

**VERMONT LAW SCHOOL'S SIXTH ANNUAL ALUMNI IN  
ENERGY SYMPOSIUM: SECURING THE FUTURE LOW  
CARBON GRID**

**SYMPOSIUM PROCEEDINGS  
OCTOBER 17, 2019**

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*BRACEWELL LLP, 2001 M ST NW, WASHINGTON, D.C., 20036*

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INTRODUCTION<sup>1</sup>

Alan Strasser: [00:00:02](#) Okay. Good afternoon. Welcome to the 6th Annual Energy Symposium reception, here at Bracewell, LLP, in Washington DC.

Alan Strasser: [00:00:11](#) We titled this program "Securing the Future: Low Carbon Grid", and we're here live. We are also simultaneously webcasting this event. We would ask folks on the phone, please mute your phones to avoid feedback. And I'd like to just give you-simply say that I'm Alan

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1. This transcript was created by Rev.com and exported on October 28, 2019. The full transcript can be found at <https://www.rev.com/transcript-editor/shared/QrNVy7fcWBpjun0Th-JNn2lcgAqnKRxrCkeFH9-mxR9rB3loxZDATf4tnq226lPgxye3CjDr-uN6eimwuzbMlrSYgWg?loadFrom=DocumentHeaderDeepLink>.

- Strasser, I'm the DC representative of the Vermont Law School, or as we call it, VLS, Alumni Energy Affinity group.
- Alan Strasser: [00:00:43](#) I'm going to introduce a couple of- acknowledge a couple of people and give an overview of our program in a moment. But before that, I'd like to ask Hans Dyke, of the Bracewell firm, to come up and say a couple of words, and we really appreciate all their help and bringing us together here.
- Hans Dyke: [00:01:02](#) Sure.
- Alan Strasser: [00:01:02](#) Hans...
- Hans Dyke: [00:01:03](#) Thanks, Al.
- Hans Dyke: [00:01:06](#) So, I'm Hans Dyke. I'm an energy infrastructure lawyer in this office, in Washington and Bracewell. We're very, very pleased to have you all back. I think many of you are back for the second time here. We were lucky enough to host for the second time. So, thank you for coming.
- Hans Dyke: [00:01:23](#) So, logistically, if you all need anything, Julia, is here..just excellent on anything technology related, if you have a technology problem. I need to mention the bathrooms, they are that way. So, walk around either left and right you'll hit them. But-to get that out of the way. Thank you all very much.
- Hans Dyke: [00:01:39](#) Bracewell is... A little bit about Bracewell. We are [inaudible 00:01:43]firm [inaudible 00:01:44] in energy infrastructure, environmental, all the stuff that goes along with that. Energy really is in our DNA.
- Hans Dyke: [00:01:51](#) We're not all things to all people, and we don't try to be. But we do energy deals, and energy work, and environmental work, and everything that goes along with that, all around the world from our offices here, Houston, London, and Dubai. So, that's who we are and sort of what we do.
- Hans Dyke: [00:02:06](#) In particular, my practice is all transactional. We'll do solar deals, wind deals, gas, fire deals. So, if there's anything sort of in this

- space, a lot of upstream oil and gas, midstream, downstream. But that's what we do.
- Hans Dyke: [00:02:19](#) Our tax lawyers, our real estate lawyers, our energy lawyers, our benefits and labor lawyers, our energy lawyers. So, when you come here, and you're at Bracewell, and you are doing energy deals or energy litigation, you don't have to educate your colleagues, who are specialists in certain areas, or your deal lawyers that are—we all do the same thing. So, it's a great place to be for people who are in the energy space.
- Hans Dyke: [00:02:41](#) Anyway, Jason Hutt cannot be here. He is...I think most of you all, I think are Vermont Law School grads and you probably all know Jason...He seems to know all of the Vermont law school grads I've met in my career. But Jason has sent his apologies. He's on a plane back from—
- Alan Strasser: [00:02:56](#) either South Dakota or I think he went from—  
Hans Dyke: [00:02:59](#) somewhere in Texas to somewhere north of Texas, and now he's on his way back and he will be at our reception this evening. But he wanted us to mention this. So,
- Hans Dyke: [00:03:14](#) So, with that, let us know if you need anything either Julia, myself, Josh Robichaud, who is one of our attorneys here and he can lend his perspective on I think the first panel that y'all have.
- Hans Dyke: [00:03:26](#) So, I'll get out of the way. Let us know if you need anything, but welcome and thanks for coming. So, I don't think—
- Alan Strasser: [00:03:38](#) Thanks, Hans. Bracewell's been a great partner. They're in the facility, they're hosting the events, they've done it before. Jason Hutt is in a really committed [inaudible 00:03:48].
- Alan Strasser: [00:03:48](#) So, I wanted to very quickly give an overview of the program, acknowledge, and thank some folks. I'll give you a quick history, and we'll get right into the program, and stay on time.

- Alan Strasser: [00:03:56](#) The other sponsors are, besides the VLS Alumni Energy Affinity group, are the EDLS Institute for Energy and the Environment. Also, Perkins Coie, as well as the DC Bar Energy Environment and Natural Resources community.
- Alan Strasser: [00:04:13](#) So, welcome to our community where we bring lots of people together, not just to make you feel less alone. The overview program is pretty quick. We have three panels, we have a Keynote, and then we have a reception starting at 5:45. All that's on the website and some materials in front.
- Alan Strasser: [00:04:31](#) There's a little pamphlet floating around that has information about the speakers.
- Alan Strasser: [00:04:37](#) The first two panels will look at in increased electrification, a transition to a lower, greener-a lower carbon greener grid, featuring natural gas and grid scale solar is two of the topics on that agenda. And then moving on into the third agenda is about cyber security, and then after those three panels, Governor Tom Ridge, now from Protect our Power, formerly from the of Pennsylvania, will be speaking our Keynote at 5:40, at 5:45 is a reception.
- Alan Strasser: [00:05:14](#) And also, I'd like to, in addition to our sponsors, thank several really important people for making this event happen, year after year. As anyone knows who's done in an event like this, there's a lot of detail, they're not huge profit-making centers. We try to raise enough money to pay for the good drinks, and hors d'oeuvres, and happy hour, basically.
- Alan Strasser: [00:05:35](#) The first people we'd like to mention are Melissa Hardwood, who's our Alumni Relations Director. If she would rise or wave her hand. She's done an incredible amount of work for us.
- Alan Strasser: [00:05:46](#) And Kevin Jones, who's Director of our Institute, our Energy Environment Institute,

and his staff. If they would please rise and acknowledge who they are. They do a ton of work for us across the country in terms of progress and thank you so much, again, for your leadership there.

Alan Strasser: [00:06:13](#)

So, in addition to that, a very, very quick note from Dean McHenry, who, from the Vermont Law School. Dean, who has attended for the last two years but could not join us because he's traveling to China to work with some partners there, but he could not make it, unfortunately. And in addition to that, I'd just like to tell you very briefly about the history of this event. The full history, if you really want to see it, is linked to our website. But it's interesting, it tells you something about the Vermont Law family.

Alan Strasser: [00:06:45](#)

Dan Phillips, he's not here, he's an alumni, had this idea of working with the alumni that are in the emerging energy field several years ago. And he wrote to the Dean and said, "I really think we need to create a forum to exchange ideas, research, and business opportunities."

Alan Strasser: [00:07:02](#)

And the Dean said, that's a great idea. So, in a meeting that was hosted in part by Dr. Kevin Jones and others at DLS, a bunch of people came together, alumni and said, this is a great idea. One of the outcomes was how about when we create a symposium and bringing a bunch of smart people together, that either are Vermont Law grads or are our friends and colleagues. And so that was done several years ago, and now we're on our 6th annual event. We again, are trying to raise intellectual capital in the energy environment fields. There's a couple of things we've done that I think are important. From a substance standpoint, this article talks about all the some of the people-that we've had on these panels and it's also on our website as well. We

brought together thought leaders and a candid forum to discuss really important issues.

Alan Strasser: [00:07:55](#) And they range from the clean power plan, to Puerto Rico's energy crisis, to all kinds of renewable energy issues, grid modernization, role of RTOs and ISOs, EDs, et cetera.

Alan Strasser: [00:08:07](#) So, we've done that in a respectful way. We always try to bring together the private sector with NGOs, with state, federal and local partners as well. And, we have also tried to capture a lot of this information. If you're ever interested in, and you're doing some research, you can go to the Vermont Journal of Environmental Law, or all the symposiums [inaudible 00:08:27] that they captured. And we also have tried to be a little more cutting edge, so we need to try to webcast this event, capture the event.

Alan Strasser: [00:08:35](#) And, we had last year, "Current Revolution", a movie about grid modernization. We had a person do the premiere, a sneak preview here. And so, we, again, these are people from outside our community. We brought them in our community to enrich the experience that we have here from the symposium. So, I want to thank everyone who's here today, all that support behind the scenes, that come to these events. We look forward to a great dialogue. And with that, we're going to start Panel number one, whenever they're ready to kick off the substantive program.

Alan Strasser: [00:09:09](#) Thank you, very much.

#### PANEL ONE: THE ROLE OF NATURAL GAS IN A 100% CLEAN POWER SECTOR

Kevin Jones: [00:09:19](#) Good afternoon.

Kevin Jones: [00:09:20](#) So, the first thing you'll note is I'm not Samantha Williams, I'm Kevin Jones, a director of Institute for Energy and the Environment, and I'm standing in for Samantha.

- Kevin Jones: [00:09:28](#) Samantha is one of our extraordinary alum. And she's the Midwest Regional Director for Climate and Clean Energy for NRDC and works out of Chicago. There's probably shortly after we had our last symposium that I reached out to Samantha and tried to talk her into moderating a panel. And she had been working on that diligently from that time. We recruited this wonderful panel here, and I think it was Monday afternoon, as I was just returning home from a long week of travel, I get a text. A very, blunt and clear text from Samantha, as I've come to communicate. It was: Broken arm. DC is up in the air. And unfortunately, Samantha had a little accident, broke her arm early in the week. And her first response, being the person that she is, the only, she just, "Oh, I think I'll make it. You know, don't worry about it."
- Kevin Jones: [00:10:20](#) And I'm thinking, "What?" Travel, air travel, these days is tough enough as it is without doing that after having just a broken your arm. But Samantha decided it was best not to travel. So, I'm here for her. And I just want to thank her and let her know we're reserving a spot on the panel next year for her for a moderator, you know, under better circumstances.
- Kevin Jones: [00:10:41](#) So our panel today, that Samantha has put together, is on the role of natural gas, and 100% clean power sector. And I'm just going to introduce the three panelists in just- with some of the background that Samantha gave me- just to introduce the topic a little bit.
- Kevin Jones: [00:10:59](#) So, today we have with us Mike O'Boyle, who's the Director of Policy and-oh-Director of Electricity Policy for Energy Innovation. And Mike and I actually met last night for the first time, at the reception for Energy Bar Association, had an engaging conversation, so we're really looking forward to his presentation today.

- Kevin Jones: [00:11:17](#) We also have with us, at other end, Kim Smaczniak, who's a managing attorney with... For the clean energy program with Earthjustice, and Kim's going to share her thoughts on this transition.
- Kevin Jones: [00:11:29](#) And finally, we have Josh Robichaud, who's an associate here with Bracewell with us today.
- Kevin Jones: [00:11:36](#) In terms of when Samantha was thinking about this, she really thought this would be a timely talking with all the 100% clean energy commitments that are showing up across the U.S. 15 to 20 States that have put out deep decarbonation power sector goals.
- Kevin Jones: [00:11:54](#) Nearly 30 utilities, themselves, that have come up with their own deep de carbonation commitments, at least 80% CO2 reduction by 2050, or earlier.
- Kevin Jones: [00:12:03](#) And the amazing leadership that some of our cities are showing. Sierra Club counts over a hundred cities with specific 100% renewable energy commitments.
- Kevin Jones: [00:12:13](#) And obviously with the urgency of the climate crisis and these clean energy commitments, one of the things that has been greater focus on, is really the role of natural gas in that transition. Clearly, natural gas has played a significant role in terms of cheap natural gas prices, really doing a lot to actually drive a lot of coal fire generation out of that- out of the market due to the economics. And obviously, they've been a part of this transition.
- Kevin Jones: [00:12:46](#) But I think the question our panelists are going to talk a little bit about today is: what is their role and what is that transition going to be like as we try to quickly move now to 100% clean power commitments?
- Kevin Jones: [00:12:57](#) And I'll turn it over to Mike to kick things off.
- Mike O'Boyle: [00:13:01](#) Great. Thanks, Kevin. Everyone can hear me just fine? Any for amplification? Okay.

- Mike O'Boyle: [00:13:07](#) So as Kevin said, I'm the director of Electricity Policy of Energy Innovation. We're a small team in San Francisco that does research and promotes policies that can drive de-carbonization, sort of at scale, and speed, at the lowest cost possible. And part of that work is our energy policy simulator. We have a modeling team that has created a model that I encourage you all to go online, there's a web app tool and play with it. It allows you to, sort of pick your own policies and see what the impact on emissions is, out to 2050. And one of the things that they did recently was update the model with new policies that allow the emissions curve to bend all the way to net zero emissions by 2050. So, in earlier iterations of the model, there was not enough industrial policies. That's a really difficult sector to decarbonize. So, they, they sort of created a hydrogen economy to make that possible, which is, you know, that's one pathway, right?
- Mike O'Boyle: [00:14:12](#) But, I encourage you to go on that, and that's sort of where I'm going to start with the presentation today about the future of natural gas in a low carbon future. And yes, I did put a provocative unfinished bridge up there. You know, natural gas was often seen as a bridge fuel. But my argument today is that, starting now, along the timelines that we've got to get to zero by 2050 in many of these States, new natural gas simply doesn't fit.
- Mike O'Boyle: [00:14:45](#) In this economy wide net zero scenario, the black line that you see here represents business as usual under current policy, and the blue line represents the net zero scenario. And that's the volume of natural gas consumed in the United States. To get to net zero emissions, you really need to get natural gas consumptions declining almost immediately to have a reasonable chance of achieving that goal. And that's just sort of how the, how the pieces fit together.

- Mike O'Boyle: [00:15:17](#) So, I'm going to talk about, just briefly, what I think we need to look at in the near term, in the medium term, and the long term, for the future of natural gas in the electricity sector.
- Mike O'Boyle: [00:15:29](#) So, in the near term, the main goal, I think, needs to be to limit the expansion of the natural gas system. So as Kevin noted, and many utilities are now adopting voluntary, 100% clean by 2050 standards. And, you know, that's 30 years from now. Natural gas power plants last 25 to 30 years. They actually have an accounting life that is anywhere from 20 to 30 years. And the graph here goes in red- if you annualized the capital payments on those assets, it's indexed to a 30-year timeline. And the longer, sort of the later, you build a new natural gas plant, the higher the annual capital costs are associated with that plant.
- Mike O'Boyle: [00:16:14](#) And as you can see, by 2030 you're talking about a 50% increase in the annual capital cost of these plants. And that continues to rise as you get closer to 2050. So, I'll also- we're not going to dig into cost now, but there are a lot of alternatives to natural gas. Solar plus storage, in particular, [is] becoming really economic alternative to providing, you know, peaking flexible capacity. That's zero carbon and those options are really increasing.
- Mike O'Boyle: [00:16:47](#) But I think avoiding the hidden costs is really important, later, associated with that natural gas infrastructure and avoiding the build out of that now is advisable.
- Mike O'Boyle: [00:16:58](#) Natural gas pipelines last 60 or more years, and we spend about \$10 billion annually in cap ex, and most of that is for the distribution system. About two or three billion is for the bulk transmission of natural gas.
- Mike O'Boyle: [00:17:13](#) If you do that same math of accelerating the retirement of those assets to 2050, you can see, if you use the 60-year timeline, you have that green line of sort of annual costs. And that rapidly increases if you set the retirement date

at 2050. And I think avoiding, again, the sort of potentially stranded assets, or at least pricing in the faster depreciation timelines, is really important to having transparency around what is the cost of continuing to build out natural gas infrastructure and what are we going to pay for it later if we don't, or if we do.

Mike O'Boyle: [00:17:53](#) So, in the medium term, I think we're definitely going to need to use the existing gas capacity that we've got, for flexibility, in conjunction with these other technologies. So, the key question is, how can we manage and pay for the pieces of the existing fleet that we need?

Mike O'Boyle: [00:18:11](#) I mean, we have 450 gigawatts of natural gas capacity in the U.S, 80 gigawatts of hydro. And how do we manage that to minimize costs, and actually use those economically, where feasible, but minimize the amount of energy we use, natural gas we burn, in managing that?

Mike O'Boyle: [00:18:31](#) So, the gas fleet and the hydro fleet are well positioned to provide a lot of the flexibility that we need to help integrate more and more variable renewables. But I'll also note that energy storage has a huge role to play as does increasing the linkages between regions, through improving grid infrastructure, and transmission, access to renewable energy.

Mike O'Boyle: [00:18:56](#) The demand side has huge untapped potential, particularly demand response to [kind] of use rates, to ship demand in response to the availability of renewables and reduce the need for peaking capacity, and also, some of the operations in the market.

Mike O'Boyle: [00:19:15](#) People that on the phone, listening in, put your cells on mute, please. We're hearing you.

Mike O'Boyle: [00:19:26](#) Yeah, yeah. A lot of paper shuffling over there. Okay. So, in the long term, what, sort of the state-of-the-art power system modeling shows is that, we don't have a ready substitute

right now with existing technology, to provide the long term storage or to provide energy during long periods of where we have low solar output, and low wind output, which can actually happen for a week at a time. And so, natural gas, right now, will be probably the main source of energy during those times, that we've got. And until we have a replacement for that, it's not really, advisable to sort of get rid of all natural gas. And so, the top line, I think, is that we need to pull resources and create market mechanisms that drive technological solutions to that problem, and sort of create carrots for industry and public private partnerships that creates those solutions.

Mike O'Boyle: [00:20:31](#)

So, I think other questions that we need to answer: What are the most valuable applications for the limited, renewable gas supply that we have? Either from waste or from biomass? You know, how distributed must, or will, our electricity system become, is an open question. It's going to go different ways in different places, but it really impacts what, how the bulk system will evolve.

Mike O'Boyle: [00:20:59](#)

I think with increasing resilience concerns, especially like in my home state of California, it's really important to consider how much local resources is going to meet a lot of that need, and how does that change the role of natural gas, that's to be determined.

Mike O'Boyle: [00:21:15](#)

What are the sources of long-term storage that can scale? There are some promising technologies. I think carbon capture and storage technology could mature and play a large role. Right now, the demonstration projects we have are a little bit more limited in how promising they are. But I'm open to more scaling of that.

Mike O'Boyle: [00:21:34](#)

And will next generation nuclear also become a resource that we can use? These are really uncertain things. But really, as you look

out to the future, these are the main questions that I think we need to address in the long term.

Mike O'Boyle: [00:21:50](#) So, I hope that gives you a frame for the rest of the discussion, and there's a lot to talk about. But I think I'll end there.

Kevin Jones: [00:22:02](#) Thanks, Mike. We'll do questions at the end. And I think the order is-Kim are you-

Kim Smaczniak: [00:22:04](#) Great. And just to let you all know, I'm from Earthjustice and Earthjustice is much like a law firm, but we do pro bono work on behalf of environmental groups and community groups. And so, our perspective on this topic is very much informed by our representational capacity. The folks that we represent are often the folks who have been most harmed by the fossil fuel economy. Environmental justice communities who have longed faced the harms of a fossil fuel economy. And, the other component of what drives us, in our answering where is the role for natural gas, is fundamentally the science around climate change. So, also an organization that puts climate objectives, which are fundamentally human rights issue, at the center of our work. So, just a reminder, and this is something that Mike touched upon, one of the things that really drives this question around gas, what it has to be, is the science around climate change.

Kim Smaczniak: [00:22:57](#) So, what do we know about when we need to get carbon neutral? The UNF Triple C, you know the world's best scientists on climate change, issued a 1.5-degree global warming report this past year. And it showed us that dramatic emissions reductions are needed if we're going to avoid the most tremendously harmful impacts of climate change and avoid the worst of what comes from two degrees, three degrees or you know, God help us, four degrees warming.

- Kim Smaczniak: [00:23:25](#) And the upshot of report is that we can still achieve that. But what we need to do that, is globally, not just in the U.S., but globally, reach net zero by mid-century. 2050, net zero. Now that net zero is not just a power sector. That is across all sectors. That means land use, agriculture, very difficult sectors to get at.
- Kim Smaczniak: [00:23:45](#) It means transportation. And so, if you back up from that, is what we need to achieve by 2050, you must have a decarbonized power sector. Because you cannot drive the emissions reductions that we need, you cannot unlock those emissions in the transport sector and other areas of the economy, without first having the power sector.
- Kim Smaczniak: [00:24:06](#) And so, this question of what is the right role for natural gas cannot be discussed without keeping that as your North star. Those are the things that we need to achieve in order to avoid the very human, very real sacrifices that come from greater degrees of warming. And just to be frank about it, our house is on fire. We've heard Greta Thunberg talk about it that way. This is true. We've let it burn too long, and we've lost some of the ability to control intellect for the most elegant solutions. We have to stop the fire, and we have to act with urgency.
- Kim Smaczniak: [00:24:39](#) And so, we're not always going to be choosing the optimal solution. Had we started work on this problem 50 years ago. We are going to have to be acting with the reality of the science.
- Kim Smaczniak: [00:24:48](#) So that's my North star in this conversation, and gives us to the answer that we have to, as an organization, our position has been, and we advocate in the proceedings we're involved in, we have to stop building new natural gas, period. It has to stop. And then move as rapidly as possible, acknowledging what Mike has described as the tradeoffs of rapid removal of existing gas plants. Well, the goal

has to be to eliminate that as quickly as possible. We cannot achieve our decarbonization goals, including in other sectors, until we do that. So that's my answer on the question.

Kim Smaczniak: [00:25:26](#)

But let me get to what I really fundamentally want to focus to in my remarks, which is that, the area that I work in largely has been in regulated energy markets. The markets that are subject to FERC regulation. The power markets that really matter to whether or not we're going to be able to stop gas build out.

Kim Smaczniak: [00:25:48](#)

So, this is particularly true if you look at the deregulated Northeast RTO, you look at [inaudible 00:25:54] if you look at ISO New England, and you look at, particularly PJM, which is the largest RTO. It had served some 65 million customers. There is a huge amount, if you looked at 2018 figures, a huge amount of planned gas, fast city growth. Thirty percent of what's projected to happen in terms of additions of gas capacity, is in those deregulated markets.

Kim Smaczniak: [00:26:18](#)

Now, part of that driving might be the Marcellus shale, very proximate-Pennsylvania, Ohio, really big potential areas for planned growth.

Kim Smaczniak: [00:26:27](#)

But the bottom line is that you cannot get to the goal of decarbonizing the power sector. You cannot achieve those 100% clean energy goals, which are largely in Eastern States, not all of them, but a lot of them, while we have the existing set of market rules.

Kim Smaczniak: [00:26:42](#)

So that is really the focus of what I want to talk about, is the fact that these rules that we have in these regional markets are a part of what is majorly driving this gas build-out, and are a major barrier to be able to achieve those 100% clean energy goals. And we cannot get to 100%, we cannot get to the tough 10% last emissions reduction solutions, until we get to the heavy work of the 40%, 50%, 60%

reductions that only entails achievable in the technology we have today, but is not possible, it's not going to happen on its own, in these markets without changing some of the assumptions that are buried in these rules. So, [00:27:05]- these are complicated sets of rules, like to really dig in and lay out some of what's stacked into those outcomes, the build out that we're seeing in these markets. It would take a lot of in-depth conversation.

Kim Smaczniak: [00:27:35](#)

I'm just going to set the stage, give an example. Give an example of a reason to be optimistic about the direction we could go and then leave a lot to the discussion. So, I'm going to have to, by nature of the time we have, keep it a little bit high level, but happy to dive in deep. Particularly for folks who may be more in the weeds of some of these RTO details.

