 will also discuss approaches and challenges to accepting a dynamic line rating signal. Finally, Panel 5 will discuss transmission line rating methodology transparency. The panel features industry experts who will discuss both the potential benefits and cost to increased line rating transparency, understanding that concerns may exist regarding the inaccessibility of transmission line rating methodologies and resulting ratings.

Panel 5 will also discuss best practice for documenting transmission line ratings, the merits or challenges of having line rating methodologies, assumptions, and/or ratings themselves be available for review and challenged by market participants and coordination between line rating methodologies and ATC calculation methodologies.

I want to thank all the participants for being here today for what I'm sure will be a lively and informative day of discussion -- morning of discussion. I want to thank Commissioner Glick for being here. I want to welcome and thank him for being here. I don't know if you have any opening statements, but welcome.

Let me close with a few housekeeping matters. The Conference is being webcast. After the Conference, the Commission will issue a request for comments. As a

reminder, please don't bring food or drink other than bottled water into the hearing room.

Please silence your cell phones if you have not done so already, and there are bathrooms and water fountains by the elevator bank on each side of the building. We have a lot of ground to cover in a short amount of time and we'd like to keep comments within topics laid out for each panel. If discussion begins to stray outside the scope of the panel or outside the scope of the question, we may interject to bring things back to topics.

For panelists -- if you'd like to be recognized to speak, please place your name card on its side, and be sure to turn your microphone on and speak directly into it. When you are not speaking, please turn your microphone off to minimize background noise.

Finally, please do your best to avoid excessive use of acronyms and abbreviations, recognizing that there are lots. Now, I would like to introduce the FERC staff at the table. From my left to right we have Tom Dautel, Jignasa Gadani, Eric Ciccoretti, Al Corbett, Vincent Le, Michael Gildea, Kevin Ryan, Alex Smith and Michael McLaughlin. Thank you all for being here.

Now for our first panel. From my right to left, the audience's left to right, we have Adam Rousselle from Alternative Transmission, Inc., Sean Morash from EnerNesh --

EnerNex, sorry, Brett Wangen from GridSME and representing WIRAB. I'll ask you to say out what that spells.

J.T. Smith from MISO, Arron Markham from NYISO, and Garrett Crowson from SPP. Thank you all for being here and now I'll let Mr. Rousselle take it away.

MR. ROUSSELLE: Good morning. I'd like to thank the Commission for convening this Conference and inviting me to present today. Circuit ratings are important to this Commission's Consumer Protection Mandate. I have focused much of my professional career on getting ratings correct.

I wrote the 2007-2010 NERC alert standard drafts. I've patented two technologies proven to independently measure conductor temperature, which were later named as best practices by the IEEE for determining conductor temperature for the purposes of facility ratings.

I've overseen the development of more than 50,000 miles of bulk electric system ratings, and NERC alert reviews. I'm the inventor of seven patents which support reliability standards on the grid.

Today, I'm going to try to focus on the third question that the panel was given and the purpose of this Conference, as I understand it, is to understand and possibly have the Commission prescribe best practices for rating electric transmission circuits with particular focus on incorporating ambient adjusted and dynamic ratings as

opposed to continually or continuing to rely only on static rating in emergency management systems.

And as the Commission has learned from other presenters, there are different ways to measure and determine ambient adjusted and dynamic ratings, each of these approaches will likely help us better understand congestion, help us optimize the use of existing circuits and thereby reducing pricing in the day ahead and real time markets.

In short, each of them has merits and one or more may capture the best practice or practices. So, should ambient adjusted and dynamic ratings be incorporated into the energy management systems? The answer is of course, yes. Measuring the physical capacity and loading of circuits as they change over time and over seasons will allow operators to respond to those changes to make better and more informed decisions.

But there is another poignant question before this Commission in regard to many, if not most, of the organized ISO and RTO markets that the Commission oversees. And how this question is answered will determine how effectively ambient adjusted and dynamic ratings can be implemented and benefit consumers.

As you heard yesterday from CAL ISO, this additional question recognizes that organized markets

routinely adjust and report ratings not based on the actual physical capacity however its measured, but instead based on the needs of the financial markets that they host.

These market models very often depart significantly from the physical reality that the ambient adjusted and dynamic ratings seek to capture with ever increasing accuracy. And of greatest concern, unlike physical measure of circuit ratings, these market models too often are completely opaque to all but a few of incumbent market participants.

Indeed, in a recent proceeding before this Commission in which I testified, representatives from four major transmission-owning utilities testified that they do not even verify the static facility ratings that they under oath report to the Commission.

The slide behind you that I'm showing, it's a very large PDF. I'm not going to go through it, but it's on the file now for you. This is the chain of custody of the facility ratings to every manual in the tariff -- where it starts from, the static rating, and how it gets ingested in PJM at least.

The question before us -- at least one of them today is what responsibilities, if any, should the RSO, excuse me RTOs and ISOs have with regard to any verification of values provided by the transmission owners, and how

should any disputes regarding those disagreements of values between the transmission owner and the ISOs be resolved?

The combined transmission owner operator's agreement, as shown here has an express requirement that both PJM and all of the ISOs routinely monitor, review and verify the facility ratings not less than twice a year.

Yesterday, NERC told us that they were aware that the facility ratings from the transmission owners were not being checked. I'm sorry, my goodness, we're worried about dynamic ratings. Changing the ratings -- this is a more temporal update of what should have already been accurate.

The threshold question is whether circuit ratings should be set for any purpose to fulfill the financial needs of certain market participants as opposed to reflecting accurately the physical reality of the circuits. Should circuit ratings be changed to support financial transmission rights, or alter clearing prices in the day ahead markets? I think not.

What purposes, if any, weren't use of market models as opposed to physical measures? I urge the Commission to delve deeply into this question. If market models are used for any purpose to change physical measures of real capacity on existing circuits, then how can this Commission ensure that the models are transparently known,

and easy for market participants to replicate?

Let me conclude with this hopeful recommendation and a caution. Yes, ambient adjusted and dynamic circuit ratings hold great promise to improve grid operations and inform smart investment decisions. But just as market models currently distort static ratings, much, if not all, of the promise of rating innovations, those that we are discussing, will not be realized if they continue to be compromised by market models run and implemented behind closed doors, thank you.

MR. KOLKMANN: Thank you, we'll next turn to Sean Morash, form EnerNex.

MR. MORASH: Hello and thank you. I'm Sean Morash, a Smart Grid Engineering Consultant with EnerNex. And my primary focus over the last few years has been on the distribution side, particularly in smart grid architectures and strategies focusing on the integration of new technologies into the grid.

The distribution system in the U.S. has long lagged the transmission system in terms of situational awareness and, generally, technology. However, the same lessons that are being learned at the distribution level today, in terms of affecting change across siloes of an organization or across different organizations, can be applied to this discussion on DLR.

And there are two primary considerations that I continuously find myself revisiting when contemplating the future of dynamic line ratings.

Number one -- these are solved technical problems. We are not all experts in all of these. I am certainly not, yet. And we heard yesterday from a number of experts in certain areas of these, but IEEE 738 shows us how to rate a line, NERC CIP tells us how to protect assets from cyberattacks, ICCP and DNP3 and other interoperability standards help us to coordinate between systems and organizations, and there is a host of telecommunications and internet standards which could facilitate data transport from the field to the control room.

Number two -- stepping forward is better than standing still. Often with these new technologies, the promise of potential can stunt growth. The promise of potential allows us to consider multiple use cases and stack values and unlock all these possibilities. And quickly, dynamic line rating can become a tool for everyone in the decision-making world, whether that's the operational system optimizing its state estimator, human operations looking for improved situational awareness, or maybe its planners looking for asset health monitoring or attempting to utilize dynamic ratings for wind plant interconnection studies.

Ultimately, for a lot of us and some of here at

FERC today, we try to do all these things at once. And we've become paralyzed by that potential. Engineers, myself included, can start to brain dump and provide every possibility instead of focusing on just one, first capability.

So, our focus today should be on taking that first step -- identifying where dynamic line ratings and ambient adjusted ratings could provide value today. Let's worry about all that future stuff in a future session.

So, what do we need for dynamic line rating streams today? Well it varies, and ultimately it comes down to economics and incentives. Are the incentives set up right? Is there a good way to model the impact of dynamic line ratings, keeping in mind what I see as the primary use, which is not to defer traditional transmission expansion, but to empower decision-makers with more informed information about the behavior of the system?

I think this panel is intended to focus on the practical considerations of achieving just that. Maybe it's my job to focus this panel on that. Regardless, staff has prepared some questions and I would be remiss if I failed to address one of them.

The concept of coordinating across RTOs and ISOs seems is an important one. It teases to the broader question of providing the appropriate incentive mechanisms

for DLR. If a DLR system is successful on its target line, merely to cause congestion elsewhere, then the net impact should be assessed.

The problem is that the net impact is difficult to assess without these large interconnection studies. So, a lot of this could fall back to capacity expansion planning mechanisms, but with a standardized tool kit on how to model a dynamically rated line. One actor's assumptions on the capabilities of a line or a system, should not differ from another's.

Another question posed to this panel is the question of transitioning from ambient adjusted to dynamically rated lines. I propose another step to fit neatly between the two, which is to incorporate wind. Wind and ambient adjusted ratings, WAAR, would utilize air temperature readings just like ambient adjusted, but also aggregate wind data.

Again, leaps are not necessary, and we can take one step at a time to improve our current situation. Thank you. I look forward to hearing from the other speakers and the discussion that follows.

MR. KOLKMANN: Thank you. And we will next turn to Mr. Wangen from GridSME and WIRAB.

MR. WANGEN: Alright, thank you. My name is Brett Wangen. I work for the Grid Subject Matter Experts,

as a consulting firm working with utilities and renewable resources around North America. Today I want to thank first the Commissioners and FERC staff for allowing me to be here and to participate.

I am speaking today on behalf of WIRAB, which is the Western Interconnection Regional Advisory Body. They're deeply involved in a lot of reliability aspects of the Western interconnection.

A little bit about my background and why they've asked me to participate. I have about 24 years working with utilities and utility technology. Today my comments are really embedded from the background that I have at working at WEC and Peak, DRC for the last 11 years. I recently left Peak and you might be familiar with Peak and it is going through a wind down and a new RC transition is occurring on the West.

So, my comments today are really focused on my Western interconnection experience with Peak. From an RC perspective in the west, TOs are definitely the ones that are responsible for determining the facilities ratings and communicating those ratings and ensuring the accuracy of those ratings.

You'll hear -- I think we heard yesterday, and you'll hear from me as well and I think from others that incentives are probably important to ensure that the data is

accurate, models are accurate. One thing that we did notice as an RC that does not, many of you might be familiar, that Peak and many of the RCs in the west do not offer market services, they're RCs and RCs exclusively.

So, that does tend to disincentive the need for high quality data, not from RC perspective, but unfortunately the folks that are providing the data maybe aren't incented enough to make sure that their data is highly accurate. So, there are problems often times with the accuracy of the ratings to the dismay of Mr. Rousselle.

But nonetheless, we do think it's important though that the TOs provide that accurate data and it is their obligation. In the west, only a small subset of the facility ratings are dynamically rated and the bulk of those are ambient adjusted ratings, not the DLR that takes into account additional datasets.

The remainder of the data -- of the rating sets, typically are your seasonal adjusted, so summer/winter. Some in the Northwest tend to have a fall and spring rating set. But of those that are dynamic, roughly 1,300 out of about 14,000 transmission line segments that are modeled in these peaks -- network model are ambient adjusted ratings, so just under 10%, which is a fairly small number given the size of the interconnection.

Most of those are, like I said, they're

temperature adjusted, and they are provided essentially continuously. They're sent in via ICCP, either the rating itself is sent in ICCP, or a temperature value is sent in and then looked-up and I think you heard some of that discussion yesterday, very consistent across peak and some of the other RTOs that were here talking.

There really are no significant challenges from an RC perspective to implementing AARs and DLRs, the technology is there in the system, it's really more on the TOs and to provide infrastructure and provide the data to the RCs, or the RTOs or ISOs.

One thing that came up yesterday that I wanted to hit on yet, it is true that often times the RCs -- certainly it is the case for Peak, and I believe other RCs that maybe don't have some of these other functions, they don't always know what the limiting elements are of the facility rating.

They know that a rating has been provided and is associated with a certain facility in the model, but all of the details of what exactly -- what equipment is limiting on it might not be known. There are exceptions to that. I think you heard Mr. Subakti, from California ISO talk about their ISO footprint has that information.

And then in certain cases within the EMS you can configure what's known as a topology limited rating which basically means if you have a limiting circuit breaker, for

example, on a ream bus and that ream bus opens, you now have a new element, so if you preconfigure that -- and that is the case in some situations, not many, but that would be a known situation and to be modeled directly for automatic implementation by the applications.

In terms of the process typically that a RC might encounter in real-time operations and again, this was talked about yesterday, but I just want to reinforce this is all happening at Peak and in the West.

When an RC identifies a pre or post contingent exceedance of an SOR or facility rating, the first thing they're going to do is contact the TOP, validate the rating. If the rating is in fact, either incorrect, or there is another rating available, a higher limit, they can update the system's VMS to accommodate that higher rating.

Now, in the West in particular, all the RCs have in their SO methodologies, some language about what is appropriate. And so, you can't just take any rating. It's either 15 or 30 minutes, at least in the west, in terms of the rating time duration that can be used for that.

If it is a permanent change that needs to be made permanent through the model update process, if it's not permanent and it's due to some temporary condition or an ambient condition that needs to be made clear that that limit be changed back at some point, otherwise that could

result in some liability gaps of having the wrong rating.

Alright, I did want to hit on the need for coordination of facility ratings and certainly in the West, as I mentioned, there a lot of change with multiple RCs coming into play. In the West, we're unique. We have a new regional variance associated with VIRO 2-6 that comes into effect in the beginning of 2020, and that new variance requires the RCs to have a common modeling and monitoring methodology.

And in that methodology -- it's not complete yet, but it's pretty solid draft form, there are requirements for RCs to monitor across their boundaries and monitor into equipment that are impactful to them and that they impact, if you will.

And so, because of that, it's very critical that the same ratings are being utilized for monitoring purposes. So, if there are AARs or DLRs, then both RCs should have those capabilities to be able to receive those dynamic ratings.

If there is static and there are changes for whatever reason, whether it be a seasonal change is occurring, or just identifying correct ratings, those will need to be coordinated very carefully.

Alright, in terms of what we see as next steps -- WIRAB believes in having improved dynamic line ratings will

lead directly to improvements in reliability. And the call to action or the ask, if you will here, WIRAB believes that it is important to take incremental next steps to move in the direction of further AAR and DLR implementation and adoption in the West.

WIRAB urges FERC to direct NERC in the regions, WEC specifically, to coordinate with TOs, TOPs, ISOs, and RCs to perform reliability assessments in 2020. Evaluating the reliability benefits barriers and direct cost implementing AAR and DLR processes in real-time operations to improve reliability.

WIRAB further encourages Western RCs and ISOs to consider some sort of fee structure, whether it be discounts due to reliability improvements through improved data, perhaps penalties but some other available options to provide the incentive, I think that's the key thing here is incentive for the adoption of AARs and DLRs in the Western interconnection. This concludes my remarks for today, thank you.