Kim Smaczniak: [00:27:53](#)

But, just to really flag the scale that we're talking about. So, in that PJM market, the 2118 projections of how much proposed gas build we have, is 40 gigawatts. Now, I suspect some of that 40-gigawatt proposal, proposed build out, may not get built. You know those are looking at what investors think they might be able to make money on. Not all of those pan out. But if you look at those numbers, what we're seeing in PJM is basically the gas- or the coal retirements that we've seen being driven- are all being replaced by gas.

Kim Smaczniak: [00:28:26](#)

And so, we will have a gas dominant system. That is not going to reach your zero-carbon goals. There's no way you can get to those deep cuts in emissions if that's the outcome we're dealing with.

Kim Smaczniak: [00:28:39](#)

So, now if we know renewables are getting cheaper and cheaper and ostensibly, this is a market in which economics should drive outcomes, why do we see this huge glut of proposed gas build? And why do I say that

these outcomes are baked into the market design?

Kim Smaczniak: [00:28:56](#) So let me turn to what I'll call exhibit A, which is capacity market design. And particularly PJMs capacity market design. And, as a reminder of past the market is the reliability mechanisms, the goal of which is to ensure that you have enough capacity on the system looking forward, MPJ was a three year ahead. Looking ahead, what do we think we're going to need, you know, in order to make sure we meet all of the system needs, plus some contingency, some unexpected event, and make sure that gets built.

Kim Smaczniak: [00:29:26](#) And so, it's a constructed demand curve, and we're going to pay out certain payments in advance to ensure that if we're having some gap between what we need and what we expect we're going to need, that there- that payments go out to incentivize to build out we're going to need.

Kim Smaczniak: [00:29:39](#) That's basically the how the mechanism works. Whole of detail that's being smoothed out under there. But the gist of it is that. And so, any PGM market watcher will tell you that current capacity market is currently a mess. The auction literally hasn't been able to be held over the past year because there's currently ongoing FERC proceeding. There's a big thicket of a fight around the extent to which PGM can push out certain resources. Specifically, nuclear plants and renewables, that are beneficiaries of state policy. And so, if for example, a renewable development project is a beneficiary of a renewable portfolio standard, the question is, can that development project effectively be pushed out of the capacity market, not be able to benefit from that revenue because of that state policy.

Kim Smaczniak: [00:30:32](#) Now because it's a politically contentious issue, it's been stuck, it's been on hold. There hasn't been a final decision about what will

come from that. PGM's proposed a set of rules that would push out those resources. FERC is in the process considering what does it think is an acceptable solution in response to PGMs proposal. So, you know, the entire market now is kind of in a confusion, because a lot of participants don't even know what the rules will be that will apply going forward. But- and that's a particularly important piece of a problem there. We have these questions over whether state policies are going to be allowed to influence the market outcomes. But even setting that aside, setting aside this very obvious and very difficult set of rule changes that are currently in flux, there are components of the market design itself more fundamental in this very recent set of policy reforms that are at issue. So at the basic mechanism, the most basic level, the capacity market was designed around an assumption that, to ensure the system operates reliably, you really need enough of a certain kind of large traditional fuel dependent generator, that's going to be built and available to operate for fixed stretch of time for as long as is needed during disruptive events. So, it's fundamentally built into the assumptions of what we want the capacity market to deliver is at its center, this idea of using traditional generators, right?

Kim Smaczniak: [00:32:10](#)

So, it's really built around the financial model of a traditional generating plant. It doesn't count capacity that comes from resources that don't operate like a traditional plant. That operates only during part of the season. If it operates during- if it operates like a renewable energy resource where there's intermittency and when it can be available. If it can't come when it's called, to run for a particular amount of hours, it either doesn't count at all or it gets discounted. So, baked in the rules of the system.

- Kim Smaczniak: [00:32:42](#) It's also the capacity market administrative mechanism that's heavily biased toward extra caution. It's got layers of added stat to the system to make sure we really avoid those adverse outcomes. And so, you have every piece of a capacity market. It's a load forecast looking three years ahead. It's an expectation about the degree that resources are going to be available to perform. It's an expectation around what the system will look like in the future. And all of it has margins of error, and all of it has to be built around a set of assumptions. And the tendency is going to be, because the market operators job is to deliver, you know, reliability and avoidance of risks, it's going to be to try to make things conservatively and build up layers of extra capacity. Which means building out extra power plants that we may or may not need, if we're wrong about those assumptions.
- Kim Smaczniak: [00:33:34](#) So, what I'm telling you is everything about how you've built the system is getting in the way of our ability to have a sleeker system that's going to emit lower emissions, and it's built towards a particular type of resource that has particular sets of risks and financial needs in order to get built. Foundational to what we're building in PJM.
- Kim Smaczniak: [00:33:54](#) Cannot get to where we want to go unless we change some of these rules. So, I don't think you need to assume that I'm correct on this. These are all things, points have been laid out by experts who are much smarter than I am, and it's really told in the numbers. So, just to point to a couple of quick resources, we can talk about these later, but there's a fantastic paper called Asymmetric Risk and Fuel Neutrality in Capacity Markets written by PhD economists. Including one who is the chief economist at Burke, on that's Jacob Mays, David Morton, and Richard O'Neill. And the upshot is essentially what I described

earlier: that the capacity market is built to address particular types of financial risks. It's a great hedge if you look like the traditional fossil fuel generator, where you have a set amount of fixed costs, and then a large amount of operating costs. Looks does not work well at all, in terms of hedging risk for something that looks like a renewable development project.

Kim Smaczniak: [00:34:49](#)

Fundamentally different kind of financing needs, and the capacity market doesn't help you to cover your financial risks if you're an investor thinking about making that bet. So, really fundamentally, again, baked into the design problems with the system we've got. The FERC itself has opened up a seasonal capacity market docket. We're looking at the fact that PJM, the way its capacity market is structured, is biasing against certain types of resources that are only available in one season. They're perfectly good. If they're good during the season when you have your peak, why shouldn't we count those? FERC's looking into it. FERC agrees. This is something that makes you scratch your head. Another example of just in the data, the fact that the capacity market is very conservative. What are PJM's target reserve margins? They're about maybe 15 to 16%. They say we need this amount.

Kim Smaczniak: [00:35:41](#)

What does it actually end up getting in the market? What it goes for, it in terms of clearing the market? It's more like 16 to 23%. Okay? So, way above what it says it needs. Okay, on top of that, when you look at what actually ends up being the correct forecast. When you account for the errors in low forecasts. We said we saw we're going to need this much, but then when we look back, we actually need less. We're actually getting close to 30% that we're purchasing

Kim Smaczniak: [00:36:22](#) So, I mean the scale of the errors in these things matter. Recently, PJM just corrected its load forecast. Very minor change. Very minor, in terms of it's not a grand sweeping thing that had to go through a FERC proceeding and was contested. 3.5 gigawatts change in how much it's going to be developed in the next capacity market auctions, because it made a tweak in its forecast.

Kim Smaczniak: [00:36:44](#) So these assumptions that are built in these models, have huge impacts on the ground, in terms of emissions. So, I think I'm running out of time a bit, so I'm going to not get into any other examples of that. But I want to just say one thing, about a reason to be optimistic about the future. And that is order 841, which is the storage orders that FERC recently put out, and is now in the DC circuit. It's been subject to challenge, but is really a landmark change in direction. So, why is this so such a landmark approach for FERC? Here to now, we've really had systems that were built around this is what a traditional generating model looks like. And everything has to fit. If you're a circle, you have to fit in a square peg, doesn't matter. We're going to try to see, and account for you, as if you should've been a traditional generating model.

Kim Smaczniak: [00:37:33](#) Storage forces them to change those underlying assumptions. Storage we know has so many different ways. It is both. It can take in energy,<sup>[00]</sup> it can inject energy into the system, so it looks like demand. It looks like supply. It is able to act like transmission, in that, it can avoid the ability to have to have build-out transmission, where there's transmission constraints. At the same time, it looks like a generator. So, it crosses boundaries in a way that forces us to rethink the model. And the amazing thing is, that in spite of the fact that we have many

challenging politics in the energy world right now, order 841 came out. And the participation model that they set out, which says we have to look at what storage capabilities are uniquely and differently, is a huge trend. Important marker for change in a trend. If this starts to happen in other areas, we start to really looking, and say, "What is the capability of this resource, and how does it help serve our actual needs?" Instead of trying to use the existing assumptions. That will mean that we can really change the system overall, and start to use a whole slew of other technological capabilities that we will need to tap, to get our clean energy goals. So, I'll stop there.

Kevin Jones: [00:38:43](#)

Thank you Kim. And we'll finish up the panel with Josh.

Josh Robichaud: [00:38:48](#)

Thank you. And once again, everyone, welcome to Bracewell. We're happy to have you for the second year. I start with the standard disclaimer. The views expressed are my own, not necessarily those of Bracewell, or our clients. But I wanted to draw on, it was touched on in each presentation, and I want to push it a little more at the forefront here, being the reliability and resiliency pieces of this. Not to say that emissions are not a major factor, and a major element in the picture that we're painting here. It's that these other two, being reliability and resiliency, are another point to balance all of this across. Hopefully, the Interstate Natural Gas Association of America, INGAA, as you may have heard it referred, put together a report earlier this year, which released in May, that looked at exactly this question. What is the role of natural gas, as we moved towards more de-carbonization?

Josh Robichaud: [00:39:41](#)

They studied the role of natural gas on a 20-year timescale, so from 2020 through 2040, what is that going to look like? And they do it through two scenarios. One being a balanced

approach, not necessarily business as usual, but sort of operating under the same assumptions, and build, and development, and growth that we have right now. And then also under a prioritized renewables, or rapid renewables, approach, which had states meeting 50% renewables by 2040, had nuclear being extended, and continuing to run. Even though, the economics may not be there. Sort of the best-case scenario assumptions to get to those end results. In the balanced approach scenario, there was slight growth. Sort of, was able to continue operating. There was still a role for natural gas to play in that scenario.

Josh Robichaud: [00:40:31](#)

On the prioritized renewables approach, it was more or less constant from where we are now. And that more or less, tracks with what we were saying. Trying to dip off or further reduce emissions, but that is to say that there would still be a role for natural gas, even in the best-case scenario with build-out of renewables, and the other constituent factors that could impact that at a house. That is because we need natural gas in order to have the renewable penetration that we want. Just off the east coast of the U.S., 19,000

Josh Robichaud: [00:41:09](#)

The more that we want those intermittent resources on the grid, which has emissions benefits, which has in some cases, cost benefits. If we want to be able to integrate those at that scale, you need a resource that can ramp quickly. That can respond to the intermittency of those resources. And right now, that is natural gas that can provide that at a cost that is reasonable and is something that we can work with. And that cost part, is not an insignificant factor in this. That if we want to have resiliency, at the same time, any sort of increase in these costs, whether it be from stranded assets, whether it be from further renewables, or more expensive

resources coming onto the grid, those increases in cost are going to hit low income customers, low income rate payers first.

Josh Robichaud: [00:41:56](#)

And same thing. We have emissions concerns; we have other policy things to balance against. But that is going to be one of the more immediate, and first concerns from policy perspective. But more importantly before the state regulatory commissions, and the federal energy regulatory commission, for that matter, they are rate regulators, at bottom. So, they want to be concerned, and focused on those things. So, all that is to say, there is a role for renewables going forward, and we want to, excuse me, a role for natural gas going forward, in coordination with renewables. The National Bureau of Economic Research in 2016, did a study of this balance between the two. A 1% increase in fast reacting fossil generation, is associated with a 0.88% increase in renewables. So very much a complimentary. They explicitly state that in their conclusions. There is a highly complementary—that they should be jointly utilized, to meet the goals of cutting emissions, and ensuring a stable supply.

Josh Robichaud: [00:42:56](#)

So that sort of is the reliability piece, and wrapped up within that, some of the economic concerns. I have a little bit on battery storage, but I know that we may have some questions around that, so I don't want to step on toes there. I just want to set the table in one quick way with that. If we want to talk about energy storage as filling the same role or being the functional equivalent of a natural gas resource, I think there is a path for energy storage to play that role, but it is not currently there. The issue mostly being the duration with which energy storage can provide output. Right now, that is anywhere from a half-hour up to about four hours. But if we're talking about, in California for example, or anywhere

where we have a mismatch, an intraday, or seasonal misalignment, that four hours isn't enough to cover what we would need through that whole period.

Josh Robichaud: [00:43:50](#)

So, you need a natural gas or something like that, that has a constant feed stock that is able to continue to run, even past that period. That said, there is great efficiencies to be gained from partnering energy storage with a natural gas resource, and we'll get to that in a second. That is some of the more recent proposed natural gas build out, is using that sort of synergy. But it's just to say that, there is a role for battery storage, but right now those are in a one for one functional equivalent of each other, setting aside the cost concerns. So then taking the long-term approaches, as Mike posed it. Well when we're thinking about the different ways that natural gas can integrate into the system. A couple of examples for you. Buc-ee's. Think Wawa, or a Cumberland Farms, a convenience store mostly out of Texas. Very large if you've ever seen them.

Josh Robichaud: [00:44:45](#)

Like most things in Texas, very large. A gas station, convenience store, truck stop. I think there's carwash. There's several of these built out across the state. They have partnered, and finance a series of small natural gas generators, that are able to island their facility off of the grid, and run independently of any other power outage, or anything else going on around it. So, Buc-ee's, is seeing this as, from a commercial perspective, we can continue to run no matter what goes on around us and continue to provide this value to our customers. But in a dire emergency situation, we can provide the critical fuel, food. In many cases, some emergency responders can set up on their facilities, to be able to continue to run through this period. That's because of the flexibility and reliability you can get out of a small, modular natural gas turbine. H-E-B,

another grocery store doing similar things, similar reasons, providing it in those ways.

Josh Robichaud: [00:45:45](#)

Just north of here, in Baltimore, there had been several public-purpose micro grid projects proposed, to interconnect several different companies. So, these public purpose micro grids, would be linking several different—so, option, nonetheless.

Josh Robichaud: [00:46:23](#)

The last example I want to talk about, is in Long Beach, California, Southern California. Edison is building a new natural gas plant, or<sup>(o)</sup> updating a natural gas plant. They are partnering that with a battery storage array. And that battery storage array, the intent is, to allow the natural gas generator to run at a consistent rate. And have the battery storage array, be able to do any of the step up or step down, that would be called upon for the generator. And from an operational perspective, this is better for the natural gas generator, because it avoids any maintenance or operational concerns that comes from ramping up or ramping down making those adjustments.

Josh Robichaud: [00:47:03](#)

You have the battery providing that slack, and it's able to respond while you can run the generator at a consistent rate. At the same time, you also have emissions benefits from that. Running at that consistent rate, you're able to plan for it, for one, and you don't have those sort of residual problems when you're pushing up and down. And AES, one of the companies building it, explicitly said that we're building this now, and it's providing flexibility to allow this to be a platform for other things.

Josh Robichaud: [00:47:32](#)

Their building partially, partially building out this battery storage array. There is space and opportunity to build that even larger, where the battery storage array can become sort of the primary generator, and the natural gas turbine just as backup, or complimenting that.

So, it provides flexibility, it provides different options. Not only for battery storage, but for other types of resources to integrate into that. So, all of that is to say, that there is a place for natural gas going forward. And in order to make the map work on that, and from a reliability perspective, and an emissions perspective, I don't think anyone can say there's one way forward, but there are options.

Kevin Jones: [00:48:14](#)

All right, thanks Josh. And panelists have left us with about a half hour for questions, which is a lot of time. While you're thinking about your questions, Samantha's given me a couple to kind of start off with here. So, let me just begin with... each of you laid out potential pathways to consider how to get to 100% clean energy. And some of you touched upon this, but I just want to put it back to all of you, to identify what you think are the key policy levers that we should be prioritizing to get us there. Who wants to start off?

Mike O'Boyle: [00:48:49](#)

Sure. Well I think Kim really highlighted the role that markets play, in sustaining investment in new natural gas, which is kind of unacceptable, given the emissions trajectory that we need to get on. So, I will defer to you, to expand upon that perspective.

Mike O'Boyle: [00:49:13](#)

I think regulated utilities also have a lot of control over their specific integrated resource planning, and decisions about what generation to either procure from the market or build to the extent they're vertically integrated. Integrated resource planning really needs an overhaul, as well. I think some of the same baked in assumptions in market design, that Kim highlighted, are also present in integrated resource planning, and reserve the definitions, embedded in reserve margins of sort of, what does resource adequacy look like. But, in particular, integrated resource plans really rely on the inputs that utilities provide into their modeling. So, there's the

issue of inputs, and then there's the issue of the modeling itself. Which may sort of lack sophisticated modeling, of how renewables can be used to provide reliability services, modeling how storage can be used.

Mike O'Boyle: [00:50:15](#)

Because, many of the models just don't really do a good job and energy storage. And then the demand side resources really don't get integrated into the integrated resource plan, hardly at all. Lots of them project load growth that never materialize, and continue to do so. So, I think reforming those integrated resource plans to actually go out to the market, test the market for real renewable energy prices, and combinations of renewable energy and storage. If they can just neutrally define the services, and allow competition, you see really improved outcomes. I would point you all to an all source RFP, a solicitation that Xcel Energy made, in 2018, for renewables in storage and natural gas. And they got PPA prices, which they published, which is not normal. Usually these are redacted, and secret, and you have to sign an NDA just to look at them, which is not good.

Mike O'Boyle: [00:51:20](#)

And, they had bids coming in—wind at a median price of \$18 a megawatt hour, solar at a median price of the low \$20s, ~~and~~ and then you add storage, and it wasn't all that much higher. And basically, Xcel was then able to procure very, very small amount of natural gas for peaking. But the vast majority of the new energy, was renewables plus storage. And they were able to accelerate the retirement of their coal plants. And really, Xcel is the leader, I would say, in the utility space that others can follow, of what it really means to meaningfully reduce emissions.

Mike O'Boyle: [00:51:57](#)

So, I would just point to integrated resource planning, and then also, those investor owned utilities that own coal, and own natural gas. They really have a vested interest in keeping

those assets around. And so, I think providing new financing mechanisms to allow utilities to not see as much downside, or risk, associated with accelerated depreciation in retirement of those assets, is also really crucial to removing those barriers toward keeping those assets online. Even when they're uneconomic, and don't fit with the emissions trajectory that we need to be on.

Kim Smaczniak: [00:52:36](#)

Yeah, and I will just endorse the value of the all source solicitation of resources, and really identify what does your system need. I mean, that's a basic principle that underlies both, in the vertically integrated and the market side. You said that we are more neutrally defining the services that are needed, as opposed to trying to identify particular attributes or fixating on what we think the characteristics are needed that will serve the system, the better we're going to be able to allow actual technologies to compete and behold, renewables plus storage is a fantastic set of resources that can do a lot, and there'll be innovation to provide additional services where there are gaps, and how you get that innovation, unless you very clearly define those needs. I will say from the regional market side, we are very far from having that kind of ability to see that manifest.

Kim Smaczniak: [00:53:28](#)

The assumptions that are baked in, and the kind of institutional structure that has developed around that, the heavy voice of utilities in the regional market, in terms of influencing the direction of the development of those markets, baked into how decisions are made, the software, the technicians, the hundreds of folks who are involved in grid operations, they are used to a certain way of thinking, and it is a difficult thing to change, change that quickly. But, it is a priority. And I think "magic wand" and we switched away

from a capacity market model to something different.

Kim Smaczniak: [00:54:02](#)

Maybe it's a little more ERCOT like, but that's not likely to happen very quickly. I still think you can start to unravel some of the excesses of the capacity market, to try to move it in the direction. We've seen a big step forward in PJM, and it focused on more of a service that you need, which is reserves, and emphasizing procuring that through energy markets, which is a little bit more—there's a little bit more competition there. I have some beefs about how PJM has implemented it, but the idea of it is something that would then move revenue away from the capacity market, into the more granular energy markets.

Kim Smaczniak: [00:54:40](#)

And it looks a little bit more like that competition, like he's talking about, where you're saying we know we're going to need some kind of reserves to be available. Let's let everyone who's capable, try to compete to provide those, and not add a lot of administrative layers to who count. So that's a great example. But I think ultimately, what I'd really like to see is the model that we saw with the storage order. I'd like to start to see that with distributed energy resources. FERC has put that on hold. The next step is thinking about, we have so many more small, available resources, that can look very different from this. Now we have a big huge amount of capacity in one place, and we need to build transmission around it. And so, what happens, when you start to be able to build in? What is the actual resource adequacy benefits of those resources?

Kim Smaczniak: [00:55:27](#)

What is the ability to be more reliable in the face of events? Since many outages on the system, are the cause of transmission. And, you happen to get the power you need, from where it's produced to where you need it. So, what is the value of that? and, should we be

incentivizing that through our market structures, instead of having state policies, that are the thing that causes that to be built out, rather than the actual compensation of to create the innovation. We need to value that in our markets, and it hasn't happened. And it won't happen till we finish a rule that, similar to the storage rule, looks at what are the capabilities of these different type of resources. Capabilities, and limitations of course, but also, really does value for what they provide to the system.

Kim Smaczniak: [00:56:19](#)

There's a whole slew of different market changes I could imagine, including getting at the barriers between seams of market. We need really to think about the system as a more integrated whole. There's a lot of arbitrariness about the rules on one side versus the other that serve no actual system benefit but create a practical barrier to being able to flow power from one side to the other. Even though, physically, geographically, these places are not that far apart. The rule differences make a big difference, and things like that are absurd, and we can do better. And that's what you need to get to a 100% clean energy—more integration, and more ability to see across the system. Where are the assets that we have, and how can we balance things?

Josh Robichaud: [00:57:08](#)

To round up the hat trick, I agree. The resource neutral procurements, I think, is an interesting way forward. But no further insight to add other than that.

Mike O'Boyle: [00:57:17](#)

Yeah. I think carbon price would definitely help too, just to throw that out there. A man can dream.

Kevin Jones: [00:57:31](#)<sup>[OBJ]</sup>

Like what you said, with the long life of new natural gas plants. And Josh, I think you touched on this. If we move rapidly for decarbonization, there's a need for existing... We may not need new resources.

- Kevin Jones: [00:57:49](#) Is there a consensus on the panel? Or what are the... That you will think about how we should be thinking about new natural gas plants. We have to be very careful about approving new natural gas plants in the market.
- Mike O'Boyle: [00:58:05](#) I think that's fair, careful. I mean, if you really look, to Kim's original point, about the need for speed and scale. We should be extremely skeptical, just from a climate mitigation standpoint, of any new fossil fuel infrastructure. And the lock in that is likely associated with that. So that would just be my first point. I don't know if there's consensus. I mean I've seen modeling from vibrant clean energy, for example, of an 80% reduction in power sector emissions, relying mostly on wind and solar generation, that shows natural gas capacity sort of remaining flat, to slightly declining. But the share of energy goes from 40%, as it is now, down to 20%, we have to figure out what market mechanisms can keep the natural gas that you know you need, for the reliability services it provides, but also allow for competition from other resources to provide that same service, and then to drive that last bit out of the system. You need policy to continue to push on that. I don't know that just raw economics is going to do it. But yeah.
- Kim Smaczniak: [00:59:44](#) So, we have a very simple answer. Yes, no new gas build-out, period. That's where we're at. The science behind climate change drives that. Of course, are investors still able to make money on new gas? Yes. And are there proposals, and will there be regulators who approve it? Yes. In fact, we will continue to see that happen. The answer for society, for the public at large, is no, we should not be building them.
- Josh Robichaud: [01:00:10](#) I think if you're going to be building, we need to be thinking about some creatively. The way that the Long Beach example was. To think

- about it only as it is now, of just a static generator, that whether it be base load, whether it be peaking, to have it narrowly viewed that way is going to create a different reality. But to be open to energy storage, or other methods of getting more utility out of that main asset, I think there's a path forward.
- Kevin Jones: [01:00:41](#) I have some more questions here, but I'm going to open it up to the audience, because I know we have some very knowledgeable people out there. And I know from having some of them in the class, there's certain people here that definitely always come full of questions too. So, who wants to kick it off? And Brian's smiling in the audience, because he's had this class. Who wants to start off?
- Audience: [01:01:09](#) My question is about upstream natural gas [inaudible 01:01:20] as being very damaging, and what policy mechanisms there are, to really get at those. The states saying, well we're renewable, they only count it in the stack, electric supply chain.
- Mike O'Boyle: [01:01:49](#) I mean, there was a federal methane leakage standard that the Obama administration passed but was gutted by the Trump administration.
- Kim Smaczniak: [01:02:04](#) I believe it's still in litigation. I'm not sure we were involved in the litigation.
- Mike O'Boyle: [01:02:07](#) Yeah. I think the Senate actually decided not to get rid of that. I think that was McCain's dying breath, actually, was to try to keep that regulation in place. I mean, some states are doing better than others. The fracking heavy states vary. I think, I've heard Colorado's methane regulations are kind of a model that other states should build on, to tighten up oil and gas extraction, and methane leaks from that. But I think it's really important to have transparent accounting. The leakage rates that the EPA has published, has been sort of scrutinized, and contested as about half, or slightly more than half, of actually what was

being emitted. So, we need consensus around that, and to tighten that up. But I mean, again to Kim's point, that's just another reason why we need to move off of natural gas. Not just in the power sector, but to begin to stop burning it in buildings as well, as quickly as possible. And those two efforts can be mutually virtuous I think.