MR. KOLKMANN: Thank you. We will next turn to J.T. Smith from MISO.

MR. SMITH: Thank you, I appreciate the opportunity to speak with you all today. My name is J.T. Smith. I am the Director of Operations Planning at MISO. I've been at MISO for 14 years, but the majority of that

time has been in our planning environment.

I heard a lot of comments yesterday and today that really make my comments not very new. My IMM and my TOs, we've already been up here and some of my peers across the RTO environment spoke many of the same things that I was going to talk about and will at least highlight a couple of comments here.

First and foremost, MISO provides the platform for ratings to come into the system, whether it be seasonal or more dynamic in nature. We actually have four methodologies that are automatically populated into our systems from a seasonal basis that happen a couple of times a year.

We have a system that allows, I think like PJM's and some of the others that we talked about or caught where we have ratings tables or temperature tables, that we get the temperature provided to us through our inter-control room communication protocol, ICCP.

We also receive rating changes directly via the ICCP process. And then finally, we also take rating adjustments through flat files. So, we've created four platforms effectively for delivery of ratings within our system. At this point, only about 7% of all line segments within the MISO footprint actually have some type of dynamic rating. The other 93% are generally seasonal.

We recognize there are benefits associated with having more dynamic rating structure. There is the -- obviously, the market efficiencies associated with congestion management, but there's also the situational awareness from reliability management as well.

It's important to understand what the capabilities are on the system, whether it be there's more capability or less capability than what is represented in the seasonal ratings. Our systems can handle the inputs in the real-time environment. And like I said, we do it today. It is automatic. We also do as mentioned previously, yesterday as well as today, we -- if we run into situations where our operators are seeing congestion or reliability issues on the system, those phone calls do happen as well to verify and check that the ratings that are being constrained potentially are correct, or if there is an opportunity for them to increase to help us get through some tight time periods.

Going forward we would -- we believe that the capability is within MISO. Now, obviously any system that's not been fully stressed from a technical capability, if we start seeing increase in volume, increase in frequency of the ratings, we may see some issues pop up, but as of right now the 7% use has not stressed those systems in the real-time environment.

Do we need 10 minute data, 15 minute data, hourly data, day by day? I think that's going to just depend on what is going to be useful for the operators in making sure that they can operate the system reliably with a predictable outcome in mind.

Our day ahead market environment may be not quite as robust as our real-time right now. We are currently going through some investments for our market systems that as they come up to speed, our day ahead environment should be more robust to be able to handle as we talk about dynamic line ratings in a forecasting nature. And with that, that concludes my comments.

MR. KOLKMANN: Thank you. We'll next turn to Aaron Markham from NYISO.

MR. MARKHAM: Good morning. My name is Aaron Markham. I'm the Director of Grid Operations at the NYISO, so I have the real-time control room operations as well as operator training reporting to me. And I appreciate the opportunity to speak on line ratings in front of you all today.

So, as an initial point of information, the NYISO, as many of the ISOs and RTOs, does not actually own any transmission equipment, so we rely on the transmission owners as the asset to owners to actually provide us ratings.

Our current methodology is that we have seasonal ratings, so we have a summer rating set which is in effect from May 1st through the end of October, and a winter rating set which is in effect from November 1st through the end of April.

All of the transmission owners provide us all the appropriate limiting equipment and components of the rating and from a seasonal perspective, the ISO comes up with what the most limiting equipment rating is for the facility and publishes that out to all the transmission owners. We do coordinate that.

Once we have the seasonal ratings, we use those in all of our forward markets. So, our transmission congestion contracts, our FTR markets, uses the seasonal rating set. Our day ahead markets use the seasonal rating set, and then in real-time we do have the ability to accept dynamic line ratings and ambient adjusted ratings through ICCP, the inter-control center communication protocol, I'll try not to use acronyms.

It's a long one. So, typically in New York, those dynamic line ratings or ambient adjusted ratings are an increase from the seasonal rating, so that frees up additional capability in real-time, both for the EMS contingency analysis assessments, as well as for the real-time markets to utilize.

So, from a transparency perspective the NYISO does publish the season rating sets as part of our operating studies, so they are available to all interested parties and we also on a limited basis, based on need, do provide what rating sets we do secure to.

So, from a post-contingency perspective, whether that's the 15 minute rating or the 4 minutes or the 4 hour rating -- excuse me. We do not differentiate between ambient adjusted and dynamic line ratings in real-time. Typically, dynamic line ratings in New York are implemented on the underground cable system, which is a majority of the facilities in the New York City/Long Island area.

And generally, ambient adjusted ratings are applied to the overhead ratings, if you want to get specific. So, the one last point I would like to make is we think that the ability to provide additional capability in real-time sets us up very good from our liability perspective. We get our forward markets, a bit conservative -- our day ahead market comes out with a reliable operating plan based on those seasonal ratings, and then if there is additional capability in real-time, we do utilize it.

So, we do have some concerns over putting in more dynamic and/or ambient adjusted ratings in the day ahead market, and that, you know, from a New York perspective,

load is very correlated to temperature in New York, so we want to make sure we get a secure day ahead commitment with a more conservative rating set.

So, I believe those are the opening comments I wanted to make. Once again, thank you for allowing me to participate today.

MR. KOLKMANN: Thank you. And we will now turn to Garrett Crowson from SPP.

MR. CROWSON: Yes, good morning. I want to thank FERC staff and the Commissioners for allowing us and inviting us to participate in this panel. Like mentioned, my name is Garrett Crowson. I've been working for Southwest Power Pool for 8 years and I have a -- I think I pressed the wrong button -- there we go I got it.

So, I have a presentation to go through, kind of some intros about myself, Southwest Power Pool and then what we've done for the ability to receive ratings -- real-time ratings in real-time. So, a little bit about myself, I've been working for SPP for a little over 8 years now. I spent a portion of that in market forensics analysis working on the market clearing engine, mostly for the integrated marketplace.

I've recently transitioned to a Senior Operations Engineer in Operations Engineering Analysis with a lot of focus on real-time analysis and new tool deployment to the

floor and various aspects of that. Where I really tie into this panel is, I led an effort to implement STPs. We've called it DLR enhancement, but it's really the ability to receive real-time ratings. So, I led that effort which just went live in March 2019.

A little bit about SPP here, we're pretty well-known at this point. I mean we've been operating for over 75 years. I'm not going to read through these bullets, but one of the main points in the second bullet that's a key word for us is "collaboration". So, a lot of SPP's importance is put around not necessarily, you know, what we're doing, but how we do it and how we collaborate with our membership, so it's a big point for us.

So, our SPP DLR AAP real-time rating, you will see TAR up there as we call it TAR, a lot of acronyms there, but really this initiative was kicked-off back in 2017 and it was really they look at a high level possible benefit of doing some sort of dynamic rating, temperature adjusted rating.

We carried those evaluations out and presented it through our stakeholder process to various groups. At that point the scope was refined to what the need really was for SPP. And that was figured out that we needed to be able to receive these ratings, however the transmission owner decided to calculate such, so we refined the scope down to

that and it ended up getting endorsed to do by our operations reliability working group, which is mostly made up of transmission owners.

So, once that was endorsed, we kicked off the project and we just got that enhancement to SPP systems in 2019 of March.

So, I'm being real brief, but I look forward to the Q&A session, so but this is a little bit about SPP's enhancement that I led the effort on. Really a big point here is that we left the onus on how the rating is calculated whether it be DLR, AAR, on the transmission owner to be able to calculate that however they felt. They're assuming the risk. They will know how they want to calculate that rating.

What we've really set up is the ability to receive such through ICCP as you've heard mentioned, that is directly fed into our EMS for real-time power flow and contingency analysis. So, there was a few things that we wanted to make sure and I tried to quantify the questions that were submitted in a few bullets here to give an overview of what we're doing.

Those bullets down at the bottom are really -- we required that reasonability limits are submitted with the request to model such real-time rating, and that really uses an upper and lower bound. So, what that does is it

basically gets, you know, the TO to sign-off on this is my upper and lower bound, and that's really to get rid of possible erroneous data or anything that they've agreed upon that shouldn't be use.

So, that's submitting on the modeling process also, and agreed upon. We also have similar stale and bad quality logic to our state estimator, I mean to our SCATA megawatt inputs to the EMS. So, if such rating coming through ICCP goes bad quality or is stale for a certain amount of time, we actually revert back to the seasonal rating which they are also submitting to us, so that was kind of a couple of logic enhancements that we put in place to make sure there was no discrepancies between what we used.

And then jointly-owned assets, they have to of course, have approval on reasonability limits, seasonal limits and their quest to model any kind of real-time rating by all asset owners. All of these, you know, bullets, as far as collaboration is a big point that I brought up.

They were all vetted and took through stakeholder working groups, so this was agreed upon as the logic we would use. So, that was a big point for us. And like I said, I look forward to the Q&A session. I know I was brief, but I hope I gave a good overview to what SPP is doing with real-time ratings, thank you.

MR. KOLKMANN: Thank you. I'll kick us off with a question that was inspired by one of Mr. Smith's comments and its related to possible needs for potential software updates in the day ahead market. You mentioned that that was occurring for MISO to essentially be able to accept DLRs in the day ahead markets.

Can you elaborate on that? And do other RTOs or other people know of similar concerns in other areas?

MR. SMITH: So, yes, directly for ours I know, as I got into this DLR understanding where information was going and how we were accepting, it has come to my understanding that our day ahead systems, we don't have good, solid processes into bringing those dynamic ratings into in a forecasted nature.

It depends a lot on the historic ratings and the understanding of what exists out there today, that gets pulled forward into the day ahead environment. So, getting the automatic or forecasted, is not within the system capabilities right now, but we are going through a significant investment profile in regard to our market systems.

And as part of that investment, our systems and we'll be able to develop processes around it to better accommodate if that is the desire to go forward with. So, it's the forward market's component or the market's

component of it is where the difficulty is right now for us.

MR. KOLKMANN: Got it, Mr. Crowson?

MR. CROWSON: Yes, so as far as STP goes, day ahead market -- these ratings aren't fed into day ahead market at this time. I think we're on a similar level that this would take an enhancement at that point. I think the biggest deal that's been brought up through several panels is the forecast, so the ability to forecast these ratings and be accurate enough to use in the day ahead market is a big point that is keeping us maybe from jumping on that.

I would like to mention that you know, we have the holistic integrated tariff team that was formed, and they've been looking at several of these things. There is an effort to do a deeper dive into dynamic line ratings and the benefits, and this might help prove the benefit to be able to push such enhancements that they had, thank you.

MR. KOLKMANN: Mr. Markham?

MR. MARKHAM: Mic difficulties, sorry. So, yes, as I said before we do currently use this seasonal rating set in our day ahead market. We do not have the ability to increase those ratings in the day ahead for the concerns I outlined.

But we will if there is a topology configuration that results in a lower equipment rating such as a breaker out at a station, we do have the ability through process to

reflect that lower rating of the day ahead market, so we get a reliable commitment.

MR. KOLKMANN: Okay, anyone else want to touch that? That's fine. I'm following-up on the day ahead points, we essentially, there's a wonder if DLRs and AARs need to be consistently applied across day ahead and real-time markets knowing, recognizing the challenges that we just spoke of logistically.

It seems like there would be a lot of benefits and a lot of challenges to applying it to the day ahead market, but we've also spoken a lot about forecasting yesterday. I wonder if panelists could give their view on that. I know that I think Mr. Markam spoke about some market challenges applying to -- regarding uplift.

But it also seems like that's already a risk with regard to load forecasting already, so if panelists could provide their view on that, that would be helpful. Mr. Rousselle?

MR. ROUSSELLE: It's interesting. Perhaps a different test and that is I'm an applied technology guy than developing real-time rating solutions before my current firm. I think what we're seeing is the advent of great new information and we're asking the question about how to integrate it with the system that was designed not to have it.

It didn't exist before. We're seeing a clash. You know, should we do it? I think we have to have the data and after we have it, you'll have a better opportunity to steer. The markets are using ratings in a way to solve in some cases, for financial transactions which will almost have nothing to do with the physical rating in the system.

And we're talking about what do we do with the actual physical real data and should we insert it over here? I think the question really is, aren't we seeing the clash of an old structured system with great new advanced technologies? And how do we manage that change?

MR. KOHKMANN: Mr. Wangen?

MR. WANGEN: So, obviously, I don't speak from a -- but I certainly can speak from a data perspective, and I think I tend to agree that this is new technology that -- and I'd be curious if New York ISO, you know, has plans to move forward. But to me, from my experience with Peak and the Western interconnection, half the battle is getting -- is evaluating your data and your data quality and having metrics in place and regular reviews and assessments to ensure that you're getting quality information.

So, I guess I would just encourage that there be processes in place to do that so that at some point, these can be implemented in day ahead markets. Because I hear the desire to be conservative, but I think, especially from our

experience in the West, that's the way the West has been for years has been overly conservative, and we're just trying to now, get to a point where we're not overly conservative, but yet we're very reliable.

I think that's a border that you can get across once you have confidence in the data that you're using your tools.

MR. KOLKMANN: That makes sense, Mr. Markham?

MR. MARKHAM: So, yes, I want to speak a little bit on the uplift potential concern that we have at the New York ISO. The way our market is structured, any change in transmission topology essentially transfer capability from the day ahead to the real-time shows up in an uplift bucket, we call balancing market congestion residual.

So, to the extent that there's less transmission capability available in real-time that balancing market congestion residual gets generated and then gets socialized out across our loads. That is a bit different from a load forecast error. So, if a load forecast error arises, either at the ISO or at the load serving entities that bid load, that actually -- that difference and that different settlement between the day ahead and real-time market, gets charged directly to the load that was short.

So, there's a little bit more direct correlation, or there's a lot more direct correlation on the load if they

miss the day ahead forecast versus if we -- I'll say, miss the transmission topology, transmission capability that's available in the day ahead. So, that's kind of the differences.

MR. KOLKMANN: Okay, Commissioner Glick, do you have any questions?

COMMISSIONER GLICK: Thank you. Just two -- hopefully quick questions, one of which is you know, I know that we're talking a lot about DLR and AAR in terms of real-time markets and as you mentioned the day ahead markets, but I was wondering if you could comment, if anyone wanted to comment with regard to the interconnection process, especially in areas where it's pretty windy.

I think it can certainly have, it seems to me, you're going to add some extra capacity not having to build additional or spend a lot of money on additional upgrades. Does anyone have any experience with that or thought about that?

MR. SMITH: I feel like I should make a comment since I spent so much time in the planning environment. I don't know if that's a good thing or not. It's difficult to think about a long-term transmission planning thought process and throw dynamic ratings into that conversation.

The build that is identified from a transmission planning perspective is occurring at the worst peak

condition assumptions that exist out there. So, if I'm already assuming a peak load generation injection as well as peak load most likely being driven by peak temperatures, it would be hard to understand, or be able to figure out what is the right transmission rating that you would need to use in those hours that is different from your standard calculation, 104 degree environment.

Now, when you're talking about renewables, wind resources in that regard, yes, their production is generally not sitting on the peak, and there's capabilities that do exist out there, but most of those resources aren't coming in as firm capacity either, they're coming in as energy resources and are subject to the capability of the system.