Kim Smaczniak: [01:03:22](#)

Right. Yeah. And I would just add, I mean on top of the state, the opportunity for states to ratchet up in the absence of federal action, controls over those leaks. Certainly, that's an authority, that many are looking at, and is going to be important mechanism to control that. The other piece, which Mike had hinted at, is trying to limit the growth of the infrastructure, and the use of this in other places. So, we are thinking about where is this gas going in other places, other aspects of the value stream. Petrochemicals. When gas isn't being sold in power, folks are using it to make other products, and we're very much engaged. Most of those petrochemical factories, plants, are in places that are facing horrific environmental injustice. Cancer alley, they're burden after burden. They already have multiple polluting sources dumping toxins, and then on top of it, these petrochemical facilities, which emit absurd amounts of carcinogens, are being built in their backyard.

Kim Smaczniak: [01:04:26](#)

And so, this is where the gas products being used if it's not being burned for power. Then there's gas in homes. And you've seen a number of places in California start to ban new gas hookups. Let's move to other sources for heating. This is an industry that needs to go away. You know it needs to go away. Let's start to look at all the places where it should no longer exist, because we cannot have an inhabitable planet as long as this industry continues to thrive. So we need to look for an alternative, and we need to have a phase out

across the board. So I think the leakers are important, but there's a whole other rest of the value stream that we're certainly thinking about. Lots of communities are thinking about, because they haven't had a choice. The consequence of that industry is being dumped on their doorsteps, and so we continue to fight those fights.

Kevin Jones: [01:05:17](#)

Audience: [01:05:26](#)

Doctor.

Thank you, Kevin. My first question is to Mike. And then the second one is to everybody. Now, I was wondering in your model, I believe the ideal clean energy means that you had in the 2050 scenario was a system powered by 100% renewable energy, like green solar. So I was wondering, to what extent, or did you guys look at for example, the opportunity costs? And we all know the challenges with those sorts of energy productivity compared to natural gas, for example, or the typical base load systems like nuclear, like Josh was saying. Did you kind of factor in the usual opportunity costs on changing our electrical system to entirely renewable energy of [inaudible 01:06:25]?

Audience: [01:06:24](#)

And if that was a useful question, then will that affect the equation of whether a potentially just pull source, like natural gas, will be useful at that point in time. And the second thing is: did you also look at, for example, the sources of the major company that build these massive batteries to solve the storage issues related to clean energy? The sources of the material that goes into production of such batteries essentially come from very few countries around the world. And we still have a very big challenge, with storage. I think there's no storage capacity, to kind of push renewable energy to that amount to preserve baseload while still managing that the market, and the Sinai system needs. So will that affect the security of supply

dimension to this challenge, to this issue? When you consider future role of natural gas, because for example, when you have an abundant supply of natural gas, [inaudible 00:33:53] there's demand and investors are willing to invest contributions to impressing them. So then the last question will then be, it's so complex to move away like you were just saying, so to move away from this reliance on natural gas or the question of capacity markets, then shouldn't the effort of policy and regulation be focused on ensuring that the operators of natural gas utilities and the operators of the natural gas supply production facilities be responsive to what they need to do in terms of environmental costs that they have

Mike O'Boyle: [01:08:48](#)

The model... It's not a capacity expansion or sophisticated electricity dispatch model. And so, the de-carbonization of the power sector, I would not say stands for an authoritative pathway to ensure... That sort of proves the case that the power system will operate reliably at 100% clean with this resource map.

Mike O'Boyle: [01:09:18](#)

So it should not be viewed that way. It's an approximation because it's across the entire economy, and that's the role the model plays. It's demonstrative. It does have reliability requirements built into the model. But I would say, compared to say the NREL Riese model or, or WIS:dom or, or any of the other power sector, Patsy extension models, it's not nearly as sophisticated. And so, I wouldn't look at it as proving that point.

Mike O'Boyle: [01:09:54](#)

It does look at opportunity costs in the sense that different policies have a cost curve—sorry—different policies are compared in terms of their, their abatement costs of the policy.

Mike O'Boyle: [01:10:06](#)

So the cost per ton abatement. Many policies are negative, others are positive. So many efficiency policies actually have a negative

cost, meaning there's a benefit associated with producing emissions. Some of the industrial policies are quite, quite costly.

Mike O'Boyle: [01:10:22](#) So that is, that is what it is in terms of... But what it does do is allow you to, to see cross sectorial interactions in a way that's sort of user-friendly, and I think generally helpful. The other thing is that the net-zero scenario, I wouldn't call it the optimal path to get there either. It's really like, can we use policy to get there? Is a fundamental question, and it answered yes, but it's going to take extraordinary action.

Mike O'Boyle: [01:10:55](#) There are other scenarios embedded in that and you can sort of build your own where you're not testing the limit of the model so much where you know the share of renewables and other things are sort of more in line with experience and things that we've experienced before. Getting to that zero by 2050, I can't overemphasize how dramatic a shift in the economy that that will take and so modeling that 30 years in the future or longer, I think there's so much uncertainty built into that. I'm just going to

Mike O'Boyle: [01:11:24](#) In terms of sources of storage materials, I wouldn't call myself an expert in that area. There's a great episode of, I don't know if you guys listen to the Energy Transition Show podcast by a guy named Chris Nelder who works at Rocky mountain Institute. He interviewed one of the leading national experts on

Mike O'Boyle: [01:11:45](#) There's rare earth metals that are needed and are really concentrated in other countries. He seems to think there's not much of a supply constraint from like availability in the earth perspective, but it really does show you the importance of international collaboration in, in making some of these technological transformations happen economically. And, you can look at the sort of current

administration's antagonism toward China, for example, as a potential barrier to cost-effective storage supply chain procurement. So I can't remember the second question, but I'm going to defer to my panelists so I don't suck up all the oxygen.

Kim Smaczniak: [01:12:23](#)

Just to add an aspect of the materials that are crucial in order to build battery storage. And, we've been thinking about that from the impacts on communities as many of these materials are mined in places that lacked good regulatory structures or governance protections.

Kim Smaczniak: [01:12:44](#)

And so, there's a real, there's a real issue with the kind of expansion of storage that you're imagining happening globally, if there are not efforts to address protections for communities who are impacted by that massive amount of extraction. So we are looking and thinking about what is our responsibility as clean energy advocates to be thinking about what the right global responses, what is the right response from an NGO from within the US to that kind of problem. And it does pose very difficult problems where this extraction happens in a context without good rule of law or environmental protection.

Josh Robichaud: [01:13:24](#)

It's a little tangential, but on the battery and resource point, I recently came across the recycling of batteries. We have a pretty robust and well understood system for recycling lead acid batteries. So, like a car battery or something like that. Partially driven by policy that that prevents you from throwing it out. It's built around being recycled. But we have a very robust and good way to do that.

Josh Robichaud: [01:13:51](#)

When it comes to the newer technologies being lithium ion, nickel, I believe, because the very variations in chemistry, size, utility, we just don't have the same amount of have ready-to-go recycling infrastructure to be able to do that. I think it's a large opportunity that

somebody could definitely jump into. But, to think about recycling those in the same way is a little different but a large opportunity, nonetheless.

Mike O'Boyle: [01:14:15](#) Yeah. I think DOE is starting a program to like research scaling lithium ion battery recycling, just for what it's worth. They see it as a priority.

Kevin Jones: [01:14:26](#) Just one thought. One of the interesting things is where the batteries are going to come from. First really are the auto industry and you know, because the volume of batteries produced for that. So one of the exciting things actually for creating opportunity that is sometimes often anticipated is using on the electric grid the car batteries and their second life. Because once you're down to like 80% capacity, you might not want to drive them around in your car. They might not be so efficient, but they're great for grid storage.

Kevin Jones: [01:14:53](#) So, it's thought to be in one of the things that... a long along life there for that first-generation battery before we have to think about this important point cycling.

Mike O'Boyle: [01:15:01](#) Yeah and that's, I think part of what's driven the cost of storage down so much is the electric vehicle market scaling with the utility scale storage market and that is helping the industry move down the cost curve way faster than people thought. It's really exciting time. There are questions of your term.

Audience: [01:15:20](#) I think we have time for one more.

Audience: [01:15:20](#) Okay, lucky me. Hopefully lucky you.

Audience: [01:15:25](#) [laughter]

Audience: [01:15:25](#) I just want to say thanks for the interesting panel. Appreciate it. Kevin, thanks for preparing this to understand what's going on. So I know we're doing kind of policy wish list. I liked the carbon price in the wholesale market and, forgetting which classes it was we took at Vermont Law, the article we read by, I believe it was Dave Roberts, saying that \$15

per megawatt carbon price would roughly keep current nuclear plants on through the end of their licenses, and a roughly \$25 price would either extend them beyond or the intent is to buy new plants. I can't get more detailed than that, but I think that's an interesting way to deal with a natural gas issue. It's broke. We are planning for that massive capacity we do need.

Audience: [01:16:12](#)

On the other hand, I'm thinking more along the lines of shooting resources, demand response as a way to shrink that requirement that we need quite enough energy efficiency. You know a lot of people think that we've ate all the low hanging fruit, but I believe that that's not true. There's a good article by Amory Lovins—I think we're probably all familiar—about the true size of the energy efficiency resource. Recommended highly. But, I'm just, my question I guess is: what do you folks see as limitations on either energy efficiency or ERs in general, and then what is kind of the potential weight as a way to eliminate the need for that heavy peak kind of bringing down that peak quite a bit so we don't use natural gas?

Kim Smaczniak: [01:17:05](#)

I mean, I would say it's, I agree there's a huge amount of reason to be excited about the latent potential for energy efficiency, demand response, and also distributed energy resources like rooftop solar. We, we don't even really have a good solid image of how much we could do with that resource if it was fully tapped.

Kim Smaczniak: [01:17:29](#)

So just an anecdote, folks. you know ERCOT is in Texas is a market that doesn't have a capacity market, doesn't have a tight reserve. It's really on the margin, particularly in the summer when you know those peaks really happen. And, the anecdotes I've heard from people who are working and investing in that market is that they are actually, the peaks are

so high and so expensive that they have latent, what, what would be called demand response, but it isn't being paid by the market.

Kim Smaczniak: [01:17:58](#)

People who are basically saying it makes more sense for us not to run now and run somewhere else and to change how we're running in order to respond to market signals and that they have some financial arrangement that not through the market that makes it work for them to make those adjustments. Right?

Kim Smaczniak: [01:18:17](#)

And so, that's happening just because of prices out there, and nobody's actually even paying you money. Imagine if someone were going to pay you money, right, ~~to~~ to make those minor adjustments. There is so much potential with the ability to have responsive technologies in our homes, thinking about what that capability means to connect the time when you're consuming the energy versus when it should be in order to respond to needs. We have no idea of what all of the synergies could look like once all of those are brought to bear with a common direction of making sure that we don't ever get too close to the point of not having enough stuff to meet what we need.

Kim Smaczniak: [01:18:51](#)

And so, I just feel like there's... it's been discussed a lot, this idea that we could be doing more. We haven't yet even taken the rudimentary steps to start to see how they interact and then to look at what's the truly innovative stuff that could come down the line after we have a real price signal for it.

Kim Smaczniak: [01:19:05](#)

So that's my view on it. I think it's exciting. I think it takes a lot of people who are not afraid to try to think outside the box, which you don't always get in engineering land and grid operator world, but once we have the incentives aligned for that to happen, I think it's going to be fantastic.

- Mike O'Boyle: [01:19:21](#) I totally agree with you. Not surprisingly, there's a lot of agreements between us, but I would just point you to the other part of that which is that rate design is under the jurisdiction of public utility commissions for the most part and the investor-owned utilities that they regulate. And, those utilities, frankly, have a disincentive to maximizing demand side resources because they function as a resources that avoid the need for utility investment.
- Mike O'Boyle: [01:20:03](#) And, under the current cost of service model, utilities make more when they can justify investing more in physical infrastructure. And by making the system more efficient and not building more poles and wires but also power plants where there's vertical integration, these utilities really have an incentive to obfuscate and especially not to proactively adopt demand side management as a core business model, which I think is what we really need to meet some of the potential that that Kim has said.
- Mike O'Boyle: [01:20:31](#) Rate-design changes generally get proposed by utilities. An outside stakeholder has limited power, resources, ability to make those things happen. You need the utility to be motivated properly. And so, that's where I feel like this movement towards performance-based regulation is really important.
- Mike O'Boyle: [01:20:49](#) That's happening in different states, including Hawaii, New York, Minnesota—Massachusetts stuff gets mixed reviews from me—Rhode Island. But anyway, I think there's a lot of potential to find ways to compensate utilities for providing those demand side management benefits and get away from capital spending as a key shareholder value maximization proposition and instead get them more aligned towards efficiency, or else try to restructure the way that utilities can operate. I think some of these

third-party administrator models for efficiency, including in Vermont, have been quite successful as well. So we really need to think outside the box and also unlock, you know, provide new interesting price signals to customers. I think it's right on.

Kevin Jones: [01:21:42](#) Yeah. I want to just ad lib one quick announcement here while I'm here. When Mike mentioned podcasts- I want to make sure everyone is aware of the Vermont Law School Environmental Law Center's new podcast the Hot House Earth. And I keep thinking, because I look up and see the cohost, Jeannie Oliver, is an assistant professor with that energy clinic. I'd also like to offer big thanks to Smith &

Kevin Jones: [01:22:08](#) Samantha, we are so sorry you weren't able to be here with us today and thank you so much for your commitment to VLS, and I don't think you could have put together a better panel and more effectively covered all of these complex and interesting issues. So, thank you all.

#### PANEL TWO: CHALLENGES & OPPORTUNITIES FOR GRID SCALE SOLAR DEVELOPMENT

Zoë Gamble Hanes: [01:22:22](#) And now we're ready for panel number two.

Zoë Gamble Hanes: [01:22:28](#) Yay. So can y'all hear me? I can't tell what this thing. Is it on? All right, my name is Zoe Gamble Haynes and I am a graduate of [inaudible]. I was there that first year that Michael Dworkin came and taught energy law. I think I took the first energy law class at Vermont Law School.

Zoë Gamble Hanes: [01:22:53](#) And my background is that I moved to North Carolina following law school. I took whatever job I could get, which was doing affordable housing tax credit work, and I hated it. I cried every single day at my desk. I was just saying to a new lawyer over here that I questioned the intelligence of going to law

school, and my managing lawyer would throw documents in my face. He would forward emails with 10,000 question marks in front of them, and I learned how to do something really boring called tax equity.

Zoë Gamble Hanes: [01:23:35](#) And when North Carolina became the epicenter for at the beginning of a huge solar boom, I was the only young, stupid enough person to charge \$180 an hour—I think was my billable rate then—to represent a bunch of solar startups because I knew tax equity.

Zoë Gamble Hanes: [01:23:56](#) And that put me in a really unique position. I got to work with virtually every solar developer and landfill gas developer that came to the state early on and then ultimately was recruited to become general counsel for FLS energy, which was a solar company that ultimately sold the Cypress Creek, which at one point in time was the largest solar company. At that time it was.

Zoë Gamble Hanes: [01:24:21](#) There's often a churn in this industry. We call it the solar coaster for those of you not in the solar industry. We call it the solar coaster. And then I was the CEO of another solar company called Time Dating Renewables. So I had sort of a business hat and a lawyer hat. And I give you all that context because what I want to say is that... then I left about a year ago and came back into private practice. I'm now at Nelson Mullins, which is a larger firm in the Southeast.

Zoë Gamble Hanes: [01:24:53](#) And I'm giving you that context because the solar industry is something that is really unique in this point in time in our history. It has incredibly low barriers to entry, relative to natural gas. And so you have this influx of an entrepreneurial spirit and people who have been willing to take pretty significant risks for a reward.

Zoë Gamble Hanes: [01:25:20](#) It's also mission-driven, and so it attracts a lot of young talents to the industry. And ultimately, that scrappiness has prevailed.

And so you have seen this huge growth in solar in ways that nobody imagined possible. Even 10 years ago when I started in this industry. If you had told me then at that time I would end up installing utility scale solar... when I joined this other company, it was around \$7 a watt. It's now regularly being installed at sub-80 cents a watt. In 10 years. There's a lot of factors for that. But fundamentally what makes a utility scale solar project work, is it as a financeable revenue stream.

Zoë Gamble Hanes: [01:26:11](#) And so, that is the framework that we're going to have this discussion about. What is it that makes, what are the legal issues, what are the regulatory issues, what are the policy concerns that are going to get more solar built?

Zoë Gamble Hanes: [01:26:26](#) And, at the end of the day, what makes solar get built is having a financeable revenue stream. And so, when you think about that... I said we have a developer who- I'm going to let everybody introduce themselves.

Zoë Gamble Hanes: [01:26:40](#) So, and then everyone will take three to five minutes and just some stuff in what you're doing. But the context, we're going to talk about the development as a developer. What are some legal challenges that pop up as it relates to zoning or siting or what does it take to actually land and secure a revenue stream?

Zoë Gamble Hanes: [01:26:57](#) And then we have break out the other major policy drivers in regulated and deregulated states. Okay? We're going to talk about regulated dates and how that factors into also the ITC, and we will talk about deregulated state. That's the framework for our conversation. You guys want to start, Jonathan, and introduce yourself? Yeah, and where he came from, how you came to be here. What's your astrological sign?

Jonathan Willson: [01:27:27](#) I'm Jonathan Wilson. I did the energy clinic. I was a master's in energy regulation and law

student a number of years ago at Vermont Law School. After leaving the clinic and joining the working world, I worked for a very short time in energy efficiency consulting before being recruited into a small entrepreneurial, scrappy develop-and-flip solar shop, that was the first solar company in New England to do true utility scale wholesale-market-participating solar assets.

Jonathan Willson: [01:28:01](#) That was Ranger Solar. Ranger Solar was acquired within 18 months of me joining the firm by NextEra Energy Resources after we kind of demolished a tri-state clean energy RFP to deliver power to the large utilities in Massachusetts, Connecticut and Rhode Island. We took about 80% of the awards. No wind was selected, which was a very... it was a strong market signal.

Jonathan Willson: [01:28:32](#) We were acquired by NextEra Energy Resources within pretty much weeks of that announcement where I then joined their utility scale solar development office, doing projects in PJM and ISO New England at all stages of development, from greenfield through advanced state level permitting.

Jonathan Willson: [01:28:53](#) I now work at Capital Power, which is a Canadian IPP that owns mostly thermal assets but also wind and is growing into the utility scale solar market. I do mergers and acquisitions activities there for them. Managing all renewable acquisitions in the United States and then doing wind development as well.

Jonathan Willson: [01:29:15](#) That's me.

Katherine Gensler: [01:29:18](#) Hello, I'm Catherine Gensler. I'm the vice president of regulatory affairs at the nation's only solar-trade association that represents companies all across the US of the solar energy industries association. I unfortunately have no connection to Vermont Law Schools. I am honored to be here anyway. Yeah, Zoe asked me to, so I showed up. But, your

description of the solar industry is really accurate and tracks mine pretty hardily.

Katherine Gensler: [01:29:50](#) I have a policy degree, my master's degree from the School of Public and Environmental Affairs at Indiana University. A program that probably many of you looked at when you were considering where to do your grad school. And after graduating I came to DC and I took a job at the Federal Energy Regulatory Commission specifically so I could work on federal energy policy. Lo and behold, those are the people who do the most of it.

Katherine Gensler: [01:30:14](#) Do not be fooled. The Department of Energy makes almost no federal energy policies, that is not their role. But then, I got a wild hair and I left my safe, secure government job in order to join a scrappy, little, I call it nearly still-in-the-garage stage of this trade association, which had been around since 1974.

Katherine Gensler: [01:30:38](#) But when I joined, there were eight employees and I think half of the people on our membership list didn't actually check their emails. So, since then we have certainly emerged into what is the powerhouse that we are today. We've got 50 employees, we cover states, we cover federal, and our membership lists is a thousand companies. And most of those people do actually respond to their email and send the membership check when it's due. So that's the most important part.

Katherine Gensler: [01:31:10](#) Most of my work has been with utility scale developers working through issues created at FERC, the Bureau of Land Management, sort of in the siting and permitting world. I learned a lot about species that I never wanted to and have done tons and tons of work in the last four years on PURPA. Raise your hand if you know what that acronym means. Yep. That is more than usual. If you have read any news coverage in the last six months about PURPA, you have probably seen a quote from me in

there. I am on the phone all the time, which is great.

Katherine Gensler: [01:31:46](#) But, I look forward to the rest of our conversation and turn it over to Steve.

Zoë Gamble Hanes: [01:31:52](#) Yeah. And just to underline that point about PURPA and as it relates regulated market for those of you that don't know, you may not know is that when we talk about regulated and deregulated markets where markets have opted to deregulate, PURPA is not as applicable. But what PURPA allows is it forces utilities to purchase power from renewable resources that are less than 80 megawatts in size in the states where they have not been deregulated. And so, that was the mechanism which grew North Carolina in a regulated market to become the second largest salt state in the country.

Stephen Shparber: [01:32:30](#) Thank you for having me here. My name's Steve Barber. I work with Zoe also at, Nelson Mullins. I'm in the DC office, Zoe's in Charlotte. So I just, a little of my background, so I'm an attorney and my path here, it's actually been really rewarding because when I was in law school, I graduated law school 2010, and I really after about my first year wanting to get into the renewable energy field.

Stephen Shparber: [01:32:56](#) So I went to law school in New York and you know, it was like, you know what, I'm going to go do project finance. And they fortunately did well my first year and was doing all your normal 2L with the interviews with law firms. And if you get a little bit by dating of when I graduated, that means my 2L law firm interviews was the fall of 2008, so I was going to interview with law firms the week Lehman Brothers filed for bankruptcy.

Stephen Shparber: [01:33:20](#) So all of a sudden all that transactional stuff that I thought I would be doing and doing all these wind deals, etc. Those offers, were no more. However, I had a professor who told me about a little regulatory agency called the

Federal Energy Regulatory Commission and said you should go try out here. They do all these things in the energy space. And I was like, sure, I need a job.

Stephen Shparber: [01:33:40](#) So true story, went to New York Law School, went to NYU undergrad when they were reading my application, thought I went to NYU law school, which is a better ranked school and that's how I got the original interview. And then I, then I crushed the interview after that after that was new. But that's how I got through the stack back in the fall of 2008 is they misread my application. So I'll take it. Sometimes better to be lucky than good for all you law students out here.

Stephen Shparber: [01:34:08](#) But anyway, I went there during my 2L year and then wound up actually going out there afterwards. Started my career at FERC and really was a FERC attorney, and still am, a two-year forum out of law school at FERC. Went to a law firm in DC.

Stephen Shparber: [01:34:25](#) I think the reason I'm here that I have been spent four years in house at PJM. PJM is the largest wholesale market in the country. I was the Lead Markets Attorney, learned a ton about how the wholesale markets operate. And about two years ago I was looking for an opportunity to move to, I wasn't thinking about going to a law firm, I just got my MBA at night thought I was going to do more of an early kind of work at a growth stage company cause I was there and I said look, there are all these opportunities but in the wholesale market swap, renewables aren't really understanding them and not taking advantage of them.