And then the system in the real-time might actually see more benefit in operating around their production in those off-peak hours, but from a planning perspective, I think it would be a really hard sell to try to figure out how to change those ratings in those transmission lines when you're talking 3, 5, 10 years out in that evaluation.

CHAIRMAN GLICK: Anybody else?

MR. ROUSSELLE: One interesting opportunity New York is great at is the entrepreneurs. If the merchant developers had access to the information in the universe which was very hard for the ISOs to at once leverage, they

would be able to learn, invest their own capital at risk, become a stakeholders, go to the ISO stakeholder meetings and advocate for the change through the ISOs process.

But without the data, we can't find ways to help. And without accurate data, we absolutely can't help. So, I think data is the key. More data is better.

MR. MORASH: My kind of comment on it was when EnerNex helps a lot of wind developers with their power system modeling, and a lot of what that winds up being is fixing other people's models when it doesn't match reality.

And one of the projects that we had, the CAT bank was causing some harmonics issues and the model was incorrect. And it turns out that they had actually dynamically rated that CAT bank because it was up on a hill and it was exposed to wind.

And so, it wasn't a formalized process, right? This was just an engineer who had kind of underbuilt his CAT bank because he knew the wind in that area. And so, you can argue whether that's ideal or not, but it kind of slipped in, and it was an older type of you know, situation. It was an older wind plant.

And so, formalizing all this and you know, is kind of the process that had already been occurring where we relied on engineers to use their engineering judgment, so that's my point, thank you.

MR. WANGEN: Just real briefly, so my company, GridSME does a lot of interconnection support with renewables, both wind and solar. And just more of an observation, I think similar to what Sean was just describing, we see that it's very undefined.

No one is talking about dynamic ratings in terms of how do they reduce network upgrade costs, how do they better integrate their resources? This is not something that I've heard at all to take back to the company whether anyone else has heard.

And I've even had some dialogue with not just the customers trying to interconnect, but those -- the systems that they're interconnecting with, and they're also struggling with what are the best practices. So, it seems like this is really just the start of that discussion.

So, you know, I personally tend to agree that maybe there's not a place for dynamic ratings in that interconnection process, but I think that should be worked out further.

MR. SMITH: If you don't mind, I just want to make one more comment. Right now, especially when it comes to the interconnection ques that are sitting, I can specifically speak of MISOs. We're not talking about 100 megawatts here, 100 megawatts there where dynamic line ratings might be more useful, or potentially could.

In fact, we're talking about thousands of megawatts injecting in the similar areas that is a 10% increase in your transmission capabilities is not going to meet those needs. We're not talking on the fringes yet, we're still bulk injection of mass amounts of megawatts into our systems right now that dynamic line ratings -- maybe that conversation could be more fruitful if we started to get to the fringes in that conversation. It's a good thing that water's been empty, I've dumped it twice now.

So, I would argue that -- and it's really not even been in my thought processes, because we're not talking about 100 megawatts, we're talking about 10,000 megawatts at this time.

COMMISSIONER GLICK: Sure, so if I can just -- with something you just mentioned, but obviously you mentioned in your initial comments about concerns about the lack of transparency and lack of in some cases, verification.

Is there anything that FERC or NERC, for that matter should be doing, should be requiring to improve that process?

MR. ROUSSELLE: Yes, sir. As I understand it, the first thing that a system requires is a report by the transmission owners to FERC of their facility ratings within FERC Form 715. And as I understand it, the ISO, ingests

that. In fact, the transmission owners, by practice, give that to the ISO and the ISO bundles those together and gives FERC 715 to the Commission.

No one is checking the facility ratings on any regular basis that I'm aware of. I have spoken to the CEO of NERC. They don't do markets. When they audit, when I have asked about audits of facility ratings, the answers that I've heard are this -- FAC 008 requires a written methodology and the audit begins by asking the utility to share the written methodology.

The audit usually ends with the production of the written methodology. I have only seen one in 5 years of extensive study. One audit, only on one circuit and that circuit was chosen by the transmission owner to give to the auditor. No one is checking, and if there's anything that you can do, sir, immediately, someone must do the math.

This isn't a question of whether I or you like the methodology, that's the utility's choice. But somebody has got to check the math, sir.

COMMISSIONER GLICK: Thank you, anyone else want to comment on that?

MR. KOLKMANN: Okay, thank you. So, building off that point, and thank you for your question Commissioner Glick, what role -- are there roles for -- are there any roles for the RTO in this process? I know Mr. Crowson spoke

pretty coherently about the upper and lower bounds. Is that something that at the very least makes sense?

There, you also mentioned about the possibility of reverting back to static ratings, to the extent you can elaborate on that, that'd be helpful as well.

MR. CROWSON: Yes, absolutely. Yes, so those logic processes were thought about when we were doing this enhancement. Basically, we still and you know, to answer comments, we still take, you know, the ratings that are submitted to us, but we basically request that upper and lower bound, along with a seasonal static rating.

So, once a DLR is what we call it, however that real-time rating is being modeled with us, it's required to check on, you know, check-off on those upper and lower bounds and the logic that we presented to our stakeholder group of how we'll revert back to that static rating.

So, what we're really trying to get ahead of there is any sort of you know, erroneous data where, you know, we might feel like SPP would be held accountable. Basically, we can get everything checked-off on and say this is the agreement on how we're going to use y our rating, but those ratings still are submitted to us and then the FAC-008, as mentioned, is the actual requirement submitted to NERC for that methodology, so.

MR. WANGEN: Yeah, from a Western integration

perspective, and I would bet that all the RTO, RC guys, the type of folks around the table here probably have processes in place as well to validate -- not necessarily an active process to validate on a regular basis that the facility ratings are accurate. The process is to push back out their models, all of the data, the facility ratings.

One line diagrams probably even an electronic method to get into their system to review state estimated results in some of the advanced applications. So, I think that the RSOs, RTOs and RCs are definitely providing the ability to do those types of verifications. Just to my understanding, and certainly from a Peak perspective, they -- those things, those actively weren't being done because they weren't the source of the ratings themselves.

MR. ROUSSELL: If I may, following-up on those two things, perhaps enforcing the rules we have, allowing NERC expanding their mandate to require perhaps even a broad system-wide in the immediate evaluation of every bulk electric transmission circuits facility rating would be helpful.

And in that regard, if there's any question about what the facility ratings are, should we put a dynamic rating cuff? If you put a blood pressure cuff on every transmission circuit, which I advocate, unequivocally, undeniably, there would be no doubt what the rating was,

what it was last week, last year.

I'm not talking about forecasting, it's just a fact. What is it? What was it? There will be no missing what the facts

are and that will be transparent to you at least. I'm a big advocate for immediate undeniable access and a review of the entire nation's bulk electric systems facility rating accuracy, sir.

MR. KOLKMANN: Does anyone else want to touch that? Going once -- so, following-up, your point about dynamic line ratings, I'm curious to know more about some of the reliability and security of the communication that's needed -- the availability, confidentiality, to what extents do NERC reliability and critical infrastructure protection standards apply to ensure that the data and system availability confidentiality exists, particularly when you're communicating? Can you speak more about that difficulty -- that challenge, particularly from the point of sensor to the point of aggregation essentially?

MR. MORASH: Yeah, so I mean it applies, right, if they're making a real-time decision that it was dynamically changing from field assets the NERC CIP applies and you have to make the appropriate -- you have to follow the rules, right?

But that shouldn't be a problem. Other people

follow the rules and do that type of thing all the time, and so I think that that distracts from the broader question of some of what Mr. Rousselle was talking about, but also creating the right incentives to make sure the transmission owners and the RTOs and ISOs are communicating, just in general.

And who's responsible for what. It shouldn't get hung up on the cyber components, because that will figure out. The rules are in place, people do it. The vendors have cyber full-time staff, right? And so, let's worry more about the interaction between the transmission owners and the RTOs from an incentive perspective.

MR. GILDEA: Yeah, I just -- following-up here on the Commissioner's as well as Dillon's and kind of just following pulling that thread a little bit on the need of the -- what I'll call improvement to the FAC-008, which is essentially a call for method H transmission provider having methodology. And then what I've heard is we have a process among the RTOs here, that basically they go back and have a process for confirming that.

But what we need really is a kind of a stand down fact check on the raw underlying data that goes in, and then you have essentially your iterative process already built in what I'm hearing. It's just a matter of an initial check on the quality of what we have kind of find -- making sure it's

very accurate and then going forward as we work and fine-tune these seasonal and dynamic line ratings, we're building off a base of factual understanding of a bit more accuracy of a build.

But we have the process of what I'm hearing from all of the RTOs, and kind of a confirmation on it. We have the process built in, but what we really need is a quality check on the underlying fundamentals and that's really not called for in the reliability standard, probably a lot of TOs have a stronger quality check internally than others, but we want to get confirmation that that quality is there and then get that up on a transparent platform.

Does that kind of bring around everything I've heard in the last 10 minutes? I want to make sure my understanding is --

MR. ROUSSELLE: I completely concur with you, sir.

MR. SMITH: I think though, and I'm going to ask my peers to correct me, but I believe we're not necessarily doing a quality check to the build up of what creates that rating. We're doing sanity checks to make sure that those ratings are not outside of what we would consider to be normal bounds for that, so we don't have that data internally to do that.

So, I just want to make sure that's clear is that

we're really doing sanity checks on the ratings that are being provided to us and not actually validating the ratings that are being produced.

MR. CORBETT: Okay, yeah, I'd like to revisit the wind issue for a wind facility. Could we agree that it would be reasonable that if a transmission owner models a wind unit in their model as producing that the sufficient amount of necessary wind for that unit to produce would be a reasonable wind assumption in rating the facilities associated with that energy resource?

MR. MARKHAM: For the NYISO and the geographic topology in New York, the wind plants generally in New York are up on the higher terrain, and the transmission lines typically run in the valleys. So, I'm not sure it's a safe assumption to say that the same wind that a wind resource is experiencing at hub height of a turbine is actually the same as you know, where that limiting transmission line may run either you know, to the valley or at the substation if it's a component in the substation that is what's limiting the output of the facility.

So, I think more detailed analysis would need to be done to at least look at -- I'll say the topology and the wind resource, or the wind profile along that transmission asset before we would want to use that assessment.

MR. CORBETT: And we hear that discussion quite

often for that question. However, when you site wind units, you are seeking out corridors which have a lot of wind to harvest. They are there for a reason. I'm not saying that there is a one to one ratio with regards to the hub wind volume versus the velocity in the valley, but there is shall we say, there is an additional wind volume in that whole vicinity that at least is beneficial to the wind unit, but also provides an opportunity for the transmission owner to model a certain amount of wind, taking the consideration when they're developing the ratings for those energy assets facilities.

MR. MORASH: So, I agree with you. The one, yes, the ISOs didn't -- the question that I would toss in there is the kind of growing trend in the industry where wind and solar resources are sited with batteries as well. And so, where you're looking at a situation where those plants have energy storage facilities that could potentially be producing when there's not the resource that the wind resource isn't there, that would need to be kind of considered as well.

I don't' think it's a fundamentally different thing from what you're talking about, but just in the creation of that rule, it should be considered.

MR. WANGEN: I think part of the question is maybe just the system topology as well and how long the

lines are. I'm not familiar with New York's system. In the West, in particular, you'll have wind in Wyoming that's going to end up in California.

And in some of these transmission lines are extremely long and so, to try to equate an amount of wind at the source to a facility rating on that transmission line or segments of lines, would be difficult just because of the length of the lines.

MR. CICCORETTI: I just want to follow-up on Mr. Corbett's question, perhaps at least to Mr. Markham. You indicated that more analysis would need to be done before one could conclude that the wind that powers an interconnecting wind facility might also increase the ratings of a transmission line.

Could that analysis be done in the interconnections to V4 in that one facility?

MR. MARKHAM: So, as I stated in my opening remarks the asset owners in New York are actually the rating authority, so I think we would have to take that back to them to see if they could do that analysis and what you know, what data would be available at the you know, at the -- either through the path of the transmission, the limiting transmission element or the substations wherever that limiting component is to see if that's something that could be done through the interconnection process.

At least from a New York perspective, we do have a minimum interconnection standard for energy production, so as long as we can redispatch around, we will let the facility connect without additional transmission upgrades. For capacity deliverability it's a bit different, but if a wind resource wants to come in as energy only, as long as we can back other resources down and come up with a secure operating plan, we will not require them to do system upgrades.

MR. SMITH: And I just wanted to add is you know, when I think about my footprint in MISO, I don't believe the limiting facilities for the interconnection are right at the direct interconnection point generally. We usually, what we'll end up seeing is crossing the Mississippi Rivers, where the congestion is, which is 300 miles away from where those wind farms are generally connecting to.

So, what the issue and what the actual problem is may not matter what's going on at the site of the wind farms and those lines. Those lines may be robust if there's congestion further down the system that may be just a different animal that you're trying to tame there.

MR. CICCORETTI: Thank you, that's helpful.

MS. GADANI: I had a follow-up question -- I had a question that takes us away from the interconnection issue. Yesterday we heard from different entities about

there may be lines and there may be -- or, there may be facilities that can be prioritized in terms of what you -- whether you decide to deploy DLR on it, notwithstanding though, we don't have data right now, but these RTOs, the RCs have some information. Is there an opportunity for the RTOs, RCs to work with the TOs to help identify turn facilities that should be candidates for new technologies -- for dynamical line rating EEO technologies, we'll start with them, I guess?

MR. CROWSON: Yes, thank you. So, I think there -- we dealt with this at SFP a little bit on how at first it was with the evaluations of how you might want to quantify a high level benefit. We tend to focus on historical, you know, binding constraints in the market and things like that to where we could dig down and look and see if the you know, actual monitored element was the constraining element.

I think where it gets really difficult after that is, you know, diving down in this shifting of the congestion. How many N minus 1's SFP checks are used, a simultaneous feasibility test, do you want to run to see where the congestion basically moves to?

So, there were some high level assumptions at first. Looking at binding constraints that have been historical binding in the market and trying to quantify what would happen if we reduced those. There could be potential

there. That is how we actually worked with the transmission owner that is utilizing our enhancement.

We've looked at those constraints and communicated with them on potential benefit.

MR. MARKHAM: So, in New York, we're very similar to that. We do have an economic planning process which looks out, I believe, 10 years and does a forecast of congestion on the system and defines what we expect to be the most limiting elements as a starting point for their research into what could be done to mitigate those limiting constraints on the system.

In addition, we have had a fair amount of success working with the asset owners, looking at real-time congestion on the system and coming up with either small upgrades on the system that remove the limiting element, maybe that's a CT issue, or a wave trap issue.

We've had the ability to work with the transmission owners to get them to replace that limiting equipment to get it up to something that, you know, may be more costly to replace, like a conductor rating.

And we've also worked very hard to implement ambient adjusted ratings and dynamic line ratings on the facilities that are typically thermally limited in New York. So, we've had pretty good success in all those fronts.

MR. SMITH: And I'll just add-on, we have the

data. We have the understanding of what's going on in the systems. I think it's important to understand, you know, you may have one member decide to move towards more dynamic rating environment, and all they're doing is pushing to the next member down the line and understanding where that's at.

But we have the data that can support and as our members start to move in that direction, we can help direct them in the right areas where maybe the most efficiency can be gained from a market congestion perspective, or maybe where the most reliability concerns exist on the system.

It doesn't have to be just about the money, it can be about the reliability too, and giving them the ideas of where, if they don't want to fully push out, we have a lot of that knowledge of where we might get the best -- the biggest bang for our buck in that regard.

MR. ROUSSELLE: It's really good to hear the ISOs are really capable of assisting the transmission owners. In 2010, the NERC alert came out and one of the things it recommended in largely almost every utility in the United States utilized, was the methodology to use PLS CAD, a software. The software manages 94% of every transmission line on earth.

This software can run a batch question in about 12 minutes on 3,500 circuits -- that means the transmission owner, what I'm saying, has almost immediate access in the

third dimensional model, for every transmission circuit they own to find the limiting span, or the three limiting spans.

They could run iterations in a week that would integrate with the ISO, they have this data. All of that data underlies when the data was taken, the temperature, right? The facility rating is based on that information. You might want to have access to those files, the ratepayers pay for them.

MR. WANGEN: One other thought is you know, if the goal is to increase the use of AARs and DLRs, yeah, I think that the RCs, RTOs, and ISOs, can have a role in that, but an observation in the West is that you know, I mentioned there was about 9% of the facilities that are in Peaks network model, have those applied.

There's a lot more of them out there, but the TOPs, the TOs, tend not to use them or not to want to provide those, and they want to operate more conservatively. They want the operators to have that conversation, you know. I think that might be just a confidence in the data perhaps, but nonetheless, there might be a need to maybe incent the use of them if they already exist, and then take that next hurdle once that's done.

MR. KOLKMANN: Okay, I do want to point out that I didn't intent to pit the RTOs against the non-RTOs, it was just -- it just kind of happened by way of alphabetizing

companies. Just to be clear on that.

I've wanted -- Brett, you've mentioned in at least the written statement. I don't remember if you said it aloud, but you mentioned a 2015 study that you were involved with that WIRAB had sponsored regarding AARs -- a lot of things. I was hoping to follow-up on that and how AAR's might be implemented out West.

Your thoughts on that, obviously primarily on the bilateral context primarily. How this might fit in with ATC calculations, I'd be curious to hear more about that.

MR. WANGEN: Sure, yeah, so you're referencing a study that facilitated to evaluate what could be done to improve ATC available transmission, transmission capability calculations in the West. And there's a little bit of a history lesson here. The West, just a decade ago was extremely conservative. There was path system operating limits that maybe arguably weren't really system operating limits, and there was a whole paradigm shift that had to occur to separate out SOLs and TTCs and there's a lot of change that's occurred to try to get things to where I think anybody from the East would say is the norm, or anybody from ERCOT.

And so, that was just sort of a step in that evaluation was okay, now that we understand that SOLs, what they are and how to use them, how can we use real-time data

to improve, not just SOL calculations, but TTC and ATC calculations?

And so, I would see you know, in that particular study, dynamic ratings weren't specifically a component of that, but would absolutely be a nice component of it to add on to that. The concept simply is the better -- more accurate your data being, more real-time your data is, the better your calculations will be, just garbage in, garbage out, good data in, good data out, so, that's kind of the premise of the study.

MR. KOLKMANN: Thank you for that. I think that exhausts my questions. I did want to open this up to the audience and see if they wanted to ask the panelists anything. I'm going to sit here for at least a minute or two and see if anyone wants to think about that -- 30 seconds. Sorry, first we'll ask, we have one more.

MR. CORBETT: Mr. Markham, you referred to your seasonal ratings as basically being divided across the entire year. And for the New York ISO in operating your system, there's definitely a difference between January the 10th and April the 14th. So, how do you communicate -- shall you say, rating changes where possibly in April you're far feeding your winter seasonal rating, and how do you see per -- or what would you recommend as possible communication improvements between the TOs and the RTOs

going forward if they were communicating more ambient adjusted or temperature adjusted ratings, so that they can communicate that to you as they make those changes?

MR. MARKHAM: So, yes, as I said, we do use two seasonal sets. There was a pretty extensive study that was done in the mid-'90's by the transmission owners in New York to look at ambient conditions in each month in New York State as well as you know, the other components of line ratings that are applicable, you know, wind conditions, solar radiance, and from that they chose rating temperature sets that were applicable for both summer and winter.

As you said, there is the -- you know, there is quit e a bit of a difference between January 10th in a Polar Vortex, and April you know, mid-April when it can be, you know, 80 degrees. Right now, the dynamic line rating capability in real-time is what's used to communicate that difference, so if there's more capability available or less that gets provided to us. Typically, the seasonal ratings are in use for the season and we get increases from those as temperature conditions are cooler than ambient.

And once we get those via ICCP, we communicate those out to all the impacted TOs, all the neighboring areas, so that the full ratings and the rating of the facility is in use, is widely known.

MR. CROWSON: Yeah, I just wanted to add at SPP,

basically, we also have a pretty wide variety of footprint from north to south and what we've found is we offered also what we call shoulder ratings with the seasonal, so we have winter and summer.

The shoulder, or basically you know, your spring and fall ratings. So, we do offer that while some, you know, don't utilize those ratings. We offer like basically a four season change. I did want to kind of use this as a segue to address a question I heard coming up quite a bit in the other panelists.

SPP was actually you know, using this process as I've heard maybe a lot of other RTOs actually using it in real-time, manually communicated via the RC to the TO. That was one of the main drivers for our enhancement and why we got backing in that is we actually alleviated that process more automatically.

So, I heard that question come up quite a bit, so I wanted to segue into that how we basically improved our real-time feed of seasonal rating.

MR. GILDEA: I have just a quick, quick, question to Sean. You mentioned in your prepared comments toward the end, I just noted here, and I put a question mark because while we had the time, I thought I'd follow-up, about a transition that you suggest, maybe of AAR to DLR with just wind.

And so, I'm assuming that you're ignoring solar, can you expand on what you meant by that?

MR. MORASH: Yeah, so when you're doing line ratings, when you look at the calculation, the wind and the temperature impact, and there's a lot of wind forecasting that gets done, and you can -- within a 3 hour, you know, resolution, you're pretty confident in what's going to show up.

We can argue about that -- whether you're pretty confident or what if that's 50% or 70% or 95% or whatever it might be, but NOAA has put a lot of work into developing accurate real-time semi-real-time wind forecasts, and you know, this kind of transitioned from a seasonal adjustment to a dynamically, you know, rated line where you're measuring at the point.

There are steps in between, right? And so, whether that's taking only the temperature forecast or if you can include the wind forecast and wind -- what we think the wind is, I think that there's some steps that would not be as difficult as investing in transmission infrastructure that could be taken.

MR. KOLKMANN: Well, I offered the possibility for audience questions. Now, I would like -- oh, sorry -- sorry Gary.

MR. CROWSON: Yeah, I think argue is the right

word. I don't want to talk too much about wind forecasting in this setting. We have a lot of wind. We do still see very high -- I don't want to say very high, but large error rates, even as close as 4 hours out, so we're talking about weather and shifting pressure systems that basically cause that change.

So, we'd have to be real conservative if that was something, we were looking at taking into account.

MR. KOLKMANN: Okay, well now I'm going to offer up the third time. And I'm going to sit here for 15.

MR. MCCAULIFFE: This has been a great discussion. I just want to comment on that. Kind of a slightly unrelated question back to -- oh, I'm sorry, Jack McCauliffe with Lindsey, a DOR provider. We had done some work with one of the ISOs that's up there -- I don't need to name it, about a year ago.

We published a paper. It's been submitted, but I'm looking for the panel's comments. This is one where there was a wind farm that was curtailed regularly because the lines -- the outtake lines for the power were constrained and it was shown that DLR could alleviate that issue.

The problem them became that the wind farm operator would benefit, but he had no ability to tell the TO to install it. The TO is not interested in installing it.

The ISO, of course, doesn't have the authority to order something like that to be installed.

So, I was just kind of interested in terms of if there is a move forward with a requirement for AAR or DLR type ratings, were equipment like that needs to be installed where there is an identified need, how would that -- do you see a mechanism to address that come about?

MR. ROUSSELLE: For yesterday's panel we listened, I think, to PJM mention that they're considering the use of DLR as a transmission upgrade enhancement, or perhaps even into the interconnection as the upgrade mechanism itself. Perhaps that, you know, that a merchant could do that.

Perhaps the generator could do that. The question really is who is going to allow us to put a blood pressure cuff on a line of someone who doesn't necessarily benefit from more information on that line, so the ISOs wouldn't.

MR. KOLKMANN: A question in the back? Please identify yourself.

MR. CURL: Sure, I'm Todd Curl, I'm with the CIRC region, I'm the Manager of Compliance Monitoring. I have oversight of the CIP and O&P audit staff, and I don't have a question. I have more of a comment. There was some discussion earlier about auditors not checking the

validation of facility ratings, and I will tell you that there are some regions that do that, and I know CIRC has been doing it for a couple of years.

And if there's -- if someone would like to discuss that offline, I will be happy to do that.

MR. KOLKMANN: Thank you for pointing that out. Okay, well, it is 10:15. We will end 15 minutes early, and we can start the next panel at 10:30, rather than 10:45. Thank you very much everyone for your time. It was very informative. We'll see everyone soon.

(Break).

MR. KOLKMANN: If people could take their seats, it'd be helpful. We'd like to get started. Thanks everyone for being here. Welcome to our fifth and final panel for today, where we'll be discussing Transmission Line Rating Methodology Transparency.

The panel features an array of industry experts who will discuss both the potential benefits and costs to increased transmission line rating transparency and understanding that concerns may exist regarding the inaccessibility of transmission line rating methodologies and resulting ratings.

Additionally, Panel 5 will discuss best practices for documenting transmission line ratings, the merits or challenges of having line rating methodologies, assumptions,

and/or ratings themselves be available for review and challenged by market participants and coordination between line rating methodologies in ATC calculations methodologies. Thanks everyone for being here. We'll start from audience's left to right, my right to left. First, we have Mr. Carlos Casablanca from AEP, Devin Hartman from ELCON, Dennis Kramer from Ameren, Michelle Bourg, from Entergy, Michael Kormos from Exelon, Joe Bowring, Monitoring Analytics, and Michael Chaisson from Potomac Economics.

Again, thank everyone for being here and we'll start with Mr. Casablanca, take us away.

MR. CASABLANCA: Good morning. I'm going to read my prepared statement. Chairman Chatterjee, Commissioners, staff, and colleagues, thank you for the opportunity to participate in this important dialogue. My name is Carlos Casablanca, and I am the Director of Advanced Transmission Studies and Technology at AEP Transmission.

American Electric Power is one of the largest electric utilities in the United States, delivering electricity to more than 5.3 million customers in 11 states. AEP also owns the nation's largest electricity transmission system, a more than 40,000-mile network that includes more 765 kilovolt extra-high voltage transmission lines than all other U.S. transmission systems combined.

AEP's transmission system, directly or

indirectly, services about 10 percent of the electricity demand in the Eastern Interconnection, and approximately 11 percent of the electricity demand in ERCOT.

Transmission system facility ratings are an integral part of the process of developing, operating, and maintaining a safe, reliable and economic transmission system. The methods through which transmission system facility ratings have been determined have evolved over time and will likely continue to evolve as science, technology and our operating experience as an industry and transmission owners continues to evolve.

Different transmission owners can, and do, apply different methodologies and assumptions in determining their facility ratings. Differences in equipment specifications, weather patterns, environmental conditions, geography, resource availability, risk profile, and operating experience are just some of the reasons why facility rating methodology differences can, and do, exist among transmission owners.

In the end, transmission owners have the duty to own and operate a safe, reliable and economic transmission system, and they accept the risks and liability associated with these obligations.

AEP believes that the existing NERC Reliability Compliance Standards, like the FAC-008 standard, are more

than adequate to have review and oversight over the facility rating methodology applied by transmission owners.

Strict processes and controls are already in place to ensure that transmission facility ratings used in long-term transmission planning and real-time operational planning studies are determined based on technically sound principals. Transmission owners are required to adhere to their established rating methodologies and all changes to the methodology or assumptions are required to be documented and communicated accordingly.

Within AEP, facility ratings methodology changes can be trigged by regulatory mandates, changes in technical reference documents and standards, new technology, or new technical insights brought about operating experience.

These methodology changes are proposed as needed and issued by our internal engineering standards teams, and go through a coordinated internal cross-functional review. The impact of the proposed changes is reviewed internally by our Transmission Planning and Transmission Operations organization, which will determine if any long-term or short-term mitigation steps will need to be put in place to address any facility rating changes as a result of the methodology change.

Once fully vetted and evaluated internally, the changes are made and communicated to the respective regional

organization. In some cases, depending on the significance of the facility rating changes, AEP will inform and discuss the changes with the appropriate regional organization prior to implementation of the ratings change.

AEP has shared details of our facility rating methodology with regional entities as part of competitive transmission project proposals undertaken under FERC Order 1000, to justify transmission line conductor selection and overall facility ratings.

A review of the rationale of selected facility rating parameters and assumptions is common by the issuer of the competitive project's Request for Proposal to ensure fairness among competing proposals. AEP has also shared details of its facility rating methodology and assumptions in past technical industry publications.

As such, if the Commission believes that developing a consistent process aimed at the publication of transmission line rating methodologies by all transmission owners would help maintain or improve the safety, reliability and cost-effectiveness of the transmission system, them AEP would support it.

If this approach were chosen, AEP would ask that the Commission implement protections to ensure that transmission owners, regional transmission organizations, independent system operators, and the Commission itself, do

not become burdened by litigation and challenges associated with third party concerns with a transmission line rating methodology and assumptions applied by different Transmission Owners.

As mentioned previously, transmission owners have the duty to own and operate a safe, reliable and economic transmission system, and they accept the risks and liability associated with these obligations. Allowing open challenges by any third party to transmission line rating methodologies would be a burden and distraction to the industry and AEP would oppose those attempts.

I would like to thank again the FERC Commissioners and staff for your time, for organizing this Technical Conference, and for allowing us to participate. I welcome your questions and look forward to the coming dialogue. Thank you.

MR. KOLKMANN: Thank you. We'll next turn to Devin Hartman from ELCON.

MR. HARTMAN: Good morning. My name is Devin Hartman. I am the President and CEO of the Electricity Consumers Resource Council. ELCON is the national association representing large industrial consumers of electricity, who own and operate major manufacturing facilities throughout the United States.

Energy-intensive industry must have access to

reliable, low-cost electricity to maintain a global cost advantage. Transmission policy, to be frank, is a growing area of concern in this regard. Transmission charges are rising rapidly, oversight is lacking, and best practices and use of advanced low-cost technologies are being foregone.

We applaud the Commission for looking into one critical aspect of this -- transparency and best practices in transmission line ratings.

There are several interrelated categories of best practices in transmission line ratings: technical, reporting and oversight. All three appear severely deficient across transmission operating systems, both within and outside ISOs.

Now, no singular best practice exists for technical line rating methodology, as I think prior commenters have pointed out, as various qualified means exist to measure and project the ratings effect of meteorological conditions.

However, temperature effects are the most impactful on ratings and have a relatively low error rate, and expectations for AARs to constitute a minimum best practice seem reasonable.