Stephen Shparber: [01:34:57](#) And I met our boss, Larry Austin, who's down in the Charlotte office, and he said, yeah, well, we have a bunch of solar clients that are working in this space, in storage companies, etc. Why you come and do this outside counsel?

- Stephen Shparber: [01:35:08](#) And I was like, well I have all these crazy ideas, will you let me do them? They said, sure. I said, okay, well I'll, I'll take the job. And I also had to move from Philadelphia to DC cause my wife got a job around the same time. So that's how I've been in Nelson Mullins. So I've been there for about two years now. And what's really cool is that I've been able to build my practice where I'm now outside counsel to some of the major renewable energy trade groups, American Wind Energy Association and Solar Energy Industry Association. And I helped them allow the FERC and the RTO work, regional transmission organization, the deregulated markets, and have the privilege of doing that.
- Stephen Shparber: [01:35:44](#) So somewhat earlier, it's cool because now basically I get paid to say all the things I was saying in house at PJM when people weren't always listening to me and now I get to write it and do that, which is great.
- Zoë Gamble Hanes: [01:35:56](#) And then also do people listen to you now?
- Stephen Shparber: [01:35:59](#) Now? Hopefully, yes, you do for the most part, which is good.
- Zoë Gamble Hanes: [01:36:02](#) No. I mean the PJM people.
- Stephen Shparber: [01:36:04](#) They're doing better. They're getting, they're getting there. It's a good process. I'll tell you, I think it's the RTO world and the people that will listen to you more than in the regulated markets in the utility world, so we can get into that a little bit. And then also, on top of that, I do it with deal with a decent amount of transactional work as well and because, as we'll talk about, a lot of the central financial cashflow streams and all of that, the regulatory changes, the policy, and the markets is what drives the revenue opportunities to use a business. You know, we're not selling widgets, we're not selling Coca-Cola. The regulatory regime you're in, the market that you're in, will determine whether you have financial cash flows or not.

So it's been cool, it's fun, It's been great to work with Zoe and thank you for having me here.

Zoë Gamble Hanes: [01:36:52](#) Just to get a quick temperature check. I think most people in the room know NRG but, but if we started talking about RTO, PJM everyone, if everyone, I don't want to over or under [inaudible] about this issue. We can get super into the weeds.

Zoë Gamble Hanes: [01:37:10](#) Raise your hand if you have never heard of the word RTO. Okay good. So we are trying to level set for it. All right, so John if you could give me where are you guys primarily developing and what are the issues that you're facing, what informs your strategy for where you're going to pursue project development, and what have been the biggest issues you've been facing?

Jonathan Willson: [01:37:44](#) Sure. Capital Power is a very new to the utility scale solar industry, especially here in the United States. And so we, over the past few months have been kind of developing our key target markets and investments strategy here in the United States, buttressed by a \$10 to \$20 million Safe-Harbor Investment that we are using to build out a couple hundred megawatts between now and 2023.

Jonathan Willson: [01:38:14](#) We are a large owner of thermal generation. In the United States, we own two large natural gas combined cycle plants, one serving Arizona public service, APS, outside of Phoenix and the other in Decatur, Alabama serving TVA. And so what we've tried to do is think about our experience in the wind industry over the past five to 10 years. How do we, how do we see the wholesale markets developing? Where do we feel that we are strongest and how do we leverage our existing capabilities and assets to grow our portfolio?

Jonathan Willson: [01:38:48](#) For us, that's led us specifically to markets that are a little harder to develop in than a lot of other developers are willing to go into

places like TVA, places that are bilateral in nature and they don't have liquid off-take. There's not a lot of companies that you can go to for origination. You really need to be able to leverage your relationships and develop a good product that has a very high likelihood of re contracting.

Jonathan Willson: [01:39:16](#) Since your merchant curve in an unorganized market and a regulated market is much harder to forecast. And so that's what we have primarily focused on. On the deregulated side, in wholesale markets, we really like MISO, their supply and demand outlook as well as PJM just because of its size. Primarily, when we look at a market, we look at what is our LCOE for our solar project moving into the future, what are the reserve margins look like?

Jonathan Willson: [01:39:50](#) What is our competitor analysis? We're really targeting the same exact market as wind and so if we think we have a competitive project that can compete toe-to-toe with wind, then we will lean towards solar in certain markets.

Jonathan Willson: [01:40:04](#) And so that's what led us, in Southern MISO and central MISO, to move more first solar as the PTC expires. PJM is a much tougher nut to crack. It's really a number of wholesale markets and geographic areas and resources all kind of crammed together. And so we have to really hone down into the details in a market like a PJM to say, what is my specific value to my customers in this specific location on the grid and how do I compete against the nine other gigawatts that are currently queued up, just in solar, in PJM, right now? There's a couple of gigawatts queued up in Ohio, so why do I need to be there is always a question that we look for. Liquid off-take or strong re contracting.

Zoë Gamble Hanes: [01:40:47](#) I heard three issues I'm going to tease out a little bit.

Zoë Gamble Hanes: [01:40:50](#) The first one is that when you're operating at regulated market or simply that you're going

in and striking a bilateral agreement with a utility like TVA or Georgia. When you're looking at your merchant curves, are you relying on PURPA as you're back stop for the merchant pricing and if so, how is that being received in the market, and has there been any issues with the recent filing? Have you gotten any questions about the viability?

Jonathan Willson: [01:41:26](#) We run PURPA as a sensitivity, but at this point if we had an initial 15 to 20-year contract signed for solar, we don't know what PURPA's going to look like at that time. What we try to assume in our re-contracting is what are the avoided costs that they're going to be facing, what do we expect natural gas is going to be in this market, and at what price can we re-contract and still meet our investment hurdles?

Zoë Gamble Hanes: [01:41:53](#) And that's really a recontract. You're not using a baseline.

Jonathan Willson: [01:41:56](#) We, we run kind of, it's like a blended approach.

Jonathan Willson: [01:42:00](#) If we had to go really worst cases, PURPA, re-contracting or what is the chance that these guys join a wholesale market? It's typically how we do it.

Zoë Gamble Hanes: [01:42:11](#) To tease it out further, the same life of a solar asset is somewhere around 40 years, 35 to 40 years. I'm going to use 40 as an outlier per se.

Jonathan Willson: [01:42:21](#) 35 is financeable.

Zoë Gamble Hanes: [01:42:23](#) We'll say 35 to 40. And the contract terms have been driven down over the past 10 years pretty precipitously. Where you used to be able to get a contract for 30 years that are now 15, 10 sometimes even five. And so, the PPA term is 15 years. You're having to put in a set of assumptions for the balance, because the first capitalized costs are basically taking up the entirety of the contract and term is paying down the cost of capital. Those assumptions on a post merchant tale are...

- Jonathan Willson: [01:42:58](#) Yes, those assumptions, they really swing value. I think they swing it even more in a deregulated market. Somewhere like an ERCOT or a MISO, at this point, over 60% of your net present value associated with your asset is coming in a merchant curve. You're really only taking on the contract if you have investment grade metrics which you need to meet, like we do as an independent power producer, or to please tax equity. You need a certain, at least seven years, preferably more than 10, to fully capture and finance your solar tax equity investment. As those trend shorter, the merchant tale becomes more important and then you get into a lot of crystal ball around carbon pricing assumptions, avoided costs of gas, all of those things. So it's pretty much a crap shoot after your contract period, no matter what market you're in.
- Jonathan Willson: [01:43:57](#) We kind of like the bilateral nature of regulated markets or a place like TVA, since they have shown a propensity to sign longer contracts still. You can still get a 20-year Busbar PPA with TVA. Comes with some strings attached, but it's still possible. And less of your NPV is left in that un-contracted period at this point. Now, PURPA deals have gotten extreme, where the PURPA rates are so low that very little NPV is coming during the contract period, and a lot of it is left out in the re-contracting period. And so, we typically avoid, as an MNA manager, I avoid projects with PURPA contracts that weren't signed really consensually. There was no real bilateral negotiations, or in markets where we don't feel that's a differentiated product in North Carolina or South Carolina. Oregon is another example of markets where a lot of PURPA contracts have been signed that there's lot of re-contracting risks at this point.
- Zoë Gamble Hanes: [01:44:55](#) So the other—and Katherine I'll let you speak too; I will reserve some of this for you—but I

heard if you're talking about live cost of energy width and the effect in your view, how do you project ITC, ITC extension doing calculus of whether it makes sense to safe harbor panels?

Jonathan Willson: [01:45:12](#) We think a Safe Harbor is kind of pay to play at this point. If you want to participate in the US solar market in 2022, you better have a balance sheet or close relationship with somebody who does have a balance sheet. There's a clear delineation. As soon as the ITC starts dropping off with investments next year, that initial 4% drop in the ITC, we anticipate a \$5 to \$7 per megawatt hour hit on PPA pricing or on sponsor equity returns. Sponsor equity returns right now are minimal. At this point, it's better to buy back shares than to do a solar deal, unless you believe you're actually getting scale. So we anticipate if you're not investing in Safe Harbor materials this year, you're not competitive in three years. Unless there's an extension, I guess.

Katherine Gensler: [01:46:11](#) Yeah. Can I?

Zoë Gamble Hanes: [01:46:13](#) Yeah. Come on.

Katherine Gensler: [01:46:14](#) All right, so here's what an extension looks like.. Oops wrong slide. I'm sure we had some pretty charts for you all.

Zoë Gamble Hanes: [01:46:22](#) And just like my pause for a plug for CS?

Katherine Gensler: [01:46:26](#) Absolutely.

Zoë Gamble Hanes: [01:46:27](#) So allow me to speak on probably the single most important industry association as it relates to lobbying efforts and has worked tirelessly on really important issues around the tariff and IBC extension and has managed to balance a lot of competing interests between residential and utility scale solar in a way that really works for the industry. In addition to that, it has been active for this event at a statewide level becoming more and more active.

Zoë Gamble Hanes: [01:47:00](#) We just recently had an industry-wide policy meeting where the issues were highlighted that would be the most important. I thought that you might touch on that because that was presented at the Industry Trade Conference that happens every year.

Katherine Gensler: [01:47:19](#) Yep.

Zoë Gamble Hanes: [01:47:20](#) All right. Go ahead.

Katherine Gensler: [01:47:21](#) Okay, so we'll start with the IDC and then take it back to the big picture view. SEIA working right now to secure an extension of the investment tax credit. As the conversation has shifted this year, it is no longer the solar investment tax credits. We got our friends from the Wind Association onboard as well. So now I believe it's being referred to as a renewable energy tax credit, which would shift that structure. The PTC and put wind as an eligible technology in section 48 for the ITC.

Katherine Gensler: [01:47:56](#) That's the goal. But on the solar side, this has been, by far, the most successful federal policy in terms of spurring investment in the solar industry, deploying solar megawatts, putting solar workers on the job. And we're all happy to talk about it these days, reducing greenhouse gas emissions. And so, our push, in advance of any of these step downs, is to try to secure an extension this year. Obviously, we've got two more years to go. We will make the most use of them if we have to.

Katherine Gensler: [01:48:33](#) But this chart up here shows what all our modeling and would Mackenzie have modeled as far as what the economic benefits are and the climate impact of extending the ITC. I believe this model is for a five-year extension, so it moves everything. It moves the ramp downs out five years. It moves the 30% along for the next five years. So we're talking about 82 gigawatts of additional solar

deployment above what we would expect to see as the baseline scenario.

Katherine Gensler: [01:49:06](#) 113,000 jobs. We've got about 250,000 folks in the solar industry right now. We expect that to grow, of course, with that baseline growth scenario. But the ITC in and of itself can bring us another a hundred thousand jobs, \$87 billion of additional investment. That's pocket change for Wells Fargo maybe, but important to us. And then 363 million tons of CO2 emissions offset. So yes, go ahead.

Audience: [01:49:41](#) What are the chances?

Katherine Gensler: [01:49:43](#) Our chances are great. Who has a crystal ball? That's the real problem here. Right? We have bipartisan support. We have eight Republican co-sponsors in the house. We have not sweet talked somebody in the Senate to putting their name on the bill yet, but we've had lots of good behind the scenes conversations. So we're still waiting for tipping over into that public sphere.

Katherine Gensler: [01:50:07](#) There is an understanding of the urgency both from the climate imperative as well as from the investment imperative. People need to be able to make business plans. Jonathan has already had to talk his bosses into spending money this year in case we don't get an extension. So, knowing that regulatory certainty drives investment decisions and drives employment actually really resonates with policymakers who like to keep their constituents employed. So, it is always, we are subject to the whims of the big picture stuff that is going on in Washington. But we have always had bipartisan support and even going back to when the investment tax credit was first put in place at that 30% level, that was Epact 05. But those of you who are still in school then, let me remind you, we had a Republican president and a Republican controlled Senate. That was a bipartisan piece of legislation at the beginning. When we got

the passage of the eight-year extension in 2008, that too was signed by a Republican president.

Katherine Gensler: [01:51:20](#) We had strong bipartisan support, particularly in the Senate with our friends from California and Nevada and Washington. They really worked to make sure that went through. I feel very badly for Lehman Brothers and all of their investors and employees. But you know what? We wrote along with that bill. It was the most chaotic legislating time I've seen in D.C. was that fall of 2008 era. And that was when, after three years of action, we finally got a long-term extension of the investment tax credit passed.

Katherine Gensler: [01:51:55](#) So, we have continued since then to build up credibility, political capital at a whole lot more friends on the Hill. Partly our lobbying efforts have increased, our member companies, those people who now answer the phones, they come to DC. They do lobby days. Zoe, you've been up here. I know your colleagues have too. We make sure that the legislators are hearing from people in their district and in DC about the jobs and the economic value that solar brings to their region. Yeah.

Audience: [01:52:31](#) So this is the extension served generally... [inaudible 01:53:33].

Katherine Gensler: [01:52:31](#) Mm-hmm (affirmative).

Audience: [01:52:31](#) What is the-

Katherine Gensler: [01:52:37](#) So that's, again, kind of the push to the end of the ITC. That's like the five-year curve that gets shifted.

Audience: [01:52:44](#) Got it.

Katherine Gensler: [01:52:45](#) Yes. So we will always sort of see investment decisions coming forward into that window.

Katherine Gensler: [01:52:55](#) Yep.

Katherine Gensler: [01:52:55](#) Before the policy is threatened with disappearing again.

Katherine Gensler: [01:53:01](#) Does anyone else want... [inaudible 01:53:05]

Zoë Gamble Hanes: [01:53:08](#) Thank you for that reminder. And I intentionally want it to be a free discussion. This is great. I don't doubt the heads band not necessarily reserving questions. I want to tie something that you're saying that I'm remembering the last go around. Because there was this extension in 2016. Right?

Katherine Gensler: [01:53:27](#) 2015.

Zoë Gamble Hanes: [01:53:29](#) December of 2015.

Katherine Gensler: [01:53:30](#) Exactly.

Zoë Gamble Hanes: [01:53:30](#) And I the conversation about balance sheets, Jonathan, was a very familiar conversation from that time. And it also ties into your comment about interconnection because there had been a dip in development assets as a result of the brake that people put on developing projects when we thought the ITP was going to expire. And because the interconnection timeline has so lengthened, it created the situation in the marketplace where there was more money than there is project. And so, I think one of the important... I'd highlight back is that I think it really ties into what you were saying about PJM and interconnection queue. And if you don't have balance sheet in 2022, like I'm really highlighting and underlining, it's not just about decision making in the near term. It really has a ripple-out effect. Yeah.

Jonathan Willson: [01:54:30](#) Yeah. And the comments on that further, I think the wind industry is a very good example of the boom bust. I don't know if the solar coaster makes sense. If you want to see an extreme version of that chart, you should look at the expected wind build in 2020. And then it completely hit the floor after that. So we expect some build in 2021, and then it falls pretty much off a cliff after that in most markets.

Jonathan Willson: [01:54:55](#) Something that you can see around that and going back to the balance sheet is there's about 20 functional wind companies in the

United States, at this point, with any level of development capabilities. The industry is pretty much coalesced around those top 20 owner operators and the 10 or so that have strong development factions behind them. Solar right now has more like 50 scaled competent teams and about five that are independent without a parent company at this point.

Jonathan Willson: [01:55:27](#) Including Fine Gate, actually. But there's dramatic consolidation coming within the solar industry to make it look a lot more like the wind industry, especially with that slow ramp down in the absolute flood of money at this point. And so, a lot of the develop and flip shops that have been out there capitalizing on declining costs and ITC extensions are slowly diminishing, I would say, or getting purchased, is really the thing. It's not like they're going out of business. They're getting eaten up by other larger companies. And so that consolidation is going to be a trend for us to watch, I would say over the next few years.

Katherine Gensler: [01:56:06](#) Yeah, and to underscore Jonathan's point, in the 25 to 30-year history of the wind PTC, there have been times that the production tax credit expired. And you can absolutely track on a graph, just the catastrophic decline for a year or 18 months while Congress gets its stuff figured out. And then, they'll put the policy back in place retroactively, but you can't retroactively invest in something. So that has actually been unfortunately convenient for us in order to explain to policy makers why we always need... We can't be looking at the deadline as December 31st, 2021. We're having these conversations now because we need to make investment decisions now for the future and avoid those catastrophic declines that we have seen from other industries.

Zoë Gamble Hanes: [01:57:03](#) I'm just going to let you continue.

Katherine Gensler: [01:57:05](#) Sure. Yeah. Let's back up a little bit to the big picture. Part of the role of the trade association is fundamentally to support the growth of the industry, to advocate on their behalf. Steve knows very well. Sometimes we put our name on a filing, take the barbs and arrows because individual companies don't want to have to do that. Right? There's some reputational risk, particularly if you're going to call out her friends, I don't know, PacifiCorp or something, for being bad actors. We do that because we're not trying to sign a contract with them. Some of our member companies are. So the other important things that we do is really provide leadership. Thought leadership. Where is the industry headed? And then our job, once we've set that vision, is on the implementation front to really get to work smoothing the path.

Katherine Gensler: [01:57:59](#) How do we make it easier for everybody to get their job done? And, that just means we can drive the investment cycle to a shorter and shorter window.

Katherine Gensler: [01:58:11](#) So, one of the things that SEIA did this year is we got all of our smart people in a room, member companies, nonmembers, a lot of the CEOs, people who are making big picture plans. And we talked about what needs to happen for the next decade. We've decided it's the solar-plus decade. Fossil is absolutely going to continue its tremendous growth and be a major part of our energy picture in the United States. So, we have attempted to identify these four areas that we are going to be working in. We put out this giant report. You can read it. It's available on our website.

Katherine Gensler: [01:58:53](#) But, the roadmap for the solar-plus decade really focuses on: a breadth of collaboration, market accelerators, market levers and policy drivers, and then managing growth of the industry so that we don't get too far out ahead of our skis. And key to this whole roadmap is

that we want solar to provide 20% of electricity by 2030. Right now, we're at 2.6%. So, we're talking about eight and a half, nine X. What this means is the growth chart you see here. Now, when I started in the solar industry with the beginning of 2008, which doesn't even make it onto this chart anymore. Then, our annual installations that year were 354 megawatts.

Katherine Gensler: [01:59:45](#) We counted every rooftop system we could find, four and five kilowatts at a time. As you can see, by the end of the decade we're going to need to do pushing 80 gigawatts in a year. We already today install more than 354 megawatts on a daily basis. That compares to our 2008 annual total.

Katherine Gensler: [02:00:16](#) What I think about every day, in smoothing the path, is what are all of the pieces that go into getting a utility-scale solar power plant online and operational? It starts with siting and permitting and the interconnection queue, and then the contracting challenges and how do you attract financing. And then, when you actually build your project, you have to play by all of the market rules, whether that's in your bilateral contract or it within your RTO market. And then we've got operational challenges or just things to keep your eye on like cyber security, which you'll hear more about on the next panel, and the physical assets. I know you guys talked about PV recycling earlier today. Like those long-term issues that also happen at the very beginning when you're getting your approval to cite something. So, these are all of the pieces that we are thinking about. How do we make each step of the process faster and easier for our members? What policies need to change in order to deliver 78 gigawatts in 2030? Who wants to join me?

Zoë Gamble Hanes: [02:01:32](#) No, I mean I think that, and again, I think you did a good job of laying out each of the

different pieces of the policy concerns and regulatory and legal framework. Just as a side note, and Steve, I'd like you to give us your conversation.

Zoë Gamble Hanes: [02:01:48](#) I remember there was a time when a lawyer could dabble in each of those areas. Right? A lawyer could do-

Katherine Gensler: [02:01:53](#) Well you had to 'cause there was only one of you.

Zoë Gamble Hanes: [02:01:55](#) Yeah. There would be development related issues. Then there was also quickly reviewing your power purchase agreements. And there was doing all of your acquisition. If you were buying a project. Now, lawyers really are specialized in each of these different domains. And I think it's another example within the industry of how, as the industry grows, even within the service providers, there's going to be deeper and deeper specialization within a particular serving particular industry, which you have capitalized on tremendously. I mean I remember as a solar company being asked by you to join this coalition of solar just three years ago. The idea of really participating within market as a solar company was like a someday, maybe conversation. That you could not raise capital around that couldn't go to a bank and get a loan for merchant solar.

Zoë Gamble Hanes: [02:02:54](#) And since then one being driven by corporate buyers, but also the issues with PURPA that I want to come back to that have made it almost impossible to develop projects within PURPA markets. You really saw that, y<sup>o</sup>u really had a vision for that, and I just want you to speak to that because that was something nobody else was doing at the time.

Stephen Shparber: [02:03:21](#) Yeah. And thanks. I think it was just, I saw it from the other side being in the market side. So, let me give a little more background on what we're talking about. So, if you look at this map... Thanks for putting it up, If you look at this map here.

- Stephen Shparber: [02:03:35](#) Oh. There's no laser pointer? No. Okay. I'll just talk and point. Anyways.
- Zoë Gamble Hanes: [02:03:41](#) Yeah. The red button.
- Stephen Shparber: [02:03:45](#) Thanks. Okay.
- Stephen Shparber: [02:03:45](#) So, here's the map of the US. The shaded areas are the deregulated markets. The non-shaded areas are the regulated market. And then the way this is there, ~~to be~~ the orange are the projects under development. Yellow are what's already in the ground. So, the solar industry, when costs were high, you needed some form of regulatory way to go and be cost effective. Regulatory means to be cost competitive.
- Stephen Shparber: [02:04:22](#) So, a lot of the solar development that happened in the Southeast, in North Carolina, which Zoe was instrumental in helping to effectuate, really developed under PURPA in a regulated framework. And basically, what PURPA does—not to take too much of your thunder, Catherine—it was passed in 1978, and it opened up competition for the first time in the US power sector. And it mandates utilities to actually purchase power from certain types of facilities, renewable energy and solar being one of them. But basically, a regulated mandate that both forces the utilities in certain instances to purchase power. And if you see here, especially the yellow, a lot of what is driven in the Southeast was all around, especially in North Carolina is all PURPA, and also California as well.
- Stephen Shparber: [02:05:05](#) There are other important issues like tax incentives, things of that nature. But at the end of the day, the reason why it's not about the market's very important is because legally, you may not be able to actually sell to anybody. Or it may be very hard to actually get a get an off taker. So, in the regulated markets, that really is what drove the development of solar, especially the last decade or so.

Zoë Gamble Hanes: [02:05:29](#) And can I just interject? For those of you who don't know, the reason why is that in North Carolina—every state can interpret and implement PURPA for its own state—and the North Carolina utilities commission mandated that that utilities, BiPAP or anything that was under five megawatts AC inside with a 15-year term, and every two years, the price reset. So, it was essentially a requirement to buy in a non-negotiated contract that was at a set price that everyone knew. And so, the only barrier to doing your assistant bill was signing interconnection and ultimately financing, and in North Carolina there was a state tax credit and that became useful.

Jonathan Willson: [02:06:18](#) And you guys have the state tax credit in addition to the federal tax credits.