DLRs often constitute best practices in chronically congested areas, but the added cost and uncertainty in variables that increase greater line rating

error may not justify the benefits in all applications. Thus, the Commission may look into establishing a floor for generalizable best practices, where benefits uniformly outweigh costs, with expectations that best practices in DLRs may fall more on a case-by-case basis.

Generally, best practices should at least incorporate duration-differentiated temperature and wind speed conditions, unless the transmission owner can demonstrate otherwise under an economically robust and transparent review process.

Seasonal line ratings appear to be standard practice, where AARs and DLRs are clearly the exception. Such chronic understating of line ratings has major economic ramifications for consumers. A stark monetization of this gap between actual and best practices was provided by the independent market monitor for MISO, which found AARs would have reduced congestion costs by over 100 million annually in recent years.

This excludes many other cost savings and reliability benefits. This magnitude of benefit is not likely unique to MISO. Rather, this is the only IMM to quantify these potential benefits in this capacity, which brought much needed attention to this issue.

Now, assessing the extent of the gap between best and actual technical practices is highly constrained by

shortcomings in reporting and oversight practices. Deficiencies stem from poor incentives for transmission owners and an opaque and frankly, outdated reliability only oversight process.

The predominant oversight perspective is that the transmission system has a fixed capacity and topology and that altering reliability parameters to incorporate unconventional methods is often a reliability risk that's not worth undertaking.

NERC Reliability Standard FAC-008-3, requires transmission owners to document line rating methodology, much of which is non-public. NERC audits of this methodology only examine reliability impacts, which generally reflect worst-case temperature assumptions.

As such, this process permits excessively conservative and economically inefficient line rating practices to continue. Moving this over to ISOs -- ISOs do not provide economic oversight either. ISOs typically play a passive role of accepting transmission owner's rating proposals without providing much or any scrutiny, especially in the economic utilization context.

Sometimes an RTO will initiate a request to change line ratings for reliability purposes like managing a contingency. Some IMMs may be able to obtain the methodology on a case-by-case basis, but do not have access

to a comprehensive database of rating methodology, nor the limiting elements behind the ratings required for a routinized review process.

As such, there is not a robust process to document and review transmission line ratings for economic performance anywhere in the country. Robust documentation and oversight is imperative, given the problematic incentive structure of some transmission owners.

At best, transmission owners are indifferent to economically adjusting line ratings because they receive no financial return for improved operational efficiency. At worst, some transmission owners have a perverse financial incentive as understated line ratings justify unnecessary transmission rate base expansion.

These problems will not fix themselves without Commission action. To address the oversight void, ELCON encourages the Commission to lead a dedicated effort to institutionalize an independent, economically robust, and transparent review process for transmission line ratings that is auditable and enforceable.

A standardized review process does not and should not require a standardized methodology, but should set minimum parameters for AARs, if not DLRs in chronically congested areas, unless demonstrated to be infeasible or uneconomic by a transmission owner.

Methodologies, assumptions, and line ratings should be available for review and challenge by market participants, to the extent possible with CEII compliance.

The Commission should be mindful of unintended consequences of a piecemeal approach. Specifically, encouraging transmission owners to actively alter their line ratings without correcting oversight deficiencies, may incent new forms of market manipulation.

Potential cross product manipulation in this regard would be difficult to detect under current market monitoring practices, given incomplete information on physical transmission withholding parameters.

The Commission could also look to expand ISO reporting metrics to include transmission system utilization rates and line ratings methodologies. This would add tremendous clarity on the gap between best and actual practices, while its aggregate format avoids any concerns over CEII or confidentiality.

While this approach would take considerable time, at least an aggregate survey of current rating methodologies would provide valuable insight on an expedited timeframe, which could inform next steps for Commission action. This concludes my prepared remarks, thank you.

MR. KOLKMANN: Thank you, we'll next turn to Mr. Kramer from Ameren.

MR. KRAMER: Thank you and good morning. My name is Dennis Kramer, Senior Director of Transmission Policy and Stakeholder Relations for Ameren Services Company, and appear today on behalf of the MISO transmission owners.

The MISO transmission owners thank the Commission for holding this Technical Conference on the concept of adjusting transmission line ratings, and this panel specifically on how transmission line ratings are established and how to provide adequate transparency to that process.

In the interest of time I'll just hit some major points of my opening statements since it's already been entered. The ratings that transmission owners determine for their facilities are a major factor in determining how the bulk electric system is operated and planned, as well as how organized markets function.

There are various types of ratings including static, seasonal, emergency and adjustable. Regardless of the purpose of the rating or the method transmission owners use to determine, the ratings must maintain public and employee safety, ensure the bulk electric system is operated and designed in compliance with NERC standards, not operate equipment in a manner detrimental to its planned lifespan, and be available to parties that depend upon these values for safe and reliable operation of the bulk electric system

or making decisions that are vital to the success of their business.

Typically, transmission owners -- transmission owners typically use very similar methods -- IEEE 738 for example, to calculate the method of line ratings. But we incorporate a multitude of factors, many of which you've heard already -- temperature, wind velocity, angle of wind direction relative to the conductor, solar radiation, and other specific environmental attributes that may be unique to a line location.

There's -- in summary, there is no one size fits all path forward and the Commission should recognize the differences in how the transmission system has developed over time because of unique topology, specific system requirements, and differing environmental conditions before any new or modified rules or requirements are considered, it is critical that all aspects of adjustable line ratings be identified and fully investigated.

This Technical Conference is a good first step in that process. The MISO transmission owners look forward to the exchange of information during this Technical Conference, and future discussions on these topics, thank you.

MR. KOLKMANN: Thank you. Miss Bourg from Entergy.

MS. BOURG: Yes, good morning. My name is Michelle Bourg. I serve as the Vice President of the Transmission Asset Management for Entergy Services, and on behalf of Entergy, I'd like to thank the Commission and staff for having this Technical Conference to discuss the use of ambient adjusted ratings.

As I mentioned yesterday in my opening remarks, this has been a journey for Entergy in our implementation of AARs, specifically, temperature-adjusted ratings. And throughout that journey we've maintained a focus on balancing first grid security and safety and the operational flexibility that the use of temperature adjusted ratings provides for us with our desire to help maximize efficiency of the market.

I talked yesterday. I'll just recap some of the comments that I made. Entergy does believe that temperature adjusted ratings and using temperature to adjust the ratings, is the most efficient way for Entergy to understand what its current rating capabilities are.

40% of our facilities are currently temperature adjusted on an hourly basis. This is an automated process that we've developed internally using commercially available weather information. We work very closely and coordinate and partner with MISO to identify what facilities within the Entergy footprint would be beneficial to temperature adjust,

and we use that operational knowledge -- both Entergy's operational knowledge, and MISO's knowledge both of you know, the operations of our grid and the market to inform that process.

We have realized significant benefits over the past three years since we formally adopted a pilot program back in 2016, and we've identified and realized anywhere from 5 to 25% average increase in ratings on our facilities and that varies by the kV class. We feel very strongly that temperature adjusted ratings, or any ambient adjusted ratings should not be utilized beyond the very near term operating horizon and should not be considered for any reasons outside of that, whether it be reliability planning, economic planning or consideration for generator interconnection studies.

There is a very significant resource commitment to achieve that the process that we've put in place and the temperature adjusted ratings in the scale that we've deployed, but we do feel strongly that there is a value in automating the process to reduce and minimize any likelihood of human error that may be introduced into the process by doing it manually.

We do feel strongly as well, and we'll reiterate risk associated with the use of short-term emergency ratings for any economic purposes or for market efficiency. The

fact that emergency ratings, as we've discussed yesterday, at the point at which a facility may have degradation of life or have damage, those ratings, being that we are jeopardizing reliability at that point and system security, we should not have those ratings used for any economic purposes.

As Dennis mentioned, you know, there is no one size fits all approach for how transmission owners should apply ambient adjusted ratings to their facilities, but I'm happy to be here on behalf of Entergy to talk about our journey and what we've learned through the process, thank you.

MR. KOLKMANN: Thank you, we'll next turn to Mr. Kormos from Exelon.

MR. KORMOS: Thank you and thank you for the opportunity to express Exelon's views on transmission ratings and give you our opinion on a little bit of it. I was also experienced with an RTO, so I may slip a little bit of that in, and please understand that's my personal opinion, not Exelon's, nor my former companies.

You know, our experience has been we are a very big supporter of ambient temperature, adjusted temperature rating sets. 5 out of our 6 utilities have in fact, implemented them fully in PJM. Many of them have done it for many, many years in PJM.

The only company that right now has not is Com-Ed in our system, and although their methodology does include it, we actually do in fact calculate them. Right now, they have an EMS limitation that does not allow them to put them into real-time operations. That limitation will be removed next year. We are doing an EMS refresher for the Exelon system.

Once that refresh is in, Com-Ed will be fully implemented with ambient temperature adjusted ratings as well. On the dynamic ratings, you know, going more fully to real-time, hourly dynamic ratings in the field measurements, however you want to look at it, I think you know, our experience is it may be a niche. There may be some opportunities out there where it makes -- it's cost-effective and the opportunity is there.

I think as many of the previous panels have mentioned, I don't see the use of it from a reliability perspective in our planning studies, only because again, we have to plan for the worst case. That is our criteria. I don't see us changing that criteria, and therefore, it really does come down to more of a congestion market efficiency.

And, you know, I would offer, at least in PJM, I think it's very transparent that for those lines that cross that threshold of market efficiency, have that kind of

congestion on there, they are put out through open windows. In those open windows, I will show you Exelon will look at every technology out there to solve that particular problem.

We have submitted proposals to PJM that include smart wires, that include batteries, we've not found one yet -- that dynamic line ratings would in fact, in our opinion, be cost effective or solve the problem. I also appreciate PJM's problem, and again, my opinion of how they would even evaluate something like that. I think, you know, trying to understand how much economic congestion could be in fact, relieved, without putting the actual devices out there and measuring what the ambient temperature of the wind speed would be, I'm not sure how PJM would go about it.

I mean I think that's one thing, and somebody mentioned PJM said they'll probably look further into how exactly would they weigh that kind of upgrade versus smart wires, versus typical reconductoring.

I think that's a question we probably still have to go further as far as asking ourselves. So, we're supporting of continuing to look at those technologies, and in fact, where they make sense, we would be happy to offer them as solutions, and if PJM believes that they are ultimately the most cost-effective way, implement them.

On the transparency issue, again, I'll sort of repeat a lot of what AEP said. You know, we are under

FAC-008 reliability standards. I will differ from the previous panel my experience with RFC and I confirmed it with a gentleman who was from RFC here in the room today.

They do not stop at the methodology. My guess, we provide them with our methodology, they also spot check us against actual ratings. We are required to provide them the ratings. We are required to provide them the underlying data to those ratings, they will redo the calculations and validate the ratings are as per the methodology, so I'm not sure where that experience he mentioned was, but that is not what we have seen in reliability first we are in fact required.

So, the fact that our -- we have documented methodologies, RFC audits against us, if we are out of compliance with that you will hear about that and we would correct it. I don't see a major issue as far as we follow our methodology and our methodology is very much based on the PJM guidelines, so PJM does have transparency, they do publish guidelines for rating transmission facilities.

We do follow those guidelines. There are some allowances for assumptions for wind speed, for internal conductor temperature and things like that that we do have some decision-making on, but we fall well within any IEEE or normal utility practice.

Like AEP, I don't think we have an issue making

that public. I would offer I don't think it needs to be filed in the tariff, I think that's a little bit overkill myself. But if the Commission felt that making those methodologies at that general level more available for people to understand what those assumptions are, we don't necessarily have any issues with that.

I would put out the warning that AEP put out though is I would hope that it just does not turn into a litigation battle. Please realize we make assumptions based on our physical assets, our geographic conditions.

We recognize that yes, changing some of those assumptions may benefit some parties, may harm other parties. There will be winners and losers in any change to those assumptions. And I'm sure there are many who would be happy for us to change them in their benefit and not so happy if we changed them against it.

So, again, I think they are done impartially based on systems conditions. I would not want to see this just turn into litigation as people just try to profit off of changing transmission ratings to benefit their particular situation.

As far as you know, the RTO -- validating our ratings again. We would have no issue with PJM validating our ratings if they so choose. In fact, I think they are another set of eyes for us and always have been. If they

see something, they think might be concerning to them on ratings, they will talk to us, absolutely.

We will fully work with them and cooperate with them. In fact, mistakes do make or can be made, if they are made, we appreciate any ability to get them corrected and done. Whether they should be required to do it, I will just give you my personal opinion. Again, I think that would be not a good use of the RTO resources.

I'm not aware of any underlying flaws where there are huge discrepancies in ratings that would justify PJM spending resources. I think they have a lot better things to do with those resources right now than go forward, but again, I don't think at the end of the day we have any significant issue if PJM would choose to want to do that.

So, with that I'm looking forward to answering your questions.

MR. KOLKMANN: Thank you, Mr. Bowring?

MR. BOWRING: Thank you, Joe Bowring, Market Monitor.

MR. KOLKMANN: Doctor Bowring, sorry.

MR. BOWRING: I needed this transmission engineer to help me. So, thank you to the staff and the Commission for focusing on this issue for a number of years, it's a critical issue, one that has not received near adequate attention so far.

So, as we know, and we've heard and is even more true than we've heard, transmission line ratings have wide ranging impacts on all elements of the PJM markets, from energy to capacity, to FDRs, congestion --

MR. KOLKMANN: I'm sorry, could you speak more into your microphone?

MR. BOWRING: I can try. Alright, is that better, okay. So, let me start over or not all the way. So, transmission line ratings have wide impacts on the PJM markets. All of the elements of those markets -- energy, capacity, interconnections that we heard about, FTR's, congestion -- every element of the PJM markets is affected, one way or another by the line ratings.

So, I want to talk -- I want to focus my comments on three areas. One is what the current practice is. Second, the AAR/DLR, AAR/DLR question and then third, respond to some of the comments that I've heard so far from other panelists in that same aspect.

So, the IMM actually recommends that all PJM transmission owners use the same methods, and we don't think that FAC-008 adequate defines those, but still subject to NERC and FERC oversight as to the basic engineering, the math and the assumptions, but ultimately end up approval by FERC.

So, the same facility ratings should have the

same -- the same facilities should have the same ratings under the same operating conditions regardless of the transmission owner. The transmission owner discretion should be minimized or eliminated in line ratings.

The line rating method should be based on the basic engineering and reflect the impact of actual operating conditions. The line rating method should be fully and publicly transparent. We'd also recommend that the FERC require that PJM routinely review all transmission facility ratings, and any changes to those ratings to ensure that the normal emergency and load ratings used in modeling the transmission system are accurate and reflect that standard ratings practice.

All the line ratings changes and the detailed reasons for them should be publicly available. So, in PJM, as you've heard, PJM provides a matrix for the transmission owners to fill out an 8 by 8 matrix with a temperature variation -- day and night variation and line rating variation. That is static emergency short-term and long-term emergency and load dump.

So, we've heard that TOs are required to fill that out. Well, yes and no. They're required to put a number in every cell, but the number in every cell can be the same with only one exception. There has to be a difference between the load dump -- a defined difference,

fairly small, to find the difference between the load dump and the short-term emergency.