Zoë Gamble Hanes: [02:06:22](#) Yeah. And I think it's important because also that really worked to drive down costs.

Stephen Shparber: [02:06:29](#) And Zoe's is one of the main people of company that actually helped with that.

Zoë Gamble Hanes: [02:06:33](#) So thank you. Continue.

Stephen Shparber: [02:06:36](#) Oh. Question. Oh sorry.

Audience: [02:06:42](#) My question is about the power prices in North Carolina. I mean, I guess the state tax credit could help, but my understanding on PURPA is it avoided cost. And usually that's not high enough. I mean, it depends on where you are, basically.

Stephen Shparber: [02:06:58](#) So great transition to what the next thing I was talking about. So yes, over time avoided costs go down. And as, Jonathan, you were talking about earlier, if that's why, especially now it's tougher to get it contract. Ten years ago, avoided costs were also higher in North Carolina. That was just a function of the market at the time. As more just resources come on, not just solar, but in general, the avoided costs tend to go down. So, and that's also just any place that you have in the US, where there's more supply and demand and

more supply, prices go down. Same in wholesale markets, but especially in when the only calculation is avoided costs, the same thing happens. But now actually in North Carolina, there's been less development candidly. I was at PJM for 2014 to 2017, and I kind of saw this from the inside. I keep a breath of what was going on in the industry and saw what was happening.

Stephen Shparber: [02:07:48](#) But I also said, well look, the RTOs, first of all, it's two thirds of the country. And second of all, costs for solar and wind are coming down, and there are all these other potential revenue opportunities and just things that they're not taking into account, in terms of how prices are formed, in terms of how do you value the storage, how do you value ancillary services? These are all incremental energy, incremental revenue opportunities that a lot of renewable just companies, the people I came in touch with the PJM, just really weren't taking into account. And I talked with a lot of them just in the course of my job with PJM. So, I kind of put two and two together in my head and said, well wait a second, it's going to be really more important for the renewable energy if they want to grow sustainably going forward.

Stephen Shparber: [02:08:33](#) But they say it more in the RTOs. And like I think I said earlier, I thought I was going to go to a growth-stage company, a solar developer or something like that, and go in there. And with all due respect to solar, I think it was like about a year or two too early, because I talked to a few of them. They're like: what are you talking about? But, then I said well I'll do it as outside counsel.

Stephen Shparber: [02:08:51](#) So essentially what I did and what we did at Nelson Mullins was we started with our initial—and I talked to Catherine as well with DIA support, certainly—we had a group of companies that were interested in being the

first movers in 2018, to participate in the wholesale market. What I mean by that is to stay in the stakeholder process, be more abreast of what's going on with FERC.

Stephen Shparber: [02:09:13](#) Not so much even for merchant plans, but just to understand what was going, because RTOs, we've been talking about the markets. But, they're responsible for the interconnection process. They're responsible for transmission planning, which by the way, the biggest unknown is what your network upgrade costs are going to be. So, RTOs in the stakeholder process that happened, ~~to~~ they're entirely responsible for that. And I think as they were talking about the last panel, the of the capacity market design and seeing what revenues you're eligible for and not eligible for, that's all done at the RTO stakeholder level, and it's very important. And if you look at also where a lot of the red is, it's coming more and more in the RTOs. Texas is a huge market. There's a ton in Virginia and Cal ISO, SPP as well. Which SEIA is very focused on along with BJM.

Stephen Shparber: [02:10:02](#) And so more and more, especially as projects get larger, t as costs for solar panels are becoming more cost competitive with other resource types, wind, but also, just natural gas, and obviously coal. Being able to compete in an equal playing field in the RTO is important. The problem with the RTOs, and I use this analogy. And it's prevalent in the regulated markets as well. So, the whole power system and all the markets were set up about 20 some odd years ago roughly. That's when the RTOs is really came into fruition in the late 90s and early 2000s. But, there were set up with a paradigm of large central generation. And the market rules in the operation, and the planning protocols were all set up in a certain paradigm and in mind. And

it's like we're going from analog to digital, and renewable energy.

Stephen Shparber: [02:10:55](#) And renewable energy, and when you talk about storage and things of that nature, they look different, they operate different, their costs are different, they're output is more variable, they're financed differently because you don't have spark spread to worry about like you have natural gas, which is another financing opportunity. You have all your fixed costs up front. There's basically zero variable cost going forward.

Stephen Shparber: [02:11:21](#) So, the way that the market rules are set up and the planning protocols and the operations are set up in RTOs directly impact the value streams that are potentially available for you as a solar developer. And it's great that's happening in relatively short period of time. I think the solar industry has woken up to that fact. SEIA, as an industry trade group, has started to get more involved. Which is great because the numbers are... By the way, I had a much easier job than Catherine, because I just did five to 10 clients to work about.

Stephen Shparber: [02:11:57](#) They're like, yeah let's go and chip in on this. You have over a thousand. So, the only reason that, in 2018, we could represent this coalition of companies was because I had far fewer to worry about. You had many more, which was good. But now everyone's on the same page and working together, which is great. I think really... And I'll turn it back to you; I've been talking a lot.

Stephen Shparber: [02:12:19](#) Sort of the next frontier I think for renewables, everything in the RTO is everything besides the ITC. And you know, the ITC is important and tax policy in general will always be important for financing any sort of infrastructure in the United States. But everything else where you're talking about interconnection reforms, if you're talking about what your revenue streams are from

energy, for capacity, for ancillary services. When you're talking about adding storage to everything, that's all going to be driven at the RTO level. And in many respects, it depends on the RTO and we'll see what ends up happening.

Stephen Shparber: [02:13:01](#) But, in general I think, competition and deregulation is better for renewables on balance than being in the regulated jurisdictions. Now, there's some people that may agree or disagree with me on that. But I think on balance, especially where we're seeing the growth over the next few years, it's going to be the deregulated markets. Especially in Texas. And it's with wind as well. With Texas, there's more in MISO, SPP and PJM, there's going to be sniffing in growth as well.

Stephen Shparber: [02:13:31](#) And then the other thing I haven't even talked about in terms of the importance of RTOs is because, and I think that on the previous panel they're talking about this, but, state policies and regs and things of that nature that drive another potential value stream for renewables. They can come into conflicts sometimes with federal regulation, and I can get into that a little bit later if we have time. But, right now, in PJM over the capacity market and what we're into [inaudible 2:14:09] about in December, that could very much hamper or potentially, depending on what comes out, open up some more opportunities for solar and the value streams they are eligible for.

Stephen Shparber: [02:14:15](#) So this is all why there's a lot going on in the deregulated markets. Keeps us busy. Keeps Katherine busy, and it will create or destroy more or fewer opportunities for solar moving forward.

Zoë Gamble Hanes: [02:14:28](#) So you're speaking of revenue streams? You're saying energy is a revenue stream, or capacity is a revenue stream, [inaudible 02:14:36] is scalable as a revenue stream.

There's voluntary procurement of energy from corporations, bilateral contracts, and then there's mandated. We haven't even touched on community solar. I think this is really important when you think about your earlier slide of getting the 80 gigawatts installed a year. And you look at how much is in the country that have not yet been installed.

Zoë Gamble Hanes: [02:14:59](#) And when, if you're talking about reaching the kind of de-carbonization that this symposium is really about, this is really scratching the surface. But it's getting at what is fundamental and essential, and that is not a small growth trajectory. And I just heard on that panel, we've been talking about issues around citing and if you guys notice there's a Microsoft, right? The-

Stephen Shparber: [02:15:23](#) Yeah.

Zoë Gamble Hanes: [02:15:24](#) [inaudible 02:15:24] Tower development. They had [crosstalk 00:33:27].

Stephen Shparber: [02:15:26](#) Sorry. Yeah.

Zoë Gamble Hanes: [02:15:31](#) That was essentially wasn't able to get zoning.

Zoë Gamble Hanes: [02:15:35](#) And so it would've been a huge solar farm that would have supplied power to Microsoft. And as you may know, the data centers are huge emitters of carbon and the usage of electricity. And there's zoning, there's citing. I really do recommend reading this. The road map gets at a lot of these issues. But if you look at the map and you look at PURPA markets-

Katherine Gensler: [02:16:01](#) Well, I hesitate to call them markets.

Zoë Gamble Hanes: [02:16:00](#) ...versus-

Katherine Gensler: [02:16:02](#) I hesitate to call them markets. Regions.

Zoë Gamble Hanes: [02:16:04](#) Regions. You're right.

Stephen Shparber: [02:16:06](#) That's true.

Zoë Gamble Hanes: [02:16:06](#) You're right. I'm just curious, though. The final topic I wanted to talk about, and then we'll open it up for questions; I'm being told we

Katherine Gensler: [02:16:23](#) Yeah.

Zoë Gamble Hanes: [02:16:25](#) Even if it was someplace like North Carolina, where it's seemingly full, but really it's only barely penetrated. You look at all the yellow dots on North Carolina, but when you consider that it's a small percentage of generating capacity in the state, it's still quite small relative to what we need to get to. Even where we have been successful in regulated markets, what are issues that have been happening with PURPA, and where do you predict that going?

Katherine Gensler: [02:16:50](#) Sure. There's a few different pathways that we take in our approach to policy in regulated markets. There is the PURPA path, and it's a subset of the solar industry that really tries to participate as a QF and wrangle through all of the rules and filings and keeping up with all of the avoided costs and doing those transactions. But we also have, in the last three years, really had a focus on the PUCs, and we always have, but specifically, we have branched out into participating in the Integrated Resource Planning process. This is where utilities get to propose and the policymakers are deciding on generation decisions for the next 30 years. The planning window is usually 10, but the asset decision is 30 or 40 years. We can't achieve this kind of growth. We can't achieve decarbonization goals if entities are continuing to build new natural gas plants, right? This is a decided move to take market share away from other generation sources. Plain and simple.

Katherine Gensler: [02:18:10](#) The more solar that gets approved, or even other renewables, RFP, whatever kind of solicitation you want to craft it, that all starts not with the beneficence of our utility friends, but really at the regulatory level. We've seen RPS's, and some of those have had massive expansions, particularly in the last couple of years, but also, just making those mundane resource planning decisions of, "What kind of

generation do we build next?" and driving solar megawatts through that channel.

Katherine Gensler: [02:18:46](#) We've also participated in rate cases that usually has the most impact on how volatile net metering programs are, or just what the value of solar is to a particular homeowner or business owner based on the underlying rates that they are being served by their monopoly utility. Then, we've also been engaged at the state level in PURPA dockets to set QF rates, to address the big overhaul that North Carolina did, for example, sort of bounce back and forth between the PUC and the legislature in order to start making changes in the PURPA space.

Katherine Gensler: [02:19:29](#) We have emphasized at the federal level on PURPA that any changes made need to really maintain a focus on competition, on increasing transparency, and on the accountability factor. FERC needs to step up its enforcement and really tell states when they're doing it wrong. It has been a pretty high bar to get FERC to go out on that limb and say, "No, this is not acceptable." We're trying to push them toward more bright line tests so that is easy to see what's acceptable and what isn't. That makes it easier for the developer; it makes it easier for the state to know if they are or are not in compliance, and frankly, it should make it easier for FERC to just reaffirm things that they've already said rather than feeling like they are in squishy ground anytime somebody brings a complaint to them about the actions of a state.

Zoë Gamble Hanes: [02:20:25](#) Steve, what's your prediction on further deregulation?

Stephen Shparber: [02:20:30](#) Without giving anything that is attorney-client privileged, I'll say there's a lot of interest in the Southeast on this going on now. A lot of this is public, a large part because we've been talking about the promise for renewables. Another big problem with the

regulated model is if you basically have a monopoly that they will go and get a guaranteed rate of return, sometimes, those monopolies don't make the right decisions. In South Carolina, I don't know how many people are aware of this; anyone hear of the V.C. Sumner project, or Sumpter? Basically, the utility down there built what amounted to a \$9 billion hole in the ground, and I'm not kidding. That will never produce a watt of power, and South Carolina rate payers are stuck with that cost for the next, I think, 20 years.

Stephen Shparber: [02:21:21](#) I think it's something like for the next 20 years, every South Carolinian is going to have to pay I think \$15 or \$20 every month on their bill just for that project. It's a huge amount.

Zoë Gamble Hanes: [02:21:35](#) This is what happens when you have a monopoly.

Stephen Shparber: [02:21:38](#) When you have monopoly.

Zoë Gamble Hanes: [02:21:38](#) It's concentrated on all being power, and they [inaudible 02:21:41] decision making within a state.

Stephen Shparber: [02:21:44](#) We complain a lot about and we talk about the wholesale markets and the issues with them, but at the end of the day, and maybe this is because I did work at PJM for four years, I still think open competition—and there's some problems what's going on in the wholesale markets, but I think on balance—the RTO model is better for Nobel long term, and also for consumers. Because of that, there's been some renewed interest, even coming from Republicans down there.

Stephen Shparber: [02:22:12](#) Actually, one of the largest proponents of solar in the Southeast is fire-breathing, Tea Party Republican from South Carolina who doesn't like the utilities, and he's the biggest proponent for solar down the Southeast. It really can be, and is, a bipartisan issue. There's been a renewed focus; we'll see what winds up happening. That's a multi-year

process, if there's any sort of deregulation in the Southeast.

Stephen Shparber: [02:22:40](#) In addition to that, going into the West, though, the California EIM energy and balance market has been expanding, and even if that doesn't go to a full-blown RTO, it's sort of this in-between model between having a deregulated wholesale market and not. But, that's been expanding throughout the West, and California is going to start operating a day-ahead market; I forget the year it's supposed to be happening. But basically, what that will do is open up for more market opportunities in the West as well in the area that's currently light right now throughout the West, which will hopefully present more opportunities for Noble.

Stephen Shparber: [02:23:21](#) I think it's happening, maybe slowly but surely, and we will see what happens.

Katherine Gensler: [02:23:27](#) As somebody who spent six years entrenched in everything that the California ISO did, and ever helpful whatever you want to call it, TransWest, West ConAg, GridWest, love the names, but those conversations that were percolating in the early 2000s, I think, have circled back around. There's been enough trust built up in the region to refresh the conversation. I don't think they're ready to move forward on anything yet. That's way too soon, but we can at least start that conversation again, and I do think that in the EIM is a good first step. I want everyone to be 1000% clear that it is in no way a substitute or akin to an RTO, but it is a helpful addition to the competitive space.

Zoë Gamble Hanes: [02:24:24](#) Well, I know now it's time for me to open the floor for questions, and I'm probably going to steal a little bit of time, making us go over our time. Just forewarning.

Audience: [02:24:36](#) Hello! First of all, thank you so much for talking about this. It's really invaluable to hear from people who have been deep in the solar

industry from a variety of different perspectives and over a long span of time, seeing it evolve in such rapid manner. Thank you.

- Audience: [02:24:53](#) My question is about a different policy that also has had a pretty productive act, especially in the last year, which are tariffs. My question is a lot more general; it's mainly for Katherine, but also for Jonathan working for the developer even if you want to contribute your perspective to that, which is, what has, in your view, been the impact of the tariff on solar modules that are being imported from China? Has it mainly been negative, driving up ETC costs? Or, have there maybe been some unintended benefits to, maybe, American-based solar module manufacturers? Overall, what do you think the impact of the solar tariffs has been on the industry, and what kinds of changes do you expect will happen in the future with regards to that?
- Katherine Gensler: [02:25:53](#) Sure. Funny you should ask, because we basically owe that report to the International Trade Commission later this year. They do a mid-year evaluation where they ask exactly that question, "How are the tariffs working? What benefits have we seen? What harm has been done? Should we keep them in place?"
- Katherine Gensler: [02:26:13](#) We estimated that tariffs would, overall, cost the solar industry about 8,000 jobs. That was pretty accurate. I don't remember anymore how many-
- Stephen Shparber: [02:26:22](#) Was eight. Was it eight?
- Katherine Gensler: [02:26:25](#) Yeah. Pretty sure. That's okay. No, no, no. Eighty was if the full thing went into... right.
- Katherine Gensler: [02:26:35](#) We definitely saw the cancellation of billions of dollars of projects and commensurate job loss on the whole 40 industry. There have been some announcements and some openings of domestic manufacturing supplies, but by and large, what we have in the United States, as great as it is, is simply not enough

volume. I got to tell you, super not enough volume for this chart. Manufacturing is a piece of that decade-long solar roadmap because we want to be able to better match just the volume of solar supplies as well as demand for installations. Jonathan, I would love to hear what's been your direct impact as a developer.

Jonathan Willson: [02:27:25](#) I've worked at two large companies that have now made safe harbor investments and needed to kind of plan out their portfolios around the tariffs. They weren't a big deal. The issue wasn't cost or where the panels were being manufactured. The issues were timing. Could the free market deliver a functional supply chain in time for me to deliver my project along my GIA timeline and my PPA execution? This was especially pronounced for PURPA projects that constantly has to have the rates changed. In markets, like for NextEra that just has tremendous amount of market force, they just told Hanwha to build more modules. When Hanwha didn't want to do that in Georgia, they had Jinko just move to Florida and build a facility. It impacted some PPAs, but you just moved it down a year and beat down all of your EPCs and everybody else to make sure that they made up the difference.

Jonathan Willson: [02:28:31](#) It wasn't that big of a deal. Certain projects definitely got hurt. Some companies that had really aggressive financing strategies and were kind of a house of cards got knocked down. That was to be expected, but the more competent companies, it wasn't that big of a deal. The most imminent example, we just made a safe harbor investment or, are on the way to executing the contract right now. We didn't bother with modules at all. We felt like the cost declines of modules made it so, "Why would I buy them until right before I'm going to build my facility if I can?" We looked at

racking, inverters, 34-and-a-half kV supply cable. Inverters are really the big-ticket item. We called the inverter manufacturers. They said, "We already moved it all to India anyway. It avoids the tariffs. It doesn't change our pricing. It actually is a little more pricey if you buy it from China." They scaled up their manufacturing in time because they anticipated India's solar market to heat up faster, but poor policy design in India has made those auctions kind of not live up to the dreams.

Jonathan Willson: [02:29:45](#) Most manufacturers that were intelligent and had a large balance sheet already had moved their manufacturing or, could move it really fast, and then had slack demand in their supply chain because of markets overseas not developing as fast as possible. It didn't impact the pricing, really, at all. It's just where do you take possession of it, and what are the shipping costs to get it home? If you can navigate that, it wasn't that big of a deal. It hurts certain specific projects that had specific COD windows that they needed to come online, but within a few months, we kind of all figured it out, and that's kind of the beauty of the free market. It just corrects itself pretty fast.

Katherine Gensler: [02:30:24](#) Yeah. I think that's true on the supply chain side and being able to choose from multiple suppliers. Certainly, our overseas producers did not have that same level of flexibility, and I know one company, their North American CEO said, "Every Friday of last year, I authorized a check to the United States Treasury" – which is that customs import duty – "of six figures. Every Friday before I went home." The sum accumulation just to move their product into the United States, curbs their previously existing business plan in the tens of millions of dollars. That was a direct hit to their bottom line, and certainly, not all

of that could be recovered from their purchasers, from their customers, so some of that came out of profit.

Jonathan Willson: [02:31:20](#) Yeah. Really nobody, besides the inverter manufacturers at this point in the solar industry, is particularly profitable. We've just beat down the pricing everywhere.

Jonathan Willson: [02:31:29](#) When the tariffs went into effect, we beat them down, and the inverter manufacturers and the module importers all took a hit on their bottom line, or we canceled projects, and they didn't sell anything. They didn't get a lot of the development in other overseas markets that they expected, and so they just had a glut of manufacturing capability and were unwilling to give up market share, so they just met whatever requirements we needed of them.

Jonathan Willson: [02:31:54](#) Right now, some of that has flipped because they have now, within a couple months and years, figured out their supply chain, and now I can say, "You'll take whatever we give you because you need to safe harbor it, so here it is. Here's our spec sheet; here's our price. You need to sign this in two weeks. If you don't, somebody else will buy that capacity." It gets flipped back around.

Jonathan Willson: [02:32:15](#) It's a fluid situation, but I think, kind of perversely, we might have a more robust supply chain globally for equipment because of this. I don't like the tariffs, obviously. If the tariffs went away, I could probably take a couple of bibs off my pricing, but overall, pricing's not going to move that much based on the equipment costs. It moves on the ITC, and it moves on how expensive tax equity and back leverage financing are and network upgrades are.

Zoë Gamble Hanes: [02:32:47](#) I feel like I'm getting an eye from the back that says that I need to say-

Audience: [02:32:52](#) One more question.

Zoë Gamble Hanes: [02:32:53](#) We have one more question. Okay.

- Audience: [02:32:56](#) Yes. Hi. Sylvia Bartell. We've had a lot of talk about PURPA, but not a single piece about the recent notice of proposed rule making from the Commission. I'm really curious to hear, obviously, quick thoughts on it from each of you.
- Stephen Shparber: [02:33:13](#) You want to go first?
- Katherine Gensler: [02:33:17](#) Yeah. We've filed thousands of pages on PURPA at this point. Boil it all down. Listen, the commission missed half of the legislative record on purpose. Competition is one of the key reasons PURPA exists. PURPA is an imperfect tool for competition. I would much rather see RTOs, competitive wholesale markets, but in the places where those don't exist, PURPA is the best thing we got. It's a crappy thing, but it's all we got.
- Katherine Gensler: [02:33:51](#) We are focused right now on crafting one more set of comments for the Commission to read, and they will be brilliant, I promise you. Again, our goal here is really relying on competition to bring the best product at the best prices to consumers. We think that PURPA needs more transparency about how avoided costs are calculated, about who's getting these contracts. We have some specific suggestions for bright-line tests on say, what constitutes a LEO? When do you actually have a Legally Enforceable Obligation? What should the term of your contract be? Going back all the way to the beginning of this conversation, contract term so that you can recover the costs of your facility is really key and it helps to reduce your regulatory risk and your financial risk to have a longer term and collect those revenues.
- Katherine Gensler: [02:34:50](#) PURPA is still an important driver of project development outside of RTO and ISO regions, and for all of the wonderful things that have happened in the electricity markets since 1978, I would postulate that in Georgia, Idaho, Wyoming, we are still living in the

1978 regulatory regime. Nothing has changed. Making PURPA match the facts on the ground and try to bring some of the best elements of competitive markets into fundamentally noncompetitive regions should really be the goal.

Stephen Shparber: [02:35:27](#) If I may add on, the thing I would add on to that, and I agree with everything you say, Katherine, this is a notice of proposed rulemaking that FERC passed – just for those may not be aware of it – to actually, really, fundamentally reform PURPA. It's supposed to give states a lot of flexibility, and they say it's opening up competition. The problem is, what they did is, they applied lessons from RTO markets to non-RTO markets, and there are a lot of other factors that make RTOs truly competitive, very much closer to free, open markets as you're going to get in the U.S. power sector and what we have for competition. And I think, for example, applying those reforms into existing RTO markets for PURPA isn't as big of a deal. For very small projects, there may be some issues, but it's not going to have a huge impact.

Stephen Shparber: [02:36:19](#) It will have very large impacts in the non-RTO regions. The problem is that PURPA sort of establishes, and Zoe you mentioned this, a floor in terms of what states can and can't do. Just trust me. States and utility commissions and utilities that have a lot of political capital and just plain capital to influence decision making, will try to go and get below that floor established by PURPA as much as they can. Not in every state, but it's in a lot of them. The problem is that, if you take the federal floor of what PURPA is, which could be pretty low and they give a lot of discretion to states in terms of how they enforce it. Basically, federal statute gives the states a lot of flexibility at how they implement [inaudible 00:02:37:08]. You take

that floor and lower it from here to here, states we'll probably try to take it down to here. Some States. That's really where the potential damage is.

Stephen Shparber: [02:37:18](#) Anecdotally, two days ago, our firm represents a group of South Carolina Solar Business Development association that's actually fighting for avoided cost proceedings that are going on in South Carolina at this time. The utilities' witness in that case, a few days ago, was quoting the NOPR as it were chapter and verse, saying you have to go and apply it this way and saying all the reasons why avoided cost needs to go down, etc. etc. That will happen if the rule becomes final. It's not so much that the rule itself has flaws in it, but I think the real danger, longer term, is going to be how it may be implemented by a lot of states. Look, if a third of the country doesn't have meaningful renewable development, this isn't going to happen, and we're not going to meet our climate goals. We're also just not going to have a very vibrant energy sector in the U.S., and that's really what the danger is. I'm not uplifting.

Zoë Gamble Hanes: [02:38:22](#) I actually believe the last few questions really highlighted what is essential about why this is so hard. It's that not only are we dealing with entrenched interests that are opposed to the growth of the industry, it is extraordinarily complicated. When you look at it, it's not just one thing. You're not manufacturing widgets and selling it. There are a thousand different factors that determine whether or not a project fundamentally has financial revenue stream. We haven't even talked about what's going to happen with capital markets, with average cost of capital and all those things. You highlighted the point that this is truly a global industry now. If China decides that they're going to build 80 gigawatts next year, we have a supply constraint in the market because

that's the max about the global manufacturing capacity right now. There's a bit more.

Zoë Gamble Hanes: [02:39:16](#) I will say that there are things that are completely unpredictable. My last hopeful note is that, when you look at this thing, people often ask me how come the prices declined so much? There's a whole lot of reasons for it. One of the reasons is because of the recession, and you will recall that everyone went nuts over Solyndra and the bail out of Solyndra. Ultimately, the loss of U.S. manufacturing for solar resulted in China purchasing all the intellectual property out of bankruptcy of U.S. manufacturers. That single event is what has driven down the cost of solar. We want to hold on to a very small piece of what, really, ultimately is the total growth of the industry when you look at the numbers for the number of folks who are employed in solar today, relative to the number of people who are employed in US-based manufacturing. That is not where the growth is going to happen. Nobody could have predicted it.

Zoë Gamble Hanes: [02:40:27](#) If you had asked me in 2008, should the U.S. be bailing out U.S. manufacturing for solar, it would have been a yes, politically. That would have clearly been the wrong decision, so we have no idea. There is technology and inventions and financial structures. It's utterly unpredictable, and the only thing that is going to really make it go is that there are people who are committed and scrappy and are willing to figure it out. There you go. Thank you very much.

PANEL THREE: FEDERAL AND STATE POLICY FOR ELECTRIC GRID  
CYBERSECURITY

Mark James: [02:41:07](#) Well, here today, when I looked at my life, I see more than 30 years of energy law experience, and that's just with Mike, if we keep going on down the panel.

Mark James: [02:41:16](#) Today, we are going to talk about cybersecurity. I'm Mark James. I am an adjunct professor and Senior Research Fellow at Vermont Law School, which means that I used to be an assistant professor there, but I've now moved on to the D.C. area. Like Kevin said, I have former students in the crowd and it's wonderful to see them and, former colleagues as well. Today's panel is going to take on the topic of cybersecurity. Trying to lay out a few questions, but the what, the why, the how, and the where of adjusting cybersecurity, and when we use that term for this panel, we're talking about operational technology. You have people who talk about OT and IT and ICS, and in the world of energy acronyms, we can keep getting more and more complicated, but we're going to be talking about operational technology.

Mark James: [02:42:13](#) We've got industrial control systems, the systems that monitor dispatch and ensure that lights stay on and everything is in the proper order and respond to different events, providing that resiliency aspect as well as the reliability, and the threats that are emerging to that as that system changes. Thinking about how we have a legacy. Our grid really is, talking about having the prior two panels to talk about natural gas and talking about solar power, our grid is a reflection of decisions and choices that have been made for the past 40 years. What we have today reflects that. What happens in 20 years will still have parts of decisions that were made today as well as elements of the decisions that were made 20

years ago and everything that's happened in that time period. It is creating some tremendous opportunities to decarbonize. The grid provides environmental and social benefits, addresses serious issues; it's also creating some very new and novel risks, things that we can anticipate and even more along the lines of Donald Rumsfeld, the "unknown unknown," things we were uncertain about of how that system will change as new technologies come along and we changed the attack surface.

Mark James: [02:43:35](#)

Millions of devices have been connecting onto the grid, and hundreds of millions of more expected to come on in the coming decades. It really does change grid vulnerabilities to grid systems. As that attack surface gets bigger, the threat actors get more sophisticated, too. They get more persistent; they get more focused both in their frequency and their potency, in Ponemon Institute, of utility professionals who now believe that operations technology is the greatest risk of where threat actors you're trying to get on to. The question of a cyber attack is a not a question of if, but a question of when, which then becomes how do you mitigate and how do you respond. Hopefully, we'll have a little bit of time to talk about that.

Mark James: [02:44:41](#)

Then, layering on top of all that, as we'll see as we go through our panels, we have federal jurisdiction and states commissions that are in play with this, and we have utilities and regional coordinating councils. We're all trying to work on this, so there are many fingers in the pie, and a lot of the questions are dry from a lack of information, just knowing what's on the system. What's visible; how do they interact together? By adding two pieces together, what risks does that create? How you add a third, and it changes everything. That type of visibility in answering those

kinds of basic questions will allow us to get to the more complicated and deeper questions about how to protect it. More importantly, where to invest, and, of interest to everybody in the intel industry, how to pay for it, the big question of, "Where's the money going to come from in the end?"

Mark James: [02:45:42](#) We're fortunate in the U.S. to have not had a major cyber-attack. There are examples elsewhere to look. Ukraine is probably the most well-known one. I just read yesterday that the U.S. has done some cyber countermeasures against Iran following the Saudi Arabia oil refinery attack. So there are examples out there, and if you talk to security professionals, they can go into a lot more depth with what's going on. We are also in a situation where the former Director of National Intelligence, Dan Coats—I'm not sure how many formers ago he is. It's fluid. It changes—in a presentation and a report in January said that the Chinese and Russians have a presence in our electricity and natural gas systems. So, terrorist groups and then criminals. If you tried to bite the head of the Baltimore [inaudible 00:30:46], you couldn't do that because they simply shut down and ransomed that part of the city.

Mark James: [02:46:52](#) On that high note, we have a wonderful panel. I'm going to do just very brief introductions, and then, let them get into the meat of the presentation. We have Mike Bardee, who is the former FERC General Council, for a period, director of FERC's Office of Electric Reliability, which oversees approval and enforcement of regulations for whatever reliability affects the security of the electric grid, as well as a Protect Our Power Advisory Board member. On that side, Vermont Law School has partnered with Protect Our Power. Our chairman, John Lang, is sitting here, and we will have another

advisory board member, Tom Ridge, come and do our keynote on a couple of major cybersecurity reports, one that came out April, one that's coming out in November. We are very glad to have Mike on our advisory board, bringing his expertise and insight.

Mark James: [02:47:48](#)

Beside him is Lynn Costantini, who is the deputy director of the Center for Partnerships and Innovation, former vice president and chief information officer at North American Electric Reliability Corporation (NERC). A long history with NERC rules and writing all of those in the early stages and again a length of time involved in these questions and maybe some answers as well, too. Joining us at the end is Andy Dressel, who was a VLS grad of 2007, named associate director at Navigant, who started his career working with the Western Electric Coordinating Council and NERC as well.

Mark James: [02:48:35](#)

We will get through this 30 years in the industry—I have no doubt about it—really focusing on NERC compliance, which is something that Mike is going to start us off with as he talks about the federal efforts on cybersecurity.

Mike Bardee: [02:48:49](#)

Thank you Mark, and thank you all for letting me speak here today. I'll start with a very quick overview of what FERC does regarding cybersecurity. FERC oversees mandatory rules for cybersecurity and for the reliability to bulk power system. The authority there is actually split between FERC and the states. For reliability purposes, FERC controls basically the transmission and the generation over a hundred kilovolts, roughly. There's some exceptions either way, but that's the basic rule. The states regulate local distribution, which is something they have regulated for decades for rate economic purposes, and that was carried forward in

- 2005 when the reliability authority was given to FERC by Congress.
- Mike Bardee: [02:49:44](#) NERC also has a role. The way it works with FERC is NERC proposes the rules, sends them to FERC. If FERC finds that they meet the standards, it will approve them. If not, it sends them back to NERC. FERC can't change the rules. They can only tell NERC to change the rules. FERC can't write the rules.
- Mike Bardee: [02:50:00](#) Like say EPA or most of the other federal agencies, if they want a new rule, they propose it and then they write it. FERC can't do that in the reliability realm. It has to rely on NERC and give instructions to NERC to do that.
- Mike Bardee: [02:50:20](#) Penalties basically, they're assessed by NERC subject to FERC review. FERC has its own independent authority, but it's rarely used. It's been used only for major events, like regional blackouts that have happened, at least in small parts of the country. Other than that, FERC has left the enforcement role to NERC. So, this scheme of relying on NERC to do the crafting of the rules and the enforcement, you know that it's a slow process because if FERC wants a rule, it has to first of all propose to tell NERC to do it.
- Mike Bardee: [02:50:55](#) Then, it has to have a final rule. Then it has to wait for NERC. Then it has to have a proposal to support what NERC does, and then a final rule. So, months to a year. If you think about cyber security, you have to wonder if that's the most appropriate process for ensuring the reliability of the grid.
- Mike Bardee: [02:51:19](#) It's also an open process, meaning that all of this, both at FERC and NERC is happening in a public venue. People can see the proposals. They can comment on them. They can find out what the agency and NERC are thinking. So again, it makes you wonder if this is right, but this is the model we have, and it's the model FERC has used for the last 10 or so

years to try and maintain the reliability and cybersecurity of the grid.

Mike Bardee: [02:51:49](#) I'll touch briefly on DOE and DHS. They do not have the kind of regulatory authority that FERC has, but they have very important roles. DOE is a sector specific agency. Obviously, Homeland Security has a broader mission involving sectors outside of energy as well. And they both have a large role either in research or information sharing or collaborating with the various industries to ensure that they're as much up to speed and doing as good a job as those agencies can encourage them to do. Not require, but encourage.

Mike Bardee: [02:52:27](#) So, let me talk about an issue that's pending at FERC now that raises one of the classic tensions in this area. In this case, it deals with how much FERC discloses when there are violations, violations of the cybersecurity stints. Those are called CIP violations, "critical infrastructure protection." Right now, FERC does not require NERC to disclose and FERC itself does not disclose the entity that violated the rules. The reason they don't do that is because of concern that that might make them more of a target for hackers or other hostile actors. If it were known that this company, in particular, was just found to have fallen down on the job, well, if you're looking for some place to start your malicious efforts, that might be the best place to go. So, they have not disclosed that in the past.

Mike Bardee: [02:53:25](#) But there are concerns about the lack of transparency of this whole scheme. People rely on the grid for most of their vital needs. And, if their local utility is the one that's down on the job, they might want to know that, to put pressure on their PUC or their legislatures or others to make them pick up their effort and do better. Right now, you don't even know who it is. So, there's been pressure to try and

rebalance, to come up with a better balance between transparency and security risks. And so, FERC and NERC's staff put out a proposal to at least name the entity and the standard that they have violated. Not the actual requirement of specific rule, but the rubric of it and the penalty that would be imposed for it. So, it would at least be a little more information than is out there now. This is just a proposal. Comments are due at the end of this month, and we'll see where FERC goes with it.

Mike Bardee: [02:54:27](#) It's a tension that comes up in a lot of areas of how much can you release publicly because the public is entitled to know what goes on with their basic electricity service or other vital sectors. But at the same time, when you disclose information you might be increasing the risks for security purposes.

Mike Bardee: [02:54:51](#) I'll touch on next an event that happened in the US system earlier this year, a cyber event. It had happened in the west, and basically it was a fire wall vulnerability. It was exploited. It interrupted communications between certain devices. It did not interrupt the supply of electricity or the delivery of electricity, but it did briefly interrupt communications, digital communications, between some devices and a control center. Just last month, actually a few weeks ago, NERC put out what they call Lessons Learned Report, which is basically trying to explain this to others in the industry so that they don't fall into the same problem. They can avoid it by learning from what happened with this company. And some of the lessons that came out of it were pretty basic strategies. In this case, for example, there already was a firmware update for this vulnerability. They just hadn't put it on yet. They hadn't updated it in their patch management yet.

- Mike Bardee: [02:55:58](#) They also obviously put the patch on and then changed their patch management processes to be more rigorous, more timely. They also tightened their firewall access rules. They restricted what IP addresses could actually get into the firewall. It's a technique called white listing. Very valuable, but there are concerns sometimes on the grid that if you do it incorrectly, you might inadvertently cause something to go wrong on the grid at the wrong time. But, they felt confident that they could limit the firewall access rules and have done so in a way that they're comfortable is going to be appropriate.
- Mike Bardee: [02:56:45](#) One other thing they found was that they had some of their facilities where they had basically dual firewalls. And those sites were unaffected in this incident. Basically, what happened was, one of them would get affected but its partner right next to it would continue the communications. So, they realized this was one way to strengthen their system. And then, NERC also pointed out some other classic techniques such as layering your defenses, segmenting your network, and monitoring your network. I mean, the basic takeaway for much of this is the basic techniques that have been talked about for a long time are really important. You got to do them right. If you screw them up, you can go wrong, even when you don't have a very sophisticated adversary trying to exploit your system.
- Mike Bardee: [02:57:38](#) I'll talk next about a report that GAO put out not long ago this summer, talking about grid cybersecurity at the federal level, basically DOE and FERC. They did say that the capabilities of hostile actors are improving, whether it's a hostile nation, a terrorist, criminals. They're, getting better. They also said that the grid is getting more vulnerable because people are putting more remotely

accessible devices on the grid to operate it. I mean, those are great efficiencies, but they do increase the attack surface on your grid.

Mike Bardee: [02:58:21](#) Connections to business networks are also increasing. There have been some breaches into business networks, but none of them made it over into the operational side of the utility. And those connections are another path that someday might be used to do so. Legacy Systems are

Mike Bardee: [02:58:59](#) Supply chain risk are also something the industry is continuing to struggle with. Whether it's new software, whether it's patches sent to you by a vendor or a vendor person. Somebody from the vendor who has access into your system. And now, the growth of the internet of things, all the things that people are plugging in to the system. Many of those are at the household level. Refrigerators. We went and looked for new appliances when we bought our new house a year ago, and you can get a stove that's now on the grid. I can go on my phone and talk to my stove. So those are another vulnerability.

Lynn Costantini: [02:59:38](#) Because, why not?

Mike Bardee: [02:59:43](#) So basically, what GAO concluded was to make a few recommendations. One, to DOE. I won't go into it in detail, but basically, they said to DOE "you need to come up with a more comprehensive, strategic approach to grid cybersecurity" including a plan that has a much better assessment of what are the risks. There have been some partial efforts, some better, some less. But DOE has to try and do it more comprehensively and better.

Mike Bardee: [03:00:14](#) To FERC they said two basic things. One is to look at the NIST cybersecurity framework and see how it compares to FERC's CIP rules. The cybersecurity framework is a very comprehensive approach. It's written broadly because it applies not just to the utility sector but to all sectors. But it has a lot of good ideas

and techniques in there. The CIP rules cover are narrower segment of the kinds of things you can do and GAO just wants FERC to look at the NIST product, the cybersecurity framework and see are there any parts that you should be using that you're not? And then the other recommendation they made to FERC was to look at whether the geographically distributed parts of the grid could be attacked in some coordinated way. That means that your current threshold, the threshold now does a system control 1500 megawatts in the same place, basically. If it doesn't, it's considered low risk and subject to very few of the rules. If it does control that much, it's subject to the full set of standards. So, what GAO said to FERC was, look at what does that threshold still make sense in light of this risk of a coordinated attack on multiple small things, instead of just one or two big things.

Mike Bardee: [03:01:48](#) The agencies DOE and FERC both agreed with the recommendations, which they are just asked to consider at this point. So, their agreement doesn't mean we are going to do 100% of what you said. But they are going to consider it. So I think both of those for FERC are really good ideas to explore, whether they should be making the kind of changes here. And hopefully they'll find some ways to improve the rules that apply here.

Mike Bardee: [03:02:24](#) I'll touch briefly on a piece of legislation that was just proposed in the Senate by senators Murkowski and Manchin, and a few others. Basically, it goes to the idea of encouraging utilities, or facilitating them, in investing more in cybersecurity. One of the problems that many utilities have is they have a rate level. If they want to spend more on cybersecurity, they either have to start a rate case and open up their whole rate level to scrutiny, or they have to just write it off the bottom line as a deduction to their net revenue

and net profits. And this would direct FERC to have rules on rate incentives for advanced cybersecurity technology and also adopt additional incentives for the smaller utilities who have limited cybersecurity resources. And also, FERC would have to allow single issue rate filings. Meaning that if a utility wanted to spend say \$20 million more on cyber security, they wouldn't have to open up all of their other expenditures to scrutiny. They could just put that in and try and justify that expenditure.

Mike Bardee: [03:03:43](#) And then there would be a program at DOE from 'munies and co-ops, most of which are not subject to FERC rate regulation. So again, if it makes progress in Congress, if it ultimately gets approved, would be one way to try and best address the barriers that slow down investment in grid cyber security.

Mike Bardee: [03:04:07](#) And the last thing I'll touch on very briefly, Mark referenced it. It's a study that came out from Seimens and the Ponemon Institute. It's really just a survey of grid cybersecurity professionals. He mentioned some of the highlights. I'll touch on just a couple others. One of the things the report described in compiling the results, the bottom line was that risk is worsening with the potential for severe financial, environmental, and infrastructure damage. They said that a lot of the respondents said their utilities really don't have a very good handle on their inventory of cyber assets.

Mike Bardee: [03:04:50](#) If you want to protect something, you have to know what you're protecting. What you have. And some of them are still struggling with that. Insider threat was something cited by a lot of the respondents. We always think of attacks from hostile nations or terrorists. But actually, a lot of the respondents to this survey said they worry more about insider threats.

- Mike Bardee: [03:05:16](#) Finally, one of the things that a lot of people cited was the human capital issue. There just aren't enough people who are trained and knowledgeable at doing cybersecurity, particularly in the utility realm, and so they all compete for the same people. And that means that somebody is not going to get the right amount of good people to do the job well. So those are all consistent with things that I heard throughout my time at FERC, at the Office of Electric Reliability, particularly the part about human capital. We felt that ourselves, we had to compete with industry or the same people. It's just a struggle to get enough good people to make sure you've got the job covered well. So, I'll stop there and turn it over to Mark.
- Mark James: [03:06:08](#) Thank you, Mike, and we will jump to Lynn. As she is getting her slides, she told me that she's an adjunct as a professor, teaching students in that specific area of security. You're ready to go.
- Lynn Costantini: [03:06:30](#) Sure. So full disclosure, I am not an attorney. Nor do I live or work in Vermont. So, that's two strikes against it. But to earn a little bit of that credibility back, I do use legal pads. Truly, I use legal pads. But I've also been a cyber security professional in the electric utility industry for almost 30 years. I can't believe I actually said that number, but it's true. Again, full disclosure, I'm a cyber security professional who uses paper and pen. But that's thinking for a minute. Okay.
- Lynn Costantini: [03:07:20](#) So, I have been asked specifically to talk about the role of the state in cybersecurity of the electric grid. I always want to make sure that we have our definitions straight and the definition of states in cybersecurity is very amorphous. There's a lot of state agencies that are involved in grid security. For example, state energy officials are involved in grid security, making sure there's enough fuel to power the resources within the state. The

departments of environmental protections in states also have a role here, how much you can generate over and above the requirements in a crisis. Department of Energy has a role too. Today I'm focusing on the role of the Public Utility Commission. Because of a lot of the things that you've talked about all afternoon, PUCs are in the eye of the hurricane, even with cybersecurity.

Lynn Costantini: [03:08:34](#)

We insure safe, reliable utility service at affordable rates. That's the role of a PUC. Whether it's for generation resources or for cyber security investments. That's our job.

Lynn Costantini: [03:08:52](#)

Just a minute on commissions, as well as Puerto Rico and Guam, and the US Virgin Islands. A plug for the program area in which I work within NARUC, The Center for Partnerships and Innovation. It's our job within this small group within NARUC to identify emerging utility challenges that might come before a PUC. We also provide expertise. We develop tools and resources for PUC commissioners and commission staff to use in the execution of their responsibilities. And we deliver training and education to help make sure that they make the best decisions for their consumers that they can.

Lynn Costantini: [03:10:04](#)

We do this under the CPI umbrella in four particular areas: energy infrastructure, modernization, system transformation, critical infrastructure, cybersecurity and resilience. That's my portfolio. And then we also talk about innovation, hot topics like electric vehicles. That's probably the hottest topic right now. So, to your point about the division line between for FERC, NERC, and states is right there at the distribution. So, the generation and transmission, generally a hundred KV and above, that's considered the bulk power grid.

Lynn Costantini: [03:10:48](#)

At the distribution substation, where the high voltage is stepped down for delivery to

businesses, communities, and homes, that's the distribution system that state public utility commissions are responsible for. That is our jurisdiction. The grid modernization that we talked about just a second ago, that's happening on the transmission, the bulk power side. We're talking about automation. We're talking about digitalization. That's happening on the bulk power side. Getting smart on that side. On the distribution system, we're also trying to get smart. But that's where a lot of that transformation that we've been talking about this afternoon is happening. That's where we're talking about the introduction of solar, the introduction of micro grids, for example.

Lynn Costantini: [03:11:48](#)

I want to introduce a couple of truisms that were coined by my friend, Mike Asante, who really was a giant in the grid security area who just passed away a couple of months ago. This is what he said in a paper he wrote in 2009. Infrastructures are critical to security and represent a common good. Hence, utilities are a natural monopoly for that reason. We represent the common good. Utilities provide a common good. And that's why we have the regulatory structures around that, that we do. Because they're providing a public good, we enabled them to recover a return on that investment. A natural monopoly.

Lynn Costantini: [03:12:41](#)

The other thing he said is infrastructures are built to last. Something that you just talked about. We're not changing grid infrastructure in and out every three years. 40 to 50 years is more like it, both on the bulk power system and on the traditional distribution system. A lot of those distribution substations, they've been there for a long time. And they will continue to be there for a long time. So, together these things mean that we are bolting on security to protect these devices. We are not securing by design. We are not

implementing secure architectures across any of our critical infrastructure.

Lynn Costantini: [03:13:37](#)

Hold that thought a minute.

Lynn Costantini: [03:13:42](#)

We've been talking about the new grid today. This is the new grid. We're talking about how we can include wind, solar, whether it's utility-scale solar, or whether it's a rooftop solar. All facilitated by the introduction of large-scale battery storage. What we want in States, what our consumers want, clean, smart, efficient, resilient and reliable service at affordable rates.

Lynn Costantini: [03:14:18](#)

Another Mike Asante truism. Because we're bolting on, not securing by design and we're adding all of this new technology into the grid, the new technology itself introduces vulnerability into the grid. So, I'll ask a rhetorical question. Is the grid vulnerable? Yeah. History says that absolutely it is vulnerable. Started with Aurora in 2007. That was a demonstration project about how technology could be used to destroy a generator. Mike Asante was the architect of that demonstration at Idaho National Labs. Then we had Stuxnet. The US and Israel disrupting the production of nuclear fuel in Iran. We just talked about the two Ukraine incidents where control systems of distribution utilities were hacked. Breakers were closed. Consumers lost electricity in both of those events. One of the scariest new attacks is called TRISIS. And that was an attack on a security system within a manufacturing plant.

Lynn Costantini: [03:15:52](#)

Forensic evidence suggests that the perpetrator intended to do bodily harm. It wasn't just bringing down the grid, it was hurting people in the process. That's a scary new threat. I promise the last Michael Asante truism. Regulations and mandates without investment and without action aren't effective. They're just not. So, what can we, as state

public utility commissions, do to drive that action, to ensure that investment is made where it needs to be made?

Lynn Costantini: [03:16:39](#)

Public utility commissions don't have one single set of mandatory cybersecurity requirements like they have at the federal side. So, it's a state by state approach to cyber security. Some States have taken the legislative route. Some have taken the regulatory route. Others have taken what I consider a more strategic and a less formal approach to pushing utilities to make investments in cyber security. Doesn't mean it's a free for all, however. We're all working toward the same goal; reliable, adequate, safe utility service. This is where NARUC can help here. Because we exist to help public utility commissions make really good decisions on a variety of topics, when it comes to cybersecurity, we have put out some tools for them to use. Our original toolkit included a discussion of risks. Because cybersecurity really is an enterprise risk endeavor. It's just not an operational technology endeavor. It's just not a business technology. It's an enterprise risk.