So, saying that PJM requires it and saying that they actually require ambient adjusted ratings are two different things. Now, as Mike said, there are a number that do that. PJM is to be praised for putting that in place in the first place in advance to require the metrics to be filled out. The next step is to make sure that it's filled out accurately in every cell.

So, at the moment PJM typically uses normal line ratings for pre-contingency long-term emergency ratings, that is 4 hour ratings for post-contingency constraints. PJM, as we talked about, requires temperature variation, but PJM -- and PJM transmission owners are responsible for developing their own methods computing line ratings, subject to the FAC-008 as you've heard.

But PJM does not review the accuracy of transmission owner's methods to do line ratings and PJM transmission owners have substantial discretion in the approach -- in fact PJM has said publicly, that there are no requirements for PJM to approve or verify a TOs ratings, or to do any kind of consistency check.

So, on AARs, we agree that AARs should be required. FERC should require every RTO to enforce the RTOs to require every RTO to do AARs, there's simply no reason

not to have that information. Not having it is akin to saying you have your ratings wrong most of the time.

It seems fairly evident and I've heard similar comments from other panelists. And given the significant impact of transmission line ratings and all the elements of the market, ensuring and improving the accuracy and transparency of line ratings is critical for the functioning of the markets.

Line ratings should incorporate ambient temperature conditions and wind speed and other relevant operating conditions, and they should do it on a standard basis as I indicated.

PJM real-time prices are calculated every 5 minutes. The system operates in real-time. There's no reason for the line ratings to be the same by season all hours of the day -- simply no reason for that. It's putting the wrong information into the system.

So, for consistency of the dynamic nature of the wholesale power markets, the line rating should be updated in real-time to reflect real-time conditions as they are for many TOs in PJM and to help ensure that real-time prices are based on actual current line ratings again, as they are in many cases in PJM.

So, DLRs -- so, DLRs provide information. They provide information which contributes to better system

operator knowledge about the nature of the system. Why TOs wouldn't want this on every single line is beyond me. I would think they would. Of course, it does cost money. There is something of a trade-off.

But it's -- from what we've heard, from the providers of the technology, it does not appear to be anything remotely like the costs of the underlying transmission system. So, I recommend that the Commission require every TO, through the RTOs, to at least engage in pilots to start to put the DLR technology -- not to use dynamic line ratings, to put the technology on the lines that we get the data.

As one of the earlier panelists said, you can't decide what that means until you have the data. We've seen some pretty variable output from those in the first panel yesterday, but you need the data to make a decision. The only way you get the data is to put those pieces of technology on the lines.

I mean there's been a lot of talk about smart grid, this seems to me to kind of be one of the basic elements of what a smart grid would be. It can't be smart without information about what's happening on every line, that's got to be part of it.

So, the goal in all this should be to use or to gather and to use the best data available about the way the

transmission system's functioning. The failure to use AARs means the line ratings are wrong, as I said, with significant consequences.

And just in general about the impact of markets -- better data is a good thing. The markets can deal with it. I mean someone on the earlier panel said all of the other issues that have been raised can be dealt with. People are dealing with those other issues every day.

There's better data the markets should be dealing with. They're dealing with it now even though not in a transparent way. They have to deal with the actual facts, so the markets can address any changes in line ratings.

So, just a couple of comments and issues from today and yesterday. So, first of all, congestion is not a bad thing. That's why we have L&P. If we thought congestion was a bad thing, we wouldn't bother with L&P, or we would copper plate the system.

They've tried that in a few places, it hasn't really worked. There's still congestion, whether you pretend there is or not. Congestion is a function, as we know of the nature of the transmission system, but also the location and generation, and the relative fuel costs of generation.

People built the system in the first place not copper plating it because it was more economic and efficient

to build high cost generation in low pockets, rather than build expensive transmission lines. So, there was some comment about PJM congestion yesterday, and PJM congestion increased in 2018, but it increased because of a couple of months -- January and February, the weather is really cold, and we're burning oil in the East and congestion was higher.

In 2019, congestion is down the first half of 2019, congestion is down dramatically. There's no long-term trend to increase congestion, but congestion, as far as I'm concerned, is neither here nor there on this issue. The issue is better data, better information about the transmission system, and that will help the markets work more efficiently, regardless of the level of congestion.

There was another comment about using DLRs in the PJM cost benefit analysis. So, just as on the side, we think the PJM cost benefit analysis is simply wrong, it ignores increases in the congestion, only looked at decreases in congestion and shouldn't be used as the basis for anything.

DLRs should be used for -- as information for whatever purposes are relevant in operating the markets. I think they should both be considered in long-term planning. There's been some talk that they shouldn't be included in the long-term planning, but they should be considered, but carefully.

You don't simply just assume that you're going to use a low rating on a peak day for truly planning the system for one peak day, which is not really how it's planned, but it has to meet that capability, then the line rating should be consistent with that.

But that doesn't mean you should ignore the information. Finally, incentives were addressed also. So, on the early -- on the first panel yesterday, it was explained that somehow benefit sharing was necessary and/or there were a number of incentive issues and somehow you have to pay people special incentives in order to provide this data.

So, as with transmission costs generally in my view, competition is to be preferred to the kind of incentives we're talking about. If you think about the incentives to build the transmission lines right now, the amount of money you would have to pay someone to overcome that incentive and do dynamic line ratings instead is massive.

It's -- the returns on capital would be phenomenal. So, I mean those simply aren't comparable. So, why not have competition if the TOs decide they don't want to do it, these are not invasive technologies, consistent with a TOs operating practice, as was suggested earlier -- generators or merchant transmission folks offer to put those

facilities on the transmission grid.

And if it's not going to be competition, it should be a regulatory requirement. Incentives simply are not going to work here, given the way rate payers rate of return works, given what Rob Gramlich reminded us about average johnson and the capital intensive nature of the underlying transmission grid. You're not going to overcome that with benefit sharing, nor should you attempt to.

So, for the fundamental in all this is use the best data, get the best data, require the best data, use it and implement it and let that affect markets as it will. So, thank you for the opportunity to talk today, and I look forward to the back and forth.

MR. KOLKMANN: Thank you. And we'll last turn to Mr. Chaisson from Potomac.

MR. CHAISSON: Good morning, I'm Mike Chaisson from Potomac Economics. We thank you for the opportunity to share our views. I'll be speaking mostly on the transparency. We're in favor of there being a general requirement -- broad requirement, for implementing AARs and some encouragement or incentives for DLRs.

Going that direction calls out for a need for transparency and the entity that needs this transparent access would be the transmission providers, the market monitors and market participants in general.

So, additional transparency regarding ratings methodology is essential for administering an AAR requirement. In spite of MISO having the FAC-008 so they can request methodologies, MISO still have very little information on TO rating methodologies, limiting elements or other inputs to the rating calculations. This makes it impossible for MISO, the transmission provider, to administer and oversee compliance with the requirement to provide AARs and to utilize ratings in a reasonable manner.

So, if FERC issues a requirement, it should include the submission of rating methodologies and other relevant data to the RTO along with timely updates of that data.

As the market monitor for MISO, we are responsible for monitoring for the withholding of transmission, which can occur by submitting understated ratings. Hence, we need the same information as RTOs to carry out our function and help enforce the AAR requirement.

On the physical withholding, the MISO Tariff tasks us with monitoring and implementation of mitigation measures for physical withhold of transmission facilities. We have to determine if the ratings are based on verifiable technical reasons.

For us to do this, we need access to the methodologies, assumptions, the calculation detail

associated with the limiting elements that set the ratings onto specific branch. So, MISO uses a bus branch granulary for the ratings which doesn't see the specifics of what's setting the limit, but that has to be transparent.

To support monitoring this data, and the next most limiting element in addition needs to be broadly available. The way the monitoring function works -- market monitoring as we do broad monitoring of lots of data, and then when we see an outlier, we do a focus investigation on those outliers, things that look of more concern.

So, the monitoring -- the methodologies and the limiting elements needs to be broadly available, but when we drop into the investigation, it's at that point that we need the calculation details. And these can just be available upon request, so we can make sure that the ratings aren't overly conservative or overly causing congestion.

As far as best practices, we did hear from Dede from the Cali ISO that they routinely receive some of this information. They get it on a no breaker level, and they know what the limiting element is.

This histogram that I have on the screen is to illustrate the need for transparency. If I'm going to see a rating, and this is for winter ratings of 115 kV line, if I'm going to look at one and say well is this a reasonable rating? The first thought is well, how does it compare with

everybody else?

Well, this is what everybody in MISO is saying that they're B rating, this what is their emergency one hour rating is and you can see that this is all over the map. The standard deviation is greater than the mean, and this isn't the worst of it. This histogram actually proceeds several more pages off to the right with outliers.

So, its everywhere. You can effectively monitor without knowing the basis for the ratings, just knowing there's a 115 kV line tells you almost nothing, so this is quite a challenge. This is over 30 TOs worth of data.

Now, there's some reasons for the dispersion of this data, sometimes it's a thermal limitation, sometimes it's not. If it's a thermal limitation, it might be the max conductor temperature. It might be the conductor sag limit, or it might be some substation equipment or terminal equipment.

If it's not a thermal limitation, it might be a voltage or a stability. So, that accounts for some of the dispersion but what I think is less justifiable is that when you look at all these winter B ratings, 63% of these are the same as the A ratings. So, the emergency rating square has the continuous rating number in them.

So, that's a concern. And additionally, 30% of the winter ratings are the same as the summer ratings, so

here we are in the middle of the winter when we're using a 90 degree summer rating, so all of those are mixed in there contributing to this big range in values for sometimes these 115 kV lines are you know, right next to each other, different TOs and showing vastly different outcomes.

Only 9% of the ratings are used in AARs, ambient adjusted ratings. So, a lot of the difference can be attributed to the ratings methodology differences. The TOs had a lot of latitude in how they meet the standards and set these methodologies. I believe the standards are pretty good in making sure the system is safe and secure, but it doesn't have protections for the transmission owner being overly conservative.

If they are unjustifiably overly conservative, that pushes them into the physical withholding question from us is market monitors -- is that past the bounds of reasonableness? So, we need a lot more transmission transportation to see whether what's driving these variances to figure out what's an outlier and to be able to dive in and look at the details and make sure it's justified.

Okay, a little more on the need for transparency. So, again we think AARs should be broadly applied. DLRs should be encouraged and incentivized. I like that idea of competition being brought in. We also don't think that substation equipment should be excluded.

A lot of substation equipment are being driven by thermal limitation and it just doesn't make sense to say that ambient temperature is irrelevant if it's a thermal limitation just because it's in a substation.

So, for the DLRs, the transmission owners are responsible for citing the ratings, and they can determine the potential ratings increases by using DLRs, but we don't think they're necessarily in the best position to figure out all the benefits associated with that because the benefits are going to be more of an economic thing in terms of dollars, so that should be more of a transparent discussion that involves the RTO ISOs and the market monitors to figure out whether this change in ratings or change in congestion is substantial and worth the benefits.

So, I think there has to be a little bit more of an open process. So, should the FAC established requirement for AARs -- independent oversight is needed to ensure that the requirement is being met.

A similar process to establishing consultative reference for generating resources can be used for transmission facilities and just how we do this, how we monitor it, where we could have ratings being organized by the characteristics of the limiting elements, and then we can group just these limiting elements in a histogram that makes sense beyond the outliers and automate that whole

process.

And then require additional documentation for just these outliers. I'm a little unique in the panels in that I've had experiences in going in and validating transmission ratings on a case by case basis and looking at the individual calculations where the RTOs -- they have systems in place to see if the value is stale or its missing and how you roll over to the seasonal if the AAR's not there.

Those are more IT issues. We're interested not in just is the software working, but is the value itself reasonable? So, that concludes my comments.

MR, KOLKMANN: Thank you. Obviously we've heard varying opinions on the idea of transparency. Starting with the methodology itself and then moving to the results of that methodology. Where do people think that -- where might it be most valuable to put the transmission methodology, if not the status quo?

Different opinions on tariffs -- the one benefit I can think of, there's a -- it's all in one spot, so it's easier for users, but we'll go off in different opinions.

MS. BOURG: I just want to make a comment, it's related to your question but it really addresses some of the conversation that's been had on this panel and the previous panel specifically relating to FAC-008, and since our friend

from NERC is not on the panel, I just wanted to share really for the benefit of the group and for the record, just some of the sub requirements.

We talked a lot about R3 in FAC-008, but the fact that R4 requires transmission owners to make the facility rating methodology available to RCs, and it goes on to list other entities as well upon request. But it reads -- not only make the facility rating methodology available, but also provide it for "inspection and technical review to the reliability coordinator".

So, going back to some of the comment around, you know, the RTOs, or the RCs don't really have the information they need to make informed judgments as to whether or not the methodology is reasonable or not. FAC-008 specifically requires in R4 that transmission owners provide that information to the RC.

So, I just -- again, I wanted to read that into the record and also in our 8 -- under FAC-008, "requires transmission owners to share limiting element information with RCs and other entities as well upon request." So, from some of the prior conversation yesterday and then today as well around other entities don't have transparency into limiting elements to make good decisions, right in the near-term or the longer-term environment.

FAC-008 does require transmission owners to make

that information available upon request.

MR. BOWRING: So, just very briefly on that. I did not -- I'm not sure what you're talking about, but I did not say the information was not available to the RTOs, I said they don't actually do the review, there's a difference.

MR. KOLKMANN: T hank you for clarifying, Devin?

MR. HARTMAN: Sure, I'll try to speak to your first question, and then maybe provide a little add-on to some of the context that was provided after that. So, first off, I think when you think about what the proper you know, reporting documentation format is, we have to figure out first what is the oversight mechanism? Who's responsible for it?

Because right now we haven't decided if it's ideally the proper role from an independent economic oversight perspective, if it should be the ISO, if it should be the IMM, if it should be a third-party. It seems like we need to understand this architecture first of what the oversight mechanism is going to be, and then figure out the question of what the proper channel is to provide that information. Now, it would seem like the easiest step is to kind of bolster the ISO role.

In that case, that may be, you know, tariff enhancements to the point of what information is already

provided. A big thing that we have to dissect on this, both in terms of the stringency of existing oversight processes and information as provided is there's a huge difference between reliability criteria and economic criteria.

And we do not have everything in place right now for economic criteria or oversight whatsoever, so we are pretty satisfied I think, with the degree of oversight on the reliability side of things where we do see opportunities for incremental improvement, of course.

But really, our main argument here is to make sure we have all the tools and information necessary on the economic criteria.

MR. KOLKMANN: Thank you, Mr. Chaisson, do you want to say something?

MR. CHAISSON: Yes. Certainly, it enables the reliability corridors to get some of this data, but it's -- I think the key phrase is upon request when requested, but what we're seeing in practice at MISO, is they don't have a comprehensive folder with all these methodologies stored. And they don't have a comprehensive database with the limiting elements and most limiting elements.

All they have are the ratings that the TOs gave them, and the ability to ask them about particular ones which they do from time to time. And if you think about it, there's always going to be some lag if you have to ask for

something and put out a formal request, have a response to that request, so it would be better just to have a comprehensive database where it's already there.