Lynn Costantini: [03:18:10](#)

So we talk about that. We put together a primer of cybersecurity topics for public utility commissions. The last one was published in 2017. We don't necessarily or naturally have the cybersecurity vernacular resident within a public utility commission. Which is why we put that primer out. This primer helps PUCs talk to their utilities about cyber security.

Lynn Costantini: [03:18:41](#)

And lastly, we put up what I call the Critical Infrastructure Resource Repository. And that's really a compendium of both federal doctrine and state doctrine around cybersecurity in the energy sector, just not the electricity sector. It encompasses natural gas, water, telecommunications, as well.

- Lynn Costantini: [03:19:05](#) So, one of the most recent things we did was put together a brand-new toolkit comprised of five different tools for utilities to use to engage their utilities in conversations about cyber security, about cybersecurity preparedness, about cyber security response and recovery, because that's what equals resilience for the distribution grid.
- Lynn Costantini: [03:19:33](#) So, the whole point was to turn a lot of that broad knowledge that we had helped them learn through the distribution of those other resources helps them provide tools that can turn that knowledge into real action. Because remember that's where Mike Asante said we need to be. We need to drive action. These tools, a lot of them, already exist in different venues in the energy sector. We tailored them specifically for application by a public utility commission. And we worked on them as a set purposefully to optimize their value to the utility, as well as to the PUC.
- Lynn Costantini: [03:20:18](#) So, you might question why would these help the utility? It gives a utility awareness of what the PUC wants to know. What questions they're going to ask. Where their focus will be during a conversation about cyber security investments. And this is what it looks like. At the top, we gave them tools so PUC could create its own strategy for engaging utilities in the cyber security realm. Then we took the primer, and we extended it to have contextual based questions for a utility both on their planning and process side around what they do in cyber security, and then their implementation. So, you say you're going to do it in policy; are you actually doing it? Tough question, right? And then we gave them a tool that they could filter all of those responses in to gauge how mature the utility cybersecurity program was. Modeled after DOE C2M2 maturity model, if you're familiar with that.

- Lynn Costantini: [03:21:36](#) Again, we didn't create much of this out of whole cloth, but we tailored it to application at the PUC and the distribution utility perspective.
- Lynn Costantini: [03:21:47](#) Another resource that we provided was a tabletop exercise guide. This guide instructs or demonstrates, I should say how, PUCs can build tabletop exercises to allow the utility to demonstrate that it has indeed, not only have policies, have implemented them, but they know how they work in real time.
- Lynn Costantini: [03:22:19](#) And then finally, we put a glossary together. Again, the cybersecurity vernacular is odd. We use a lot of acronyms just like everywhere, I guess in the energy industry. But it's particularly vague in the cybersecurity world. So, we put a cyber security glossary together. And we also, then, take this model, these tools, and we go on the road with them. We go to public utility commissions and demonstrate to them how we intend these tools to be used in real time.
- Lynn Costantini: [03:23:06](#) These are the things that NARUC is working on right now to continue providing that awareness. The education toolkit for public utilities to really do well in the cybersecurity space. We're working on an information sharing guide within a state. So, who needs to know what about cyber security threats and vulnerabilities, and when do they need to know it? Who do they need to tell? You'd think that's pretty straightforward. But I'm sure my federal partner will tell you it is a morass of uncertainty. Really. Who do you talk to when? We're also working on a guide to help public utility commissions overcome the workforce challenges that Mike had suggested exist, across the industry.
- PART 6 OF 8 ENDS [03:24:04]
- Lynn Costantini: [03:24:00](#) So, if the federal partners can't afford cyber security talent because the private sector is scooping them up, we at the state, we're even

at a lower rung of being able to attract cyber security talent. This is going to take a real creative solution, and we're going to be working on that throughout 2020. And lastly, information protection is a huge issue because you said everything is done in a transparent manner. Well, states have sunshine laws for that exact reason. To make sure that information that they have in their possession is made public.

Lynn Costantini: [03:24:43](#)

Well, when we talk about information in the cyber security realm, we don't want it to be public. We don't want to paint targets on utility's back. We don't want to expose weaknesses in the utility system because, dollars to doughnuts, they're going to be targeted immediately upon publication of that information. So, we're going to be working with public utility commissions to see if we can find solutions to those challenges, as well. have to go backwards.

Mark James: [03:25:20](#)

Go all the way backwards?

Lynn Costantini: [03:25:20](#)

Yeah.

Mark James: [03:25:20](#)

Go all the way back.

Mark James: [03:25:21](#)

If Andy went all the way back, just the main point, kind of, publishing things could be the version of Russia-

Andrew Dressel: [03:25:27](#)

Oh, oh, too far.

Mike Bardee: [03:25:28](#)

You're looking-

Lynn Costantini: [03:25:29](#)

That's right.

Mark James: [03:25:32](#)

That type of access is a critical issue that needs to be addressed.

Andrew Dressel: [03:25:37](#)

Okay, there we are.

Mark James: [03:25:38](#)

Or you can begin to address any technical issues you need to think about, how do you move the information around, and where all those crop up? All right. Final panelist.

Andrew Dressel: [03:25:53](#)

Sothings? And, what are we thinking about when we go out to utilities and work with them to help them improve, both their compliance, which might be the highest-level focus from certain elements inside the

company. Because what Mike was talking about earlier can carry a fine potentially of \$1 million per violation per day, versus what's actually secure, because compliance and security are not one for one.

Andrew Dressel: [03:26:33](#)

So, I'm trying to figure out where to look. If I'm not looking out at you, I'm sorry. So, here are some of the ways that cyber attackers can attack a system. There can be insider threats that Mike mentioned earlier. There can be spear phishing. So phishing is general application. Those are those spam emails you get about, you know, from your credit card provider. You know, there's typically lots of misspellings or they're fairly easy to spot, but spear phishing, they've done their homework; they know where you work, they know what organizations you're in, and so this is what happened with the DNC hack. This is what happened with the hacks at OPM and New York Times, and in Ukraine. They find out, you know, who these people are, where they are, what they do, who they're associated with. And so, they reach out to them as if they know you.

Andrew Dressel: [03:27:32](#)

And while there still might be the misspellings, there might be strange attachments in the emails that come in. It's a very effective mechanism because you're really playing with human psychology. There's distributed denial-of-service attacks, or DDoS, in the lingo. What that is, it's just a flooding of the system and overwhelming of the system. And we also saw that in the Ukraine attack, it was a multimodal attack where they flooded their call centers with phone calls, so they couldn't even get communications out to start working on the problem. There's ransomware. This one makes the news quite a lot. Luckily it hasn't made it into the operations side, but if your corporate side is completely locked up, if your

corporate side of the network, and I'll talk about network segmentation here a little bit more than just a minute, you might have a real problem operating everything. There's password or privileged or personal information. Yeah, going blank right now.

Lynn Costantini: [03:28:41](#)

Personally identifiable information.

Andrew Dressel: [03:28:43](#)

Personally identifiable information that gets compromised that can be used in a spear phish or it could be used just to brute force attack your passwords or your password failsafes. You know, when you don't have your password, but they asked you, "What was the name of your first pet?" and they can figure that stuff out as well. And then there's a physical malware introduction and we saw that in the Stuxnet attack that Lynn mentioned earlier, where they actually had a physical USB drive that they entered into the SCADA network and unloaded the malware payload.

Andrew Dressel: [03:29:20](#)

I think I skipped one here. There we go. Oh no. So, this is the guy you got to look out for, but really their uniform tends to look more like a military uniform. So, typically, when we're talking about threats to the electric industry, including insider threats, these are nation-states. These are well-organized, well-funded, sophisticated attacks. They're military units. The picture there of the wanted poster, I believe that's from the follow-up of the New York Times attack that was tracked back to a Chinese military unit. And the four that are on there are not randomly chosen. Those are the four that are cited most often in cybersecurity type events: Russia, China, North Korea, and Iran.

Andrew Dressel: [03:30:36](#)

And so, what is operations technology versus information technology? So, information technology is really the stuff you're familiar with, your typical networks, your servers, modems, switches, firewalls. That's your information technology. But your operations

technology is different. A lot of it works on internet protocol IP, but it's what controls the systems. It flips switches, it feeds in information for heads up, real-time displays. It can trip relays, which also opens circuits, things like that. Tcall industrial control systems. And in that there's SCADA, that's the most frequent one. It's "supervisory control and data acquisition" that's kind of the hub that controls all the other pieces out in the field that move around. EMS, which is kind of a subset of SCADA, which where you think about for large operations. We have a California ISO's control floor there and so the EMS monitors tens of thousands of data points and transmission generation balance because everything needs to be adjusted at all times.

Andrew Dressel: [03:31:59](#)

Programmable logic controllers. Those are the things that actuate movement there, what controls the SCADA will tell the PLCs to open breakers. RTUs feed the information back to the SCADA. And then there's also a whole world of devices, but there's also relays, circuit breakers, network devices. All ofsee, the one with the blue boxes, that's inside a substation house. Those are digital relays. What they do, they'll open a breaker. They have various different protection, protective functions, you know, they sense different things, a voltage frequency and they'll open up and clear faults and a lot of them re-close after they clear. That can become interesting when we start talking about cyber events. The other thing we see is just an inverter out in the field at a solar plant.

Andrew Dressel: [03:33:05](#)

Som what are the basics of cybersecurity plan? I'm most familiar with the NERC CIP rules, the critical infrastructure protection rules. But you see a similar framework with NIST, which is the National Institute of Standards and Technology. You see similar

things with ISO 27,000. But, what does your organizational structure look like? How do you deal with cyber security issues? Is there a line of sight at the executive level? Do you have a CISO, a Chief Information Security Officer or equivalent, that's looking at these issues and can bring that level of weight to the CEO so that operational decisions can be made, whether that's funding new technologies or adding manpower or responding to emerging threats. Also, it's how do you roll out policies and procedures that address everything that's below. Access controls are key. And there's physical access and there's logical access and it's kind of like a castle on a moat. There are all these different layers.

Andrew Dressel: [03:34:20](#)

They call it defense in depth. At the farthest layer most people can get in, but when you get down to your really critical devices, you want very few people to have access, both physically and logically. The architecture has similar kind of goal; it's multilayered. You want to have diverse and redundant features. As Mike mentioned about the communication event that happened earlier this year, it affected one site but not the other because they had a diverse redundant system. Because redundant, in itself in the cybersecurity world, generally doesn't work. Because if the tech works one place, they'll work in the other if you have the same types of systems.

Andrew Dressel: [03:35:01](#)

And point protection, you're probably real familiar with. That's your Symantec, your McAfee things running on your devices. Vulnerability management. You're also familiar with this one, though you might not be aware of it. Wupdates, and there's often some additional stuff jammed in there as well. But, by and large, there are security updates and that fixes holes in code. All code has flaws. The psychology of it as a little beyond

me. But if you have millions of lines of codes, you have lots of flaws.

Andrew Dressel: [03:35:45](#)

Also, part of vulnerability management is testing your system. So, having cyber vulnerability assessments, penetration testing, these guys have fun. They go out, they pretend that they work at the power plants, and they try to get in. Or, they try to get access to the system logically and physically. They might show up as the pizza guy. Everyone opens the door for the pizza guy. Handout chocolate bars, you know, all sorts of things that. They like to have fun. They're an interesting group. Monitoring and alerting. You want to know system health. You want to be aware of what is flowing across your system. Mike mentioned white listing earlier. You should only have those channels open for normal and emergency use. But even across those normally open channels, you want to know, is there something unusual flowing across? Asudden, you're sending out lots of information or a lot of information is coming in in unusual patterns.

Andrew Dressel: [03:36:48](#)

That should be detected. There should be alerting, heads-up displays to the people sitting at the EMS desk and elsewhere. Change control whenever you're putting in new software, new security patches, new firmware. That should be done in a very mechanical, methodical way, so that you identify potential risks and then you do a second check after it's been installed. Ahave to do this first in a test bed, a non-production system that's separate, although that's not a fail-safe. There have been problems with that as well. But the most important thing about all these OT devices is that they're reliable. They can't have interruption. So not only are we worried about security, but we're just worried about their day to day operation.

Andrew Dressel: [03:37:51](#) Mike also mentioned information protection; that's key. In many other industries, this is the entirety of cybersecurity. You're trying to protect your information. You know, cyber security is different in the electric world. There's nothing to steal, then you don't have criminals looking to get anything. You have people that are either just plain malicious or they're in some kind of national power struggle with all of us. Supply chain management. That's been an increasing concern. And as Mike mentioned, it's not just what devices you get, it's also how those devices are updated. Do you know where that update is coming from? Anyone who's providing services to you, do you know who it is?

Andrew Dressel: [03:38:46](#) And this is going to address not only machine and device procurement. There's software procurement, there's vendor procurement, but there's also, even when you're talking about machine-to-machine communications, there needs to be some kind of way to interrupt, monitor, and disconnect that exchange of information. Incident response planning. I've heard many defense people say that we're living left-of-boom, and it's not a matter of if, it's when. So, when we get to boom, how do we get beyond it? And so incident response planning and backup and restoration planning, it's really how do you get your systems back up? And this is a complicated process. Not only do you have to get your systems caught back up, but we live in an AC world, alternating current world and everything needs to be sync together. So, you have to bring things up a little bit at a time and piece by piece and make sure that you don't create more problems.

Andrew Dressel: [03:39:53](#) And then something that's come up, in both Lynn and Mike's presentation: information sharing. We have a special alphabet soup for

this one. There are many organizations that are focused on information sharing. And so, this is putting out information about vulnerabilities for the firewall that had that communication event earlier this year for critical updates. They put out mitigating measures, what you should do if you have one of these, but you can't patch right away. These are things like the Electric Sector Information Sharing and Analysis Center. We have the, the CRISP program, which is run by the DOE, which is the "Computer Risk Information Sharing Program." And there used to be a whole bunch of these things called CURTs, the "Computer Urgency Readiness Teams." And, beyond just information sharing, they can come and help with the response.

Andrew Dressel: [03:40:57](#)

So if a smaller entity got attacked, there would be similar to a mutual aid that we're talking about when there's a hurricane and they line up trucks in Alabama to drive into Florida. They're looking to really institute a similar program for cyber readiness for those that aren't quite fully staffed or adequately staff. Because we talked about the federal and the state level. A lot of these municipalities and co-ops, they're very rural and they have very small budgets and it's really hard for them to get the right level of personnel. So, challenges in implementation: a lack of understanding, especially at the executive level. I think that's changing. We see that with the Siemens Report, also Utility Dive puts something every year in the last two years or three years with the biggest risk cited by industry executives was cybersecurity.

Andrew Dressel: [03:41:57](#)

Evolving threats, the internet of things, the growth of the attack surface, evolving technology, evolving regulations. Maybe those aren't evolving quickly enough. On the bulk level, we're looking at, not exclusively, but a lot of them were written in 2012 and

things like virtualized systems weren't really addressed. Workforce shortages, we've talked about that a lot. Often cyber security is viewed as a cost center. You know, "what am I getting out of this investment?" So, as Lynn and Mike had mentioned, and as Mark had mentioned as well, paying for this is a big source of pain. And finally, organizational culture. While the mandatory reliability standards for the bulk system have been around since 2008 for cybersecurity, there's still resistance within organizations to show their work. "Well, I'm doing it, why do I have to have evidence that I'm doing it?" And, and that way you can't really assess whether they're secure or compliant. So, that makes it quite difficult. I tried to go as quickly as possible, but I think I'm at the end here.

Mark James: [03:43:20](#)

Thank you. I've been given instructions that we have until 5:30 and then they hard-stop for our keynote speaker. So that gives us eight minutes to cover everything about cybersecurity. So, if there are any questions, please raise your hand. I think it's interesting that you guys to go down the granularity required at certain levels in this industry to talk about it. How do you protect utilities from their own employees' behaviors to coming up to the higher levels, how you create sufficient visibility without adding to the risks that already exist? Those two levels create some unique challenges.

Andrew Dressel: [03:44:07](#)

Part of the insider threat is not just people acting maliciously, it's just them not acting fully aware. You know, clicking on a link in an email or an attachment. So, protecting people from themselves has to be somewhat as a goal of the ITOT groups.

Mark James: [03:44:29](#)

I talked to t he  
guy that lead the research program at ECRI, the Electric Car Research Institute, and they do their own internal testing and they send out

spear phishing attempts to their own people and they said the first time, yeah, they get 12%. The second time, they get 6% of people who respond to it. The third time, they 3% then they go to their office and they talk to them. So, we have a question; Tom?

Audience: [03:44:56](#) Yeah, I just want to quickly thank the panel; this was a really great hour. One of the things that really strikes me about a big challenge here is that the main concerns really are these foreign entities and malicious action. And when you compare that to a lot of factors that we match for electricity, a lot of justification for things are for reliability, a lot of other actions are based on the clear benefit to the consumer.

Audience: [03:45:19](#) And so that, I think, really shows some of the big issues that we have with who's paying for this? Who really bears that burden? And we've seen some of those issues that I think you guys are going to talk about in terms of the federal government takes care of certain things. Traditionally, they are responsible for national security. So, having, especially I think a distribution of vulnerabilities in all these and even customers responsible for electric security is a big issue. So, I was wondering if I could talk a little bit about those institutional challenges that when we have to the internet of things and we have these new types of character resources, how's that really going to change responsibility? How do we navigate that to make sure that we aren't missing things, that we don't have vulnerabilities. This is how we set up our system.

Lynn Costantini: [03:46:02](#) I can take a stab at it. I really think it's a combination of a lot of the things that we've talked about. Within an enterprise and the enterprise risk management context, cyber security generally is looked at as a cost center rather than a profit center. But when you look

more broadly at the value that securing your infrastructure gives you, like you can continue to provide your service that is making profits for you, it makes a lot of sense. And something that Andy said is really, really important. Cyber security and the value proposition of cybersecurity is now openly discussed at board-levels and with CEOs. Up to, I would say a couple of years ago, it was always the IT people's problem to deal with, but now we're looking at it more as an enterprise risk and enter a risk to the business, not a risk to an asset. So, I think changing the conversation in that way has been very, very helpful.

Andrew Dressel: [03:47:15](#)

Yeah, I would echo all of that. There's been discussion for a long time and Mike's probably been involved in some of the discussions, of how do you ensure that all these multitudes individual actors can work together cohesively as a whole? There's a good part to that too. Tsecurity, that's not on the mission statement of a certain, you know, Pepco or you know, Dominion.

Andrew Dressel: [03:48:21](#)

So they're very interested in doing the right thing. You know, I think some of the efforts that we blew by about the information sharing. Some of them, there has been an effort to get security clearances for those at utilities and other organizations so that they could get information fed right to them from the NSA, from DHS, and elsewhere so that they can get that operational information as rapidly as possible and there's not a delay, and they can do that. But it's a challenge, and it's going to continue to be a challenge. But there are numerous efforts of entities to work together. And there's a whole other side of this that we haven't discussed, which is physical security of the grid. And there's efforts there. A So, there are efforts, it's just hard.

- Mike Bardee: [03:49:36](#) The only thing I would add is we've got this institutional structure that's very complicated between three different federal agencies, 50 different state commissions, let alone ~~the~~ the governor's office, the energy officers and everybody else and then 3000 utilities, some of which are very big and some of which serve 10,000 people isolated 30 miles away from the next town. And so institutionally, you're trying to get all these organizations moving in the same direction, cooperative, collaboratively, is a struggle. People try and generally succeed. But, think of cyber security where the weakest link in this whole system could be the one that is used to bring down an interconnection. So, the tiniest little utility that is connected to PJM in the mid-Atlantic region could be the path that somebody uses. So, it's really an ongoing struggle to get everybody in this industry to share the information they should be sharing and to work together. It has worked well so far, but it is going to be an ongoing struggle.
- Audience: [03:50:47](#) I want to get a quick one in to see if we get a ton of hypothesizing going. I've been looking at a lot of the EER market rules going on and one that seems to have flopped a little bit is aggregation as a market participant, assuming that does go forward eventually. I'm curious how NERC and FERC would interpret whose responsibility it is to make sure those aggregators are following certain fiber guidelines and how would that trickle down to the aggregated individuals, also how do you deal with all these different water heaters, you have all these different battery systems. How do you then enforce the standardization across that so there's not little backdoors and, you know, say company A's battery. I'm not sure that was much clearer.
- Mike Bardee: [03:51:46](#) Let me start by saying they have done aggregation of demand response and I don't

- know the way that NERC has applied its rules to them. I just don't remember those criteria.
- Andrew Dressel: [03:52:01](#) They largely haven't.
- Lynn Costantini: [03:52:04](#) But there's progress.
- Andrew Dressel: [03:52:05](#) Right.
- Mike Bardee: [03:52:06](#) So, my sense is the DER, unless they cross some magnitude threshold, are probably going to be similarly off the radar for purposes of NERC and FERC. Some will cross the threshold. I don't know where that line is, but I think if it's anything like the rules that apply to the bigger components NERC's going to point the finger at the big entity and make them responsible for going downstream to the smaller entities they're aggregating.
- Andrew Dressel: [03:52:41](#) I'd just add a little bit on. It seems like there's almost a need for something like a UL, an underwriter's laboratory or something similar for any grid connected device. I know at the DER level, SunSpec Alliance is out there trying to generate the solar standards, inverter standards, things like that. And they're working with the IEEE team that's rewriting 1547... I can't remember the other one. But, just to build in some level of security when you have an interconnected device, and from just a pure security perspective, everyone's nest and every other device should have password enabled. And so you can't just have one password and have a botnet, which has millions of computers that you essentially control, go out and hit all of them at the same time knowing that the default password; zero, zero, zero, zero and then they can get all those devices to work for them as well through something like a Distributed Denial of Service attack or something else.
- Andrew Dressel: [03:53:49](#) Going to Lynn's point, secure-by-design needs to be everyone's responsibility. It can't just be the utilities and it can't just be the regulators.

- Lynn Costantini: [03:54:01](#) But there are several bills. You mentioned one, the Protect Act. But there's a couple of bills in both the House and Senate committees that are talking about just what you're talking about, <sup>06:</sup>supply chain. How do we secure the supply chain? How do we do component testing like a UL does? Right now, that really is the burden of the utility that employs those third parties; that risk is their risk. They cannot transfer that risk to the third party. And NERC has explored that problem. Haven't found the solution yet. But again, I think it's going to be a combination. This is partnership. When we're talking about cybersecurity, we really are talking about collaboration and partnership because not one single entity can solve this problem on its own.
- Mark James: [03:54:52](#) And you do see that the state commission level, you see them trying to grab even third-party suppliers.
- Mark James: [03:54:59](#) The ability to create and try and structure rules about how to back your third-party suppliers. That's more services moved to being provided by them or being provided through a cloud service that, you are two or three layers down the road and you don't have regulatory oversight over it, nor regulatory control in place and that's a whole other side of vulnerability. We have a question.
- Audience: [03:55:21](#) Yeah, hi. Is there any precedent where regulators get denied a utility's proposal or a request for a cyber security investment? And related to that, there have been policy moves lately to turn major software systems into a capital expense or utilities because that's now their major business, and how does that work for cyber security?
- Lynn Costantini: [03:55:52](#) Both really good questions. Now at the state level, yeah. Cap-ex is rolled into rate base, but other soft expenses, like O&M, is an O&M expense. But we are looking at a variety of different rate mechanisms to apply

specifically to cybersecurity expenditures, particularly performance-based rate making with trackers for cybersecurity expenditures. And to your first question, the answer is anecdotally, no. There is no single authoritative source for that information. But in my conversations with utilities, in my conversations with PUC's, if, they can identify what a cybersecurity expenditure is because often in a rate case they're buried, they will be approved.

Mark James: [03:56:56](#)

Interestingly, National Grid is coming up for a management audit and one of the things that our security is standing there looking at, as I was discussing with that a former student who's from Massachusetts, their IT program was described as being disjointed, unreactive, and I can't remember, there's a third term they used that was equally in line of just not having it, not being thought out, not being planned out, being cohesive and then coming back to what the kicker was, what's the benefit to rate payers? Again, Alex's point and to your question as well, as these investments go forward, there will inevitably be this, come back again, but okay, it's been approved and now we need to come back and think about what is the value that they produce from that. And, dealing with the world of anticipatory threats of unknown consequence, to invest \$35 million to avoid a \$300 million, all of loss of life, economic value, it's always hard to prove that a negative and to demonstrate that value. But they always come back with, "Who pays for it?"

Mark James: [03:58:00](#)

The rate payer, the taxpayer?" So. I keep answering all the tough questions today.

Mark James: [03:58:07](#)

So I want to thank the panel and have you thank them as well. this has been wonderful for me and I hope that... I'm going to assume that everyone else has found it equally enjoyable. So, thank you very much.

## KEYNOTE ADDRESS: THE HONORABLE TOM RIDGE

- Kevin Jones: [03:58:22](#) ...where he became the first secretary of US Department of Homeland Security. Tom Ridge was twice elected Governor of Pennsylvania. He served as the state's 43rd Governor from 1995 to 2001 and currently serves as chairman of the National Organization on Disability and serves as co-chairman of the Blue Ribbon Study Panel on Biodefense as well as other private and public entities. Graduated from Harvard with honors and was drafted in the US Army where he served as Infantry Sergeant in Vietnam earning the Bronze Star for Valor, the Combat Infantry Badge, and the Vietnamese Cross of Gallantry. He earned his law degree from Penn State University's Dickinson School of Law, and he was one of the first Vietnam combat veterans elected to US House of Representatives where he served six terms and I'm very pleased to introduce Governor Tom Ridge.
- Tom Ridge: [03:59:30](#) Thank you for the kind introduction. Thanks for a very warm reception. I don't know if you saw the brochure or whatever announcing that I was going to be here but it said "Keynote address." Well I'm going to spare you a lot of time and a lot of effort. There'll be no, "Keynote address," but I'm delighted to have the opportunity to have a conversation with you because I like the importance of the conversation, the informality of the gathering so, thank you. You can tell listening to my introduction, it's been pretty difficult for me to hold a job.
- Tom Ridge: [04:00:09](#) Ridge can't hold a job, he's had seven different paychecks. The one thing you didn't know, I was a garbage collector at the State Park, we were the guys that left at 2:30. We didn't look too good, we didn't smell too good, but the cool guys had the white powder, the

white cream on their nose walking around with whistles. Those were the lifeguards. But anyway, they didn't pay... overcome that adversity, and you move on. First to the law school, then to the Institute.

Tom Ridge: [04:00:37](#) I'm very pleased to be associated with your work because I'm associated with Protect Our Power as well. We're very gratified by the strong relationship and particularly the quality of work you did in Phase One on securing the grid, so I just thought it was really important to identify that. I also think it's pretty interesting. I love the notion of the Institute for Energy and the Environment. I get the connection. A lot of people still don't, and then so I tip my hat to the prescient, almost aspirational view that the Institute has, so it's fascinating to have been associated with that as well. Been thinking about some of the remarks I'm going to share with you this afternoon, and is there a social hour where I'm going to... [laughter] That's good. That's very good.

Tom Ridge: [04:01:26](#) It had occurred to me... Seriously I thought about this. In different phases of my growth, just from a young man, a student, to political figure, to Cabinet Secretary, all these things, how my view vis-a-vis the world of electricity and everything else has changed just as I've grown, become more involved in, just life writ large, and then the world of politics. 330 million people in this country, how many do you think, when they flick on the switch, think about anything other than, "Will the lights come on? Will the grill, you know, the refrigerator work? Can I get my coffee done?" And beyond that, and I'm not being critical, but how many of you think that I have 330 million people, how many we have, that worry about anything other than reliability?

Tom Ridge: [04:02:32](#) Very few. Very few.

- Tom Ridge: [04:02:37](#) And that group, how many of them really worry about, "What's the source of the generation? Nuclear? I don't know. Coal? I don't know. Oil? I don't know; I just want it there." And their interest in that probably grows over a period of time but when you think about the average consumer, so, all right, so I'm one of those folks. I want the lights to go on, I want the beer in the refrigerator to be cold. It's life amenities, you've got to have it. Suddenly you get into Congress and then you think, "Heaven, now I'm the Governor and I've got a public utility commission, that puts some really smart, able people, and several of them are lawyers, really skilled in compliance, really skilled in regulatory environment."
- Tom Ridge: [04:03:21](#) Now what am I thinking about? Well, now I'm thinking about reliability. I'm thinking about cost. These are publicly traded... most of them are publicly traded utilities, so what's their cost recovery mechanism? And all of a sudden, now from the civilian who's flicking on the lights, I'm thinking as Governor and now I know the other thing I did is think about what as a kid or just a consumer, now I'm paying for it and I want it to be there, I want it to be reliable. I'll tell you one of the most intriguing personalities in my time. I was in Congress for six terms before I was Governor and you got coverage all the time. Hup in Erie, Pennsylvania. This was big news in Erie. He would get the cameras and he'd go, and he'd put a letter in the mailbox to me, his congressmen complaining about utility costs. They got covered.
- Tom Ridge: [04:04:20](#) All of a sudden when you're in government and you're dealing with the PUC. They wrestled with it all the time, particularly the time when we know the infrastructure is aging or the challenges we have right now as we go from the Edison era of electricity to the

Google era. I mean that's a real challenge for us. So, all right, reliability. Now I'm thinking about cost. I'm thinking about the politics of the regulatory environment.

Tom Ridge: [04:04:49](#)

Now I'm Secretary of Homeland Security. Well, once we get over, decide we have the Department, when we get inside and one of the things we have to do is we take a look at this great economy of ours and at the time we divided in 13 critical sectors, that fell into 16, but of all the sectors in the economy, of all the sectors that drive the world's largest economy, what is most integral to them all? I would say probably energy and electricity. So another perspective, and what are the risks attendant to it? Well, we know what they are, physical, weather, EMP, or geo-magnetic. We got that. Outside. I remember way back when we were doing, "Red cell." Oh, it's what it is.

Tom Ridge: [04:05:50](#)

We get some really smart people who weren't necessarily counter-terrorism experts, but smart people saying, "If you had these tools, what would you do if this was a target?" And we would combine the physical attacks simultaneously with a cyber-attack. You can imagine the confusion that caused. So all of a sudden they were looking at it as not only as a utility issue and a regulatory issue, it is becoming a national security issue. August of 2004 I'm not going to ask you where you were. Pretty young crowd.

Tom Ridge: [04:06:27](#)

Hope you weren't in an elevator, but 50 million people were hit by the Northeast Blackout with a period of a couple of days. It was hot and humid, really drained the resources. Everybody was amping on. I mean, they just had voltage up, higher than they've had it in years, and burnouts and all of a sudden [inaudible 04:06:49] caused a couple of trees to fall. Some lines went down. All of a sudden you get a blackout that lasted anywhere from several hours to a couple of

days. Now it's just a couple of bad decisions made and there are a couple of tree limbs falling south of Cleveland, Ohio.

Tom Ridge: [04:07:09](#) Look at what happened. That wasn't a concentrated attack of any kind. That was some human error; hot, humid day; you can overload on the system and a certain number of multiple causations resulted in that. But we did it in this world of managing the risk to the most important piece of critical infrastructure in America and how do you do it?

Tom Ridge: [04:07:39](#) And how do you do it at the same time you have to upgrade really antiquated... an antiquated industry. Now that's the bad side. The good side is as you modernize and if you can build in security, that's a good thing.

Tom Ridge: [04:07:58](#) Going to take some time. Everybody was so excited about the internet of things. Excitement, I mean the promise of that, and what it can do to productivity and profitability and enhance agriculture and health care, but every point is a potential vulnerability. So, whether it's 25 billion or 30 billion devices by 2025, the number is so big it's... And that's the environment within which critical infrastructure and the most critical piece of infrastructure must exist going forward. And the challenge, I think, is that I'm not worried too much about happiness. I mean, I'm not an alarmist. I mean people asked me after my first couple of months in Homeland Security, "You probably don't sleep much at night, if you can sleep." I said, "I don't sleep much, but I sleep well," because at least I know now the infrastructure, the men and women every day throughout the government trying to make us more, make us safer.

Tom Ridge: [04:09:11](#) But the grid. The grid. We know the Russians play with it. Listen, I was on the board of Exelon for a while. They worried about it? Absolutely. They're worried about modernizing at the same time they're trying to

do improve and enhance their cybersecurity. At the same time, they're trying to go to Illinois and to Pennsylvania and to Maryland to get rate increases so they can upgrade the architecture, enhance cybersecurity and at the same time keep the regulators and the consumers happy. That's a pretty complicated task in this world, and I'm not quite sure that the industry itself, particularly around cybersecurity, has been focused enough on educating the general public as to the potential costs of managing the cyber-risk associated with the most critical piece of infrastructure in America. You know, it is a dynamic environment. It's so much easier to play offense than defense in the cyber world. It is cheaper.

Tom Ridge: [04:10:29](#) Russians, the Chinese, the Iranians, even to a certain extent, it's primitive as it is, North Koreans, they're all playing around with it. Look, not only play around in our electoral system in the United States. The Russians played around in Brexit, they played around in France. They've been playing around, but these are new tools and make no mistake about it, the Chinese and the Russians and others take a look at our grid as being a key component of how this greatest economy in the world flourishes. You knock that down and you cause enormous physical damage, financial and economic damage, and depending whether or not it's ever done in association with any other kind of attack, God only knows what consequences."

Tom Ridge: [04:11:18](#) So I'm not breathless about this. That's a fact of life. We live in what I call the digital forevermore. The digital sun is never going to set. It's going to get hotter. That's just the way it's going to be. And so, when you take on this project and say, "Okay, this is the reality." An antiquated grid—we're modernizing it—is

- subject to the greatest risk, I think today, is the cyber-risk.
- Tom Ridge: [04:11:50](#) See the weather maybe, maybe down the road there'll be a nuclear discharge, you'll get an EMP that will knock it out. There might be another incident, the tree-falls, the limb-falls, and you've got a black out for a while, but the greatest risk, systemic risk is cyber. And so, what I think you've done is said, "Okay," I really appreciate the fact that you took a look at how some of the states are doing it. My only disappointment is you don't look at Pennsylvania. Come on, man. But that's good. I don't know if that's good or bad. But the fact of the matter is, is that I've always felt as Governor, you do take a look at how the states do things. Lessons to be learned.
- Tom Ridge: [04:12:32](#) The highest form of flattery is emulating what somebody else did in another state, and frankly a lot of these critical issues—and you know my politics—but if it's a good idea, who cares whether it's Republican or Democrat Governor, Republican or Democrat regulatory commission? If they got a good idea and you can apply it... We did that when I was Governor across the board in a couple of areas and so I think the notion that you look to some states, about specifically what they're doing and as you get to phase two it's, "Okay, now here's what everybody should be doing," I tip my hat and I like that. I like the research model. How many of you were involved in writing that report? Do you know what I'm talking about here?
- Tom Ridge: [04:13:11](#) I know you did. Did you write it all by yourself?
- Audience: [04:13:13](#) No, the students. I had four students on Phase One and two students on Phase Two.
- Tom Ridge: [04:13:19](#) But there's a great report. This group know what I'm talking about? I hope so. I mean it's a very thorough, exhaustive report.
- Audience: [04:13:25](#) Pennsylvania comes up in Phase Two.

- Tom Ridge: [04:13:28](#) Good. Good, good. I hope so. Lessons good or bad. I mean that's what's really important because there's much to be learned from how the states are doing it. But the reality is the biggest challenge that we have, I don't take are from hacktivists, I don't think necessarily from criminal organizations. This is such a critical piece of our infrastructure, the biggest potential threat, even though the hacktivist can cause mischief and the criminal organization can do this and we're in some work to be part of this down the road, just trying to extract the money...
- Tom Ridge: [04:13:59](#) The biggest long-term, tactical and strategic event would be from a foreign entity and a foreign country, and we know primarily who they are, and so how do we go about managing the risk? There's a law of diminishing returns even in cybersecurity and you just have to accept that. And so, some of the early recommendations. Machine-to-machine information sharing, and AI is going to have a big role to play down the road in helping us oversee and manage the grid writ large. And what do you think we found is, the utility companies themselves pay pretty close attention to their own infrastructure but the grid itself, that distribution system, that's pretty vulnerable, initially. It's very important that you focused on that and I was glad that you did.
- Tom Ridge: [04:14:48](#) When I was in—this is a quick anecdote, if you don't mind. A couple of years ago I was invited to speak in China, and there were a couple of thousand mostly young people. I suspect many of them spoke English, but I didn't have an interpreter. They wanted me to talk about Homeland Security and I couldn't very well as a citizen, United States or Cabinet member, talk about DHS and cybersecurity without talking about two things publicly. One was about espionage. I

was careful for my sake. I must have been pretty careful because I'm here, and I had to talk about privacy and it was really the espionage that concerned me. So, after it was all over, they invited me to have tea with the Minister of Information Technology and Security. 15 or 20 minutes into the conversation, talked to him, he acted as if he was interested in how we set up the Homeland Security and like... And he raised his cup of tea and he said, "Well, you know, friends drink tea and enemies shoot at one another." And I said, "Minister, I've done both."

Tom Ridge: [04:16:09](#)

And then I will tell you—and this is the world you're living in—in an inscrutable faced, unemotional, started lecturing me about the notion that the Chinese would be hacking into America's infrastructure and stealing secrets. Can't make that up. Can't make that up. I said to the minister, and again, I think we need to understand this... I said, "Minister, we teach Sun Tzu in our military academies."

Tom Ridge: [04:16:42](#)

And he once said, to paraphrase, "it's the only the enlightened leader and the brilliant general that tries to secure as much information as possible before the battle will ever obtain victory on the battlefield." So, let's look at this. You're looking over our shoulder, we're looking over yours. Let's take the conversation elsewhere.

Tom Ridge: [04:16:59](#)

The fact of the matter is, is that our enemies, we recognize this, not just only playing around in our elections, they're playing around in the digital forevermore. They see it as a tool, actually of harassment, actually of threat. Also, a tool that done either independently or in conjunction with more traditional weapons could cause great harm to their enemies. That's the reality. But we have capabilities too. We're not pretending...

Tom Ridge: [04:17:30](#)

One thing I try to remind people, we have watches, they have time. Big difference in

their mindset. And so, we have to be vigilant in a dynamic environment, which means the tools they have are changing all the time. They're pinged hundreds of thousands of times a day; let's accept the reality. But the challenge when it comes to the grid is the challenge of convincing the consumer and the regulator and the companies that oversee this, that they need a permanent, sustained commitment in a dynamic environment, to deal with the cyber threat because of all the threats that they have to manage it's the most serious and the most consequential. One of the great lines in your report, first page or two, you say you call the cyber threat, "Low frequency, grave consequence, and high probability," or something like that. It's there and so I appreciate the scholarly research and the work that you and your students did on that.

Tom Ridge:

[04:18:51](#)

So, I don't want to belabor the point on cybersecurity. It's a risk that can be managed. It has to be managed. It's a little more complicated when it comes to the utility arena because there's so many different companies and so many regulatory agencies. That's why going on a state by state basis and hopefully coming up with some... maybe Phase Two says, "All States should be at least doing this," or recommending... Has to be some kind of metrics as well as to how we can measure our security and we're going to have to hold these folks accountable down the road, but it's going to be some work. We're very pleased to be associated with it. The extent that we can help you with Phase Two, we're looking forward to that as we had some my friends at Protect Our Power. We thank you. By the way, I might spend a little more time to talk about cybersecurity, this is a very interesting group. Social hour's down the road, but you

- got me here. If you're doing a Q&A, I'd be happy to do it.
- Tom Ridge: [04:19:49](#) I want to thank you. That's it. That's the keynote. You can read it.
- Tom Ridge: [04:19:52](#) I thought about doing it as a big binder with a lot of pages and opening the first one and saying, "It is good to be with you..." It just doesn't work.
- Tom Ridge: [04:20:10](#) Way back when, right after you leave the Cabinet, and I say this with gratitude, there are speake's bureaus in town that work with organizations around the country that actually paid people like yours truly to speak. This might be the closest I ever got to white collar crime. Now that just evaporates after a while. I've been out of politics for so long and out of government. Let's take a case. They invited me to speak once on TV so I was excited... But at the first speech I gave, I really worked hard. I mean words matter and I wanted it to sound... And I thought it was pretty good, but I didn't feel like... I called back on the times I've been in audiences listening to speakers and I much prefer the more conversational tone, it doesn't to be perfect, the syntax doesn't have to be perfect. You don't have to make complete sentences so, you're relieved of a keynote, but I'm happy to have the chance to share the knowledge with you. But do you have any questions from your audience here? Political or otherwise?
- Tom Ridge: [04:21:23](#) Oh, by the way, one thing I also didn't tell you though, that I think we've learned and I wanted to get back to comment at the Institute for Energy and the Environment. There's some Republicans who believe in climate change and think that mankind does have responsibility to recognize there's some degree of both culpability and responsibility. Not to eliminate it because there are other factors other than humankind, but we are playing a significant role and that's the other

thing that was intrigued about the Institute for Energy and the Environment because they're so together and I wanted to tip my hat to the Law School and the Institute for putting the two together in that regard.

Tom Ridge: [04:22:02](#) Sir. I'm going to call you sir and tell you, hit me with what your question is.

Audience: [04:22:08](#) So, picking up on that last thing as you said. Is there anything about cybersecurity that makes it non-bipartisan?

Tom Ridge: [04:22:19](#) Well, that's a great question. That's a really intriguing perspective because I'm thinking about issues that are dividing us, which seem to be about all of them. I got to be careful how I to say this. There may be people who think that the Russians didn't interfere with our election, digitally. Maybe a couple of those, but I think, I think the answer ultimately is it could be one of the few issues that would generate the bipartisan support politically.

Tom Ridge: [04:23:07](#) It's a great question. So how does it translate into legislation that has an impact on what we're talking about today? Writ large and forget about other critical sectors but impact on the grid or on utility company. To date much of the... and I think it's been bipartisan and well I guess it's mainly bipartisan, but today the government has been more punitive than helpful, more punitive than aspirational, more punitive or maybe... I don't know what MERC has done, but I know the MPC and some others have taken a look at companies and said, "Well you weren't strong enough, you didn't pay attention to this, or you should have avoided that," and they've been penalizing. So, it would be good if, to your point, there was some bipartisan legislation, that said something as simple as, "Big-time tax credits to utility companies, etc. to invest."

Audience: [04:24:13](#) It's been a trend for so long on the Hill all to always do big packages and putting everything but the kitchen sink into one bill

- and that's partly why I asked the question because it sounds like cyber should be able to stand on its own if there's bipartisan support for it and move it as necessary.
- Tom Ridge: [04:24:41](#) I think it's interesting. There's some bipartisan support or additional dollars to the states to help them secure the 2020 electoral process and that's easy. Make responsible the Govs. We oversee that and I think there'd be bipartisan support for that.
- Audience: [04:24:57](#) Sir, if you could stand behind the microphone. We apologize. Didn't even turn it on.
- Tom Ridge: [04:25:02](#) No problem. Okay?
- Audience: [04:25:05](#) Flip that little... little green switch on there?
- Tom Ridge: [04:25:08](#) There you go. Can you hear me now?
- Audience: [04:25:08](#) Hell yeah.
- Audience: [04:25:09](#) Or you can put it down.
- Tom Ridge: [04:25:12](#) You couldn't hear me before?
- Tom Ridge: [04:25:16](#) [inaudible 04:25:16] which shows there is bipartisan support in increasing [inaudible 04:25:24] ... digital forevermore. The grid is permanent. It's going to be greener, planet's going to get hotter. That's just reality. Don't run from it okay. What do we need to do with the country to help individuals manage it? And from an institutional point of view, utility companies it's about, first of all, it's just making sure that the employees of that... it's about training and education. Technology, yeah it is important, but training and education is as important as the technology and staffing. Was a great question. I respect it.
- Tom Ridge: [04:25:56](#) Yes Ma'am.
- Audience: [04:26:04](#) Oh hi. Thanks for being here today Governor, and I'm really glad to hear that the Department of Homeland Security really does prioritize the-
- Tom Ridge: [04:26:25](#) Well we did before.
- Audience: [04:26:27](#) Or did prioritize.
- Tom Ridge: [04:26:28](#) We understood there was a war but there were other things-

- Audience: [04:26:29](#) The point is the health and safety of the grid is essential to American economic productivity and success and so and our continuing competitiveness going forward in an international world. And so my question is, we all in the press desire this very... With the science being unequivocal that climate change is going to lead to increasing inclement weather and more and more severe weather events like wildfires out in California or massive storms here on the East Coast, do you know if the Department of Homeland Security is taking that aspect of our grid security as seriously as they are the cyber threat because it seems like that's also a pressing issue that might be threatening American peace, democracy and productivity.
- Tom Ridge: [04:27:24](#) Occasionally I know, I will tell you honestly in my limited time... I was there for a couple of years, it was not a part of what we dealt with, and my perspective, it's probably a multiple jurisdiction, Energy [inaudible 04:27:33] health should be up here in this. There's so many implications to climate change. I view climate change whether people like it or not as another a national security threat. The destabilization that occurs in certain parts of the world, whether it's famine caused by a drought, and you made a great case that climate change itself has created physical problems, destabilize regions and countries and create internal political problems. And so, people don't believe that, but I think it's also a national security problem. Anybody's probably paying more attention. Anybody's paying attention but had to deal with the consequences right now, probably the military intelligence community.
- Tom Ridge: [04:28:31](#) I think it's regrettable and I say, "My friends"... "My Republican friends", I'm not willing to say it is the only reason the climate has changed. I'm sure there have [inaudible

04:28:41] cycle [inaudible 04:28:43] but let's presume there was. You cannot convince me that millions and millions of present of stocks, knocks, and carbon dioxide in the atmosphere is a good thing.

Tom Ridge: [04:28:55](#) And I didn't do that well in physics and chemistry, but if you create a layer, which basically what we're doing, it traps heat. Well trap heat in your house and put an ice cube on your kitchen table and see what happens.

Tom Ridge: [04:29:13](#) So, we know there's trapped heat, and we know the repercussions of the heat being trapped. The ocean's getting warmer. Talk to these geologists or if you talk to this biologist, a one or two or three degree increase in the temperature of water in certain parts of the world affects that ecosystem.

Tom Ridge: [04:29:36](#) I mean people far smarter than I am can go into great detail. So, I'm a believer without being as knowledgeable as maybe even some of you are. So, let's just get that reality and do what we can to reduce.

Tom Ridge: [04:29:57](#) I know in Vermont... Nuclear is probably not popular in Vermont. I'm a big nuclear guy. I'd be willing to do it. What is your emissions? We didn't have Fukushima Daiichi, when it came out and the President of the United States, the Governor were standing there watching TMI three or four days after they shut the plant down because we know how to build them, we build them safe. And how we're disposing of the material, I understand that's controversial-

Tom Ridge: [04:30:25](#) So, it's a great question. I think this is where there are multiple jurisdictional issues and it again has become part of that polarized political environment we have in this country. You either believe it or you do not. Nobody's willing to say, "Well, I don't know what's just causing the building to trap heat." Heat's having long-term consequences to our environment, but not in our... in future

generation's going to... one of my family expressions... You got them going on this. There was a great native American expression that you've probably heard. "You do not inherit the Earth from your ancestors, you borrow it from your children." If you put that your responsibility is to steward the environment today, in that respect I do think you-

- Tom Ridge: [04:31:23](#) ...inherent the green of the Earth. I'm not sure that's more than 50 degrees-
- Tom Ridge: [04:31:23](#) Wonderful things that have happened to it and we aren't necessarily leaving it in better shape.
- Tom Ridge: [04:31:23](#) So, great question. That's right, we're ready for this...
- Tom Ridge: [04:31:39](#) Hey y'all, it's happy hour at Andrew's, I am very thirsty, you know. Thank you very much, good to be with you.