MR. KOLKMANN: Thank you.

MR. KORMOS: So, I'll try to answer all kinds of different questions there. You know, as far as where it should be posted, I mean I don't think it needs to be in the tariff, I just think it would be burdensome to our changes for us to have to file, but again, if that's the Commission wishes, so be it.

I think just simply using the RTOs to post those methodologies as they said, PJM already posts their guidelines on transmission. I mean I think it would be more easier for us to basically where there are any assumptions where we have to make a decision, we would list what those decisions were.

If there are any deviations from their methodology is, we'd be happy to list what their, you know, what those deviations are. I think that would be the easiest and cleanest, rather than having people have to search through tariffs.

I think it would be easier if it was all readily available through the ISO RTOs if you so choose. You know, I would also go back and just also point out, I mean there's a lot of talk about, you know, auditing all of our ratings.

Please recognize that the vast amount of ratings on the system have no impact.

Those lines are not overloaded. Those lines do not go into congestion. It is a very small subset, Joe may know better than me what the subset is, a very small subset. And if there is an issue, I would suggest we focus on those first, and I think at least in PJM they do.

For those lines that are in routine congestion, or extreme congestion, even for a short period of time, I can assure you the first question asked is are the ratings right? And that discussion happens with the TOs. The TOs will go back and validate it. That discussion also happens in the planning world.

Again, I don't know if there's a formal -- what the limiting element is, but I can also assure you yes, if PJM asks, and when I was a PJM I asked, and now that I'm at Exelon, I will provide the answer of we will be clear, yes, it's a wave trap -- easy to fix, easy to replace.

Now, as I said also for the ratings that have an impact in PJM, they get put out through open windows in the market efficiency. You know, for all of the other -- I'm sort of surprised Joe suggested we put on dynamic rating devices on all lines. I'd be happy for that rate base.

I think it's a real waste of money because quite frankly, most of our lines are irrelevant. And also realize

too, Joe mentioned that some cases in dynamic ratings, you will see the same ratings. That is a legitimate thing -- it's not that we are not doing dynamic ratings, but in certain cases the piece of equipment that is limiting that is not impacted by thermal conditions.

So, things like transformers that have their own cooling, they're not impacted by the weather. They will maintain their own temperature based on their fans and their oil keeping itself at its perfect temperature. The rating is set by that and what we're doing is just switching in fans to keep those things.

So, again, there's no difference in the temperatures. There are certain switches, again, temperature and wind normally have to do with the conduct, its annealing capabilities and its sagging capabilities -- rigid bus barn substation doesn't have any of that, so there's just again, there is practical limitations as to what you know, where it would even play.

I was just again, if the Commission is interested in focusing on, please let's not do what I think some have suggested where we audit every rating out there. We put in a device everywhere out there. I just think that's a very big waste of time and money.

I personally think we can focus on those that are impacting. I think PJM is doing a good job. We can always

do better. Joe will tell us how we can do better, and we'll work there.

He told me I can tell him to do better. I'm sorry, I just want to be clear. I did not say put a DLR on every line. I said in an ideal world if it was free, we'd do that, but it costs money and what I suggested was it be a mandated pilot for everybody.

MR. KOLKMANN: Thank you.

MR. KRAMER: And I won't belabor the facts because a lot of this has already been said. As Michelle mentioned, FAC-008 puts very stringent requirements on the transmission owners for us to basically come up with actual ratings.

There seems to be kind of an undercurrent here that we have reliability ratings and we have economic ratings, and that they are somehow disconnected or separate. FAC-008 says there is an accurate rating, and that's what we are striving to do. It doesn't mean FAC-008 doesn't mention that there's opportunities in the non-planning environment and even in the operating horizons for adjusted ratings -- that's potential.

But I guess I would push back on if people are saying that the FAC rating is specifically wrong for economics, or it's faulty, or something of that nature because I don't think it is. I think that there is actually

a methodology -- FAC requires us to have a methodology that's available as Michelle mentioned, it has to be explainable, it has to be defendable, so there is a method to the madness so to speak here.

This is not something that's conjured up independently with no forethought about what it would be used for. Most of the lines that we're going to talk about aren't going to impact the market in any way, shape or form. The amount of congestion lines that actually are impactful are usually a small number, so the cost of DLR -- and I admit, it shouldn't be on every one, but if you're going to go that extreme step, we have to make sure it's cost-effective.

In MISO at least, if there is a discrepancy, as I think you heard J.T. mention in the rating, or as a concern, MISO will contact the transmission owner, request information about it and if it's in the operating horizon, the TO will consider whether it's possible to make that change.

As far as also on the capabilities the access information right now, we're going to do the FERC 715 data, which in many cases, describe the rating methodology, so there is some information available there that people need to take advantage of, thank you.

MR. DILLON KOLKMANN: Did you want to say thing?

MR. BOWRING: So, I think it's important not to take false comfort in FAC-008. The fact that there is a methodology required doesn't mean it's the right one. It doesn't mean the methodology itself has been vetted carefully. There's a choice of methodologies and it's quite vague, in FAC-008, and then the only requirement is to verify that you're putting into place the chosen methodology, not that it's right.

And that's a huge gap. So, just it's important to remember that. So, it's -- when I say there should be the same method applied by everyone, and the same and different TOs with the same line, actually literally the same lines, with the same rating, it's in market contrast to that.

MR. KRAMER: Yeah, I guess, this is Dennis Kramer. The only thing I'll say is most TOs I'm aware of are using IEEE 738, or some derivative of that. So, a statement that these methodologies are unproven or untested, I would take issue with that for IEEE.

MR. BOWRING: So, the physics is the same. The input assumptions are not and that's what drives typically a lot of the differences.

MS. BOURG: I guess I just want to answer the question. This is Michelle Bourg with Entergy. Have you

seen in your experience in the PJM market or otherwise, a review of any of the methodologies that in your opinion have been egregious or not prudent from a sound engineering perspective?

MR. BOWRING: No, I mean the issue we're raising is they're not being reviewed, so the place to start is to review the methods themselves, and to have a rigorous process in place for doing that.

So, we're not saying there's some particular transmission owners doing anything wrong. What we're saying is that there is not an active review process in place, there needs to be.

MS. BOURG: I guess, correct me if I'm wrong, just one follow-up question. And it's my understanding, so please correct me, that PJM does publish ratings -- facility rating guidelines, either at the PJM level on behalf of the individual TOs, so that was the reason for my question because I thought PJM did have that information readily available.

MR. BOWRING: Yeah, I mean, if you look at that guidelines page, it's not quite what you think it is, so some of it is outdated, it's not -- it doesn't cover every TO, so I'm not sure what you think is there, but it does not specifically set out the method being used by the CO for rating of lines and by lines we mean, of course, all

elements of the transmission system.

MS. BOURG: Okay, I have to take a look at that document.

MR. KOLKMANN: Michael?

MR. CHAISSON: Mike Chaisson. I did some of the methodologies of different TOs in some of my investigations and one methodology might say it's basically name plate only. And another might say well it could be engineering review in addition. Another one might say there could be test data or engineering review, or a methodology and those three different methodologies come out with three contrasting ratings.

So, I don't -- it's hard to say, but if they are all "the correct rating" or "the accurate rating," they're different. And if these three ratings are describing a conductor that's in the same place, it's going to be basically the same ambient conditions than it doesn't seem like they could all be -- the possibility lies that one of them is overly conservative and doesn't need to be that conservative.

MR. KOLKMANN: Dennis?

MR. KRAMER: Yeah, and just let me give a little bit of an explanation on the three methodologies you just mentioned I believe are straight from the NERC standard for FAC-008. In other words, the TO is responsible for

establishing that rating and explaining it and defending it.

In some cases, we have name plate which may be the easiest, simplest to do. In others, there may not be a name plate rating, this may be something that's 30 or 40 years old, and we can't find the records because it went through maybe the ownership of three or four different utilities.

So, you have to do an engineering analysis. That's not something wrong, that's actually the best method we have available to us. So, to say that you have to use name plate rating always, what do we do if we don't have it? FAC-008 has already figured that out that you don't have one method of capability of defining the rating. In some cases, you have to go out and do a physical inspection of what does that look like?

What does that jumper look like? Is it full out copper? Is it a ACSR? What is it, what's the diameter? And then we have to do an engineering judgment and calculation of what that element is. So, don't indict us for using the best methods available to identify the rating on an element or a line because other information and methods aren't available to us. Thank you.

MR. CHAISSON: Yeah, let me add just a little more clarification in my experience. This is a case where the name plate ratings were available in all cases. One TO only

used the name plate. The other one had the discretion to use two or three other methods but didn't have those other things in his rating.

They could have done them, but I don't know why their ratings are different, but it's not an example where they had to do something else because they didn't have a name plate.

MR. DAUTEL: I have a related question that gets to the economics versus reliability and the questions of who's doing auditing that we discussed earlier. So, I think we heard a comment that auditing wasn't being done and then we heard a comment that it is part, at least from a reliability perspective, it's done either by the RC or NERC.

I guess my question is what are reliability on a DP, auditing a rating to see if it's adjusted and reasonable? Or, would they only be looking to see if the assumptions are conservative enough to protect reliability? And if not, does someone need to be in the position evaluating the justness and reasonableness or economics?

MR. KORMOS: I understood the entire question. Probably going back to I think made previously, there are not different ratings for economics and reliability. There are different ratings chosen when they do studies, so they may use just a seasonal rating to do a long-term study because you have to assume the weather will be all over

during that study period, so you can't use an ambient 86 degree day rating, because you can't be sure every day in that study will be that.

So, there are different ratings used in reliability studies that would be different from what is being used in real-time operations where they may be looking at the specific conditions of that day, putting in the rating temperature set for that condition, and operating to that.

The ratings between reliability and the economics are the same. There is only one line rating for our line.

MR. DAUTEL: I mean I appreciate that. I go back to my point that I'm not sure a reliability auditor would be working if the line was too conservatively.

MR. KORMOS: Right, so I would agree because I think, you know, when you look at rating, at basically how much risk you're willing to take with those facilities. And again, you can run things to a hotter internal conductor temperature. You can anneal them faster. You potentially can sag them. That's a risk determination that each TO needs to make based on the conditions of their assets and what they know in the field.

And I absolutely agree. You have to understand what you have in the field and just simply using name plate, you may be comfortable in some circumstances doing that, you

may not be -- particularly in an older station, just assuming name plate is the right one.

You know, I would agree. I don't know if anybody is making and should be making those risk judgments for the owner. I think we are consistent. We are not doing them based on providing a competitive advantage to any entity in either direction.

And again, our goal is to maintain and protect and provide reliability of those assets and therefore we have picked our methodologies and we stick to our methodologies. And just because somebody might benefit, if we basically lose more life on an asset, I don't know -- but I can assure you reliability first is not making those decisions.

MR. DAUTEL: Just to clarify, I don't have anything on my mind about reading into the reliability margin where you'd lose life on an asset, I'm just talking about whether a rating is a reasonable rating from a no-risk standpoint.

MR. KORMOS: No risk, and I think that's what the problem is there's always risk. There's -- well, risk and again, there's no difference between the rating for reliability and there is -- I don't know about margin. There's not really margin in there. I mean we've decided that we'll run our internal conductor temperatures up to

140, that's what we rate the lines based on. Somebody else may choose to run them hotter on their system, maybe.

In some cases, we put zero wind speed for some of our utilities in the East because we believe that's appropriate. For our Midwest, we might use 2 feet per second because we think that's a more reasonable based on historic weather, so.

MR. DAUTEL: Okay, I want to get some responses in here, Joe?

MR. BOWRING: Just very quickly, I agree with Mike and I know you didn't imply that but there's only one set of line ratings. But the question is should you be using a 90 degree line rating on a 30 degree day? And the answer is no, and that's not imposing any significant risk on you Mike, I don't think.

So, I mean and that's the question. Is it okay to use the 90 degrees as some people are doing, does that really make sense? Of course, it doesn't, but that would nonetheless pass the NERC test. So, clearly, that's not enough. So, if you think of that as a reliability standard and using an ambient adjusted as the economic standard, then of course there has to be a test for the economic standard.

What I suggest is that FERC should get involved. FERC should require a different standard of review, and of course, there's risk and I agree with that. And there

should be some systematic way of allowing for transmission owners to express that risk in a mathematically way, whether they're different choices or not. I mean, you know, that's a more subtle question. But at the very least, it should be made explicit.

MS. BOURG: Yeah, I just wanted to add, I mean you can't -- we're not operating two separate power grids here, there's not an economic grid and a reliability grid. At the end of the day, to your point, it's one facility rating. I think there is an interest and a benefit for reliability coordinators to be interested in that rating such that, and you know, we've talked about as part of the interview story here, there's value in knowing that you've got the best possible rating from an operational flexibility perspective.

So, just to your point, operating to this overly conservative rating is not always the best approach, even from a reliability perspective. And that's been what we've, you know, what we've determined and what we've realized through our journey with exploring and implementing temperature adjusted ratings.

And I would encourage you to think about it as such that even the reliability coordinator has an interest in understanding what is the true capability of that line, it's not just an economic question.

MR. DAUTEL: Devin?

MR. HARTMAN: Yeah thanks, and Tom, I think your question really hit it right on the head. And to clarify from a couple other points that were made here, we're not talking about different sets of line ratings, we're talking about different sets of criteria, some of which exist and some are not in existence, for reviewing this and right now the standard criteria for reliability only.

And if -- it's really important to note that, you know, the current paradigm is already letting these practices go through as is, and we've seen this from the preponderance of evidence. There's a ton of slack in the system and so, the only logical explanation is there's not an economic scrub that's going on here as well.

So, there's a difference whether you have the same entity incorporate a different set of criteria to just focus on a singular line rating, or you have a liability set of criteria that NERC, you know, performs, and then you have another entity that kind of talks about alright, you could almost bracket it and have a ceiling and a floor for different review processes.

Either way, there's different ways to kind of skin this cat, but at the end of the day we're only looking at reliability criteria right now, and we're, you know, the result is that there's hundreds of millions of dollars being

left on the table that we're not squeezing out of the system.

MR. CASABLANCA: So, I think the original question was about who kind of should get to decide and review the methodology and the assumptions and all that? But I think a question we cannot forget is what is the basis that whatever entity is hypothetically selected, will use to determine what is appropriate and what's not?

I think historically, transmission owners like us, right, we've relied on research -- published research, testing, operational experience, vendor discussions, to make that determination. And I think, maybe as I said during my opening statement, I think others too, is that hopefully, you know, it ends up that we all start methodically sharing all of our methodology right, as part of whatever mechanism that is selected hypothetically, then we can rely and lean on those research entities, academia, you know, when they look at Power Research Institute, IEEE, CIGRE, others, you know, reputable resources so that they can maybe review the methodologies in aggregate, identify areas where maybe there's a lot of discrepancy.

And from that maybe then we can do some research to investigate why are certain parameters selected, and whether those parameters are appropriate or not. I mean, as we speak, there are discussions happening I think on

emissivity and some other related factors based on new research or new findings or new field tests that have been performed.

So, this is a, you know, as I eluded to, this is an ongoing process and so, I understand it's important to decide if we have to review it, who will do it. But I'm really curious how they're going to make that judgement, and let's not forget that.

MR. KOLKMANN: And do others agree with that? Essentially, one of the benefits to transparency would seem like other TOs could maybe gain some benefit to looking into this is how AEP, for example, has chosen to rate their lines and this is the methodologies they've chosen, so maybe we can -- maybe there are lessons learned.

MR. BOWRING: Absolutely, I didn't expect to agree with what he said, but I actually did. So, I mean, science-based engineering fact-based standards for the methods, absolutely. And the more information that is shared and the more everyone can come to a common agreement about that, again, fact-based and engineering-based, of course that's a good thing, and that should lead to an improvement in methods, the standardization of methods and the ability to actually solve some of the problems we're talking about.

MS. GADANI: Question -- so, it was helpful to

hear from both Exelon and AP that if this methodology, if the Commission would require it to be posted on the website would be okay. Can the other TOs talk about their concerns, because I know I've heard this information provided to the RCs, they have it, but I think our question is a little bit broader and was to the point that was made earlier about sharing information.

So, is there any concern that the Commission should be aware of with posting this type of methodology information on the website in communicating when changes are made to the rating?

MS. BOURG: Yeah, I mean, I'll speak yeah going to TA's requirement 4. Not only can the RC request the facility rating methodology of the TO, neighboring TOs can also ask for the methodology of the TOs that they interconnect with. So, I guess going back to Carlos's point in the spirit of sharing and transparency, I mean we have that ability today to understand and to gain information from our neighbors, you know, to understand where we may have opportunities for improvement.

You know, specifically relating to you know, I guess our perspective around whether or not our facility rating methodology could or should be shared publicly, either via MISO or from Entergy, and that's certainly something we would be open to continue discussion about.

Certainly, understanding the risk and trade-offs, I think the no-fly zone of sort for us, or the point where we would be very uncomfortable, would be the sharing of individual facility ratings. So, the methodology -- certainly agreeable to the discussion, ratings themselves.

And I think other panelists have shared, you know, concerns around, you know, the potential for litigation, scrutiny by parties that may not have the same core reliability security interest at heart, and just really the distraction that that poses around you know, the review of rating by rating.

The methodology -- I think that's something that's you know, that's something that certainly we'd be open to continuing to talk about.

MR. KRAMER: Yes, Dennis Kramer. The -- I would agree with what Michelle was saying that we can all learn from each other and we don't claim to have perfect knowledge about what the best methods are in all cases. As Mike said, you know, in some cases we have data, maybe we can learn from each other to improve it.

So, having the methodologies available and understanding them, like in most cases. I know in Ameren's case, we put that in our 715. If you go look at the 715, you'll see the methodology that lays out how the ratings are developed.

But we would definitely share the concern with providing -- we will consider probably CEII data, which would be information around how you can duplicate the rating on a particular line where we would give you all that information because we don't deal in that. We don't want to be giving out CEII data that is your guys' job and FERC, to decide where that goes.

So, we would be very uncomfortable with any discussion around us providing that on a website. But as far as the methodology, the process that goes into it, I think that's something we'd definitely be willing to discussion, how do we make that available and understandable for stakeholders.

MS. BOURG: Right.

MR. HARTMAN: One redundant theme that came up in this line of responses I think is whether TOs have sufficient information to understand, you know, what the best practice may be on a line specific case. So, going back, even to the point that Mike Kormos made of looking at like the prudency of a DLR upgrade on a given line, you know, that's not going to be a one size fits all approach right for the Commission.

And it's, you know, at the risk of sounding like a transmission owner, it may be -- right, right, right, don't take any offense. It may be unreasonable for us to

expect that the TOs are going to sit there and say, "Well, based on system congestion here, you know, the benefits here are outweighing the costs, and we're going to, you know, undertake additional cap X for a few items here." So, I think it gets back to kind of talking about what is sort of like an independent review process to kind of develop a counter factual and give us a sense of where cost benefits may come with different applications.

And then you kind of set that up. If you have a good counter factual, then you can have a consultative process with individual TOs online and that I think would perhaps be something that would address a lot of concerns on the ambiguity of discretion, and of course, someone raised points on liability -- that's going to be a big issue.

If we're starting to ask TOs to do things that are incorporating more variables with greater degrees of uncertainty, when we do have inevitable you know, from load loss tied to certain transmission practices in different cases, there's going to be lawsuits, and if there's a lot of ambiguity in terms of what should have been done, that's going to be costly in a litigation side.

And a lot of our members are engaged in those types of lawsuits, so I think the more we can kind of clarify expectations, it kind of helps all parties across the board. Is that reasonable?

MR. KOLKMANN: Thank you.

MR. KRAMER: I would just ask, this is Dennis Kramer, if you thought that was reasonable. I think in summary of basically being able to understand and have a knowledge base of why the rating methodology as such is good, the litigation is something we seek to avoid with these ratings.

We do not want to get into a situation where a rating is litigated up through the FERC or the courts as Mike Kormos said, when our rating is changed, it changes the system flows. And when you change the system flows, somebody makes more money, somebody makes less money.

So, we take that very seriously, we do that and any ratings we do not necessarily -- we do not look at who benefits and who does not benefit from that rating flow. We do the best we can to get a rating that is accurate and also supports the system reliability.

Can we improve in those rating methodologies? Yes, I think most anyone would be foolish to say that we do everything perfectly. Thanks.

MR. KOLKMANN: I do want to talk about the FTR market briefly, maybe not briefly. Because it seems like that's one of the benefits that might be gained through additional transparency. Were the Commission to move in the direction or TOs to move in the direction of more ambient

adjusted ratings, there would be consequences to the FTR market, obviously that's -- their values are based on congestion, whilst the models themselves are often based on the static assumptions for supply.

So, what do we do about that and is the answer -- is it okay, is the answer just more transparency so that market participants would know? This is what -- this is how congestion is going to be calculated and thus affecting bids. I'll throw that open to anyone who wants to talk.

MR. KRAMER: Dennis Kramer, FTR funding has been a long-term discussion within MISO. And its -- the concern is if you -- if we provide information for market participants, which I think I said in my opening statement, that we feel that the individuals who are market participants, need the information available to them so they can make accurate and good business decisions.

That means they have access to it, that means it's stable. It's not changing every day, and it's also something that they can use for predictions going forward, because that's what FTR's are, they're looking forward.

Where we would have concerns is if we start dissecting after the fact events where you say well, we did an adjusted rating and for the next two months, six months, whatever duration the FTR may be, and it expected a rating temperature of 80, the temperature went up to 90, so

therefore the rating was less.

Therefore, FTR funding now may go down. Well, now we're going to get a post-mortem, so to speak, of why did you assume that rating was this? Why did you assume that temperature? And then you go into the litigation area. That's the part that we would have definite concerns with would be after the fact, Monday morning quarterbacking of any types of adjusted ratings or things of that nature.

Because like they said, funding will go up and down. That's been a very sensitive topic within MISO for several years.

MR. KOLKMANN: Mr. Bowring?

MR. BOWRING: So, since -- I think we would leave ratings stable so that we make life easier for FTR participants and don't get litigation. It strikes me as being an indefensible position. There is better data, better data is always better. If that makes FTR purchasing more-risky, so be it, that's life in buying FTRs.

FTRs can never and should never return more congestion than there was or less congestion than there was if they're designed properly, which they're often not always. But the idea that we shouldn't change ratings, even to reflect correct ambient temperatures because somebody might not have predicted it -- it's just wrong.

The right ratings -- the right ratings, the right

rating. If it's 90 degrees out, you should use 90 degrees. If it's 30 degrees out, you should use 30 degrees and not keep 90 year 'round, because it makes life easier for FTR holders, that's irrelevant. Their job is to react to the reality of the market, not the other way around.

MR. KRAMER: Yeah, this is Dennis Kramer, I just want to clarify Joe, no, I wasn't saying that we should not adjust the ratings. What I was saying is we just have to make sure everyone knows, as you just eluded to, what the rules are so they can make those risk-based assessments as a market participant.

MR. BOWRING: Yeah, no I think that it goes back to something I've said, and others have said, which is that's for the standard rating method, it argues for a well and a certain transparent rating method.

So, yeah, of course, the transmission owner should not be sued because somebody didn't like the fact that the weather changed. I agree. But the method should make it very clear, unambiguously clear, to the extent possible, how the weather impacts the rating.

MR. HARTMAN: So, a couple things I think to think about in the FTR front. One is that if we're going to incorporate some more of these elements into, you know, the assumptions behind what's going to be driving congestion patterns, we have to be careful if there's not enough

transparency, if we start incorporating more of these elements without expanding and having sufficient transparency, then you create opportunities for information asymmetries.

Information asymmetries lead to problematic behavior in a lot of formats which we may discuss more in a bit. And then there's also the element of any uncertainty that's under these variables introduced, like we talked about before. Doing temperature adjustments is one thing, throwing in some of these other conditions will introduce more error factors.

Now, as long as the information expectations are clearly communicated and all different market participants have access to the same information, I think from a you know, a load congestion management perspective, and you know, we should probably talk to the traders about this, which would be great.

And perhaps in some follow-up comments we should engage them. But thinking about like, is this a bold change for risk management profiles to some degree, so we probably need to think about the incorporation of the assumptions that go into FTRs, as well as then be in line with that when we talk about, for example, what goes into the day ahead models versus the real-time, where we've already seen that if you have you know, different assumptions behind what

would activate different constraints for example, you'll see different forms of regulatory arbitrage in some cases and condition rates in forms of gaming.

So, we do have to think about consistency, addressing information, asymmetries and thinking about how risk management profiles will change across the system.

MR. KHELOUSSI: Thank you very much. This has been very informative. There's a lot of steps between you know, calculation of rating, decision about guidelines or methods. Where that information goes, if its apparently not even in one dataset, it's in folders and it's difficult to access for I think Michael mentioned.

I guess -- I understand the litigation concern, I get it. Is there -- are there reasons that for example, the market monitors should not have access to this data? And then you know, what do you do in the non-RTO regions? Like, where is the lowest hanging fruit without getting anywhere close to litigation?

I feel like aggregating data into one dataset, like that's just -- that's not even like something, that's just a good practice of collecting data, you know. So, just can anyone comment on the sort of tangible, lowest hanging fruit to resolve some of the transparency concerns.

MR. BOWRING: So, the answer to your question about should market owners have access to data, the answer

is yes. I believe we are under the PJM tariff. But more broadly, I think you're right. Data management is -- better data, data management and having the data accessible to the RTO, and the market monitors, but also even potentially is the competitors, is maybe different levels of data, but there's more detail that needs to be provided to competitors, so if the TO doesn't want to invest in certain elements and someone else does, then that's an option.

But data management and routine maintenance of databases and access to that data, of course, accounted for all the security issues is I think, a low hanging fruit, as you say.

MR. CHAISSON: I have a quick question and then I have a little longer question. Mike Chaisson. Market monitors having access to data. When I requested data from transmission owners, I've always received it. But some of them have said that they didn't agree that I was entitled to it because I wasn't a reliability coordinator, but they gave it to me anyway. They didn't think the tariff required them to do it.

So, it's not universally felt amongst everybody that the market monitor should have it. As a market monitor, I certainly thing we should because we couldn't do that part of the tariff otherwise.

MR. KHELOUSSI: Sorry, real quick follow-up. I

think in your slides, you say you don't have access to at least certain things that you would want.

MR. CHAISSON: So, what we don't have access to is a comprehensive dataset of what the limiting next limiting elements are. We don't know what kind of conductor it is on each of these 115 kV lines, there might be different designs of conductors.

We don't have a dataset of all the methodologies, so it makes the monitoring part difficult. Now the investigation step, where we do a data request, we can dig all that up.

MR. KHELOUSSI: Okay. Thank you.

MR. CORBETT: Okay, I'll pick-up where I left off. Real quickly, one thing I want to wrap my mind around is this loss of life concern. If you use the ANC IEEE CIGRE standard rating in your facilities, just say simply to those methodologies, or algorithms that they have.

I could see where your -- for like your normal ratings, they're based on a zero or shall we say minimum loss of life. I realize you could encourage additional loss of life if you were to go to a higher emergency rating, however that's only if they experience those ratings, so we'll call that loss of life at risk.

So, what I ask you is you could have a transmission facility that's limited because of a switch,

and that particular switch rating is limited because of the porcelain insulators. So, who is reporting the status of remaining you know, the typical bathtub curve analysis, who's reporting the residual remaining life on these field facilities due to ratings, or loading experience? Does anybody want to speak to their organization's loss of life tracking analysis?

MR. KORMOS: Yeah, I don't know if anybody's doing it for every piece of equipment in circumstances where if you have a piece of equipment, you have a disconnect, and it prematurely fails below the name plate rating, and you're doing an investigation and that investigation uncovers some kind of age-related material defect. Yeah, we might go in and then take that particular device and de-rate it across our system, just because again, we're as much concerned about it failing in the field unexpectedly as anything else.

So, I don't know if we're doing loss of life bathtub, you know, probably risk assessments on every piece of equipment, I just don't think we're that sophisticated. You know, again, there's a lot of -- you know, some of our equipment is 50-60-70 years old. In some cases, again, you're just looking at actual experiences, investigations afterwards as to why failures might have happened when you didn't expect them to happen in particular.

That may lead to how you look at particular ratings, so.

MR. CORBETT: I understand that. I appreciate that. The final question that I had was -- yeah, the last question I had was dealing with you know, the FERC shares in wanting to have accurate ratings for numerous reasons.

A matter of fact, following the 2003 blackout, we issued Order 693 directly the development of FAC-008, and specifically in FAC-008, it says that when you're determining your facility ratings, please identify how you took into consideration ambient conditions.

So, that's been out there for over 10 years, and we're just looking for more methodologies that include more shall we say, methodologies that include more analysis are taking into consideration ambient conditions.

And what I'm hearing, is I'm hearing like from PJM, they have this, almost like an Excel spread sheet, which could populate their facilities based on certain ambient bandwidths, and then I'm also hearing some entities saying that they use local weather condition forecasts.

I'm not proposing any one methodology, but it appears that there's a lot of low hanging fruit methodologies that are out there are shall we say, aggregate components that could develop a methodology without being so much of a heavy lift, or technologically burdensome -- at

least start moving down that path. Any comments with regard to that?

MR. BOWRING: You're right.

MR. KOLKMANN: On that note, I think it's 12:15. I know it's 12:15. Let's go with that. So, I want to thank all the panelists for being here. It was very informative. It's been a great day of discussion, you've given us a lot to think about, so thank you for that.

There will be an opportunity to request or to respond to all of this. There will be a post-Conference request for comments. I encourage you to respond to that. We surely didn't get through everything today, so I appreciate your willingness to respond after the fact. Thank you very much.

(Whereupon the Conference concluded at 12:15 p.m.)

CERTIFICATE OF OFFICIAL REPORTER

This is to certify that the attached proceeding before the FEDERAL ENERGY REGULATORY COMMISSION in the Matter of:

Name of Proceeding:

Managing Transmission Line Ratings

Docket No.: AD19-15-000

Place: Washington, DC

Date: Wednesday, September 11, 2019

were held as herein appears, and that this is the original transcript thereof for the file of the Federal Energy Regulatory Commission, and is a full correct transcription of the proceedings.

Bala Chandran

Official Reporter