Transcript of LaFleur podcast for Columbia Energy Exchange

HOST JASON BORDOFF: The National Academy of Engineering has called the North American power grid the "supreme engineering achievement of the 20th century." A network of generation, transmission and distribution, it works together to bring reliable and affordable electricity virtually all the time to all Americans, providing a service essential to the nation's security and our well-being. But the passage of time and new innovations present new challenges for the electric grid. The information technology revolution, increasingly networked systems, distributed generation and more intermittent energy sources, smart grids and new technologies that link our appliances, our cars, our smartphones to the grid, these all present great benefits but also pose potential risks. Add on top of that the threat of terrorism, of natural disasters that may be increasingly frequent, local opposition to new infrastructure and simply aging infrastructure and limited resources. All of these mean maintaining the reliability and affordability of electricity services is a daunting challenge.

Hello, I'm Jason Bordoff, director of Columbia University's Center on Global Energy Policy and your host for today's episode of Columbia Energy Exchange, the Center's podcast.

Our guest today is responsible, among many other things, for overseeing reliability of our grid, Cheryl LaFleur, a Commissioner at the Federal Energy Regulatory Commission, known as FERC. Cheryl has served as Commissioner since 2010, exactly six years ago this month joining the Commission, including as acting Chairman and Chairman from 2013 to 2015. Prior to joining FERC she had 20 years of private sector experience in the electric and natural gas industry. Cheryl thanks for joining us.

Can you tell us about the overall state of the grid today? How reliable is it? What are its greatest challenges? What are the things that keep you up at night when it comes to grid security?

COMMISSIONER LAFLEUR: Well as you referenced in the National Academy of Engineering, the high-voltage electric grid is an amazing machine. It is really the fundamental piece of critical infrastructure that powers all of the other critical infrastructures – water, gas, finance, health – on which our society depends. And it is maintained by a very dedicated group of people who are available 24/7 to keep it up and running. However, because of its criticality we absolutely cannot be complacent. We are aware there have been significant power outages and blackouts in the past, and it requires constant vigilance to keep it running.

The things that I most worry about – first of all, on top of the system of wires that has been there for quite some time, like so many other things in society, we've put on top a system of digitization using the computers and the telephony to run the wires in new and more exciting ways. While that has given rise to all kinds of new technologies and advancements that are good for society, that makes the grid more vulnerable to cybersecurity and people potentially interfering with the control systems and computers that make the grid run. Those threats are emerging very quickly, and that is one of the things that I spend a lot of time thinking about.

The second fundamental threat to the grid is the tremendous resource transition that we are going through in the United States right now. We are at a major inflection point from a time when most of our electricity came from coal, nuclear and a little bit of other things on the edge, to far more reliance on natural gas, as the predominant fossil fuel, and renewable technologies, primarily wind and solar, as well as demand side technologies on the customer side of the meter. That is mostly powered by environmental requirements and aspirations, but it requires a whole new development of the grid

because the grid was basically built for the resources that existed before. This means we need new gas supply pipelines, new transmission lines to connect the new resources, and as you referenced, infrastructure is not easy to build.

BORDOFF: Just explain for our listeners the role that FERC and the federal government play in that. Utilities are regulated in many ways at the local level, so what's the role of FERC

COMMISSIONER LAFLEUR: In our federal system, FERC has responsibility and authority for the interstate transportation of energy, the high-voltage interstate transmission grid, both the rates that are charged for it and we oversee a set of mandatory reliability security standards for that grid. And we also oversee interstate natural gas pipelines and the rates of interstate oil pipelines, among other things. The local distribution lines that go up and down your streets that are connected to a meter in your home are regulated in the 50 state capitals by state public utility commissions.

BORDOFF: Got it. So let's go back to those two kinds of risks you identified. Cyber and technology and then the change in the resource mix. Can you say a little bit more about cyber risk. What form might that take? How likely is it? How vulnerable – how hard is it to do something like this? Is this a pretty unusual, difficult thing or is it something that is kind of going on more often and maybe is happening today and maybe people are stopping it and we don't even know it.

COMMISSIONER LAFLEUR: Well there is an organization under the auspices of the Department of Homeland Security – NCCIC, the National Cybersecurity & Communications Integration Center – that tracks people trying to penetrate computer systems across all of the infrastructures. And by far the most attacked is the high-voltage electric grid, which has people trying to get in literally every day, be they individual hackers, nation states or other adverse players out there.

The grid is subject to a set of mandatory standards, overseen and enforced by FERC, that put in place a set of basic protections – password protection, air-gapping between corporate and operating systems, perimeter protections – that make it quite secure against most of those attacks. We have never had, up to this point, a power interruption in the United States caused by cybersecurity, by a cyber breach.

BORDOFF: These are standards you put in place for private companies, for regulated utilities, that they have to abide by?

COMMISSIONER LAFLEUR: Yes, for all, whether they're private investor-owned utilities or public power – you know, municipals and co-ops – they all have to abide by these standards if they run the bulk electric grid. So while we have a very strong set of standards the threats continue to evolve rapidly. You know, it seems like even the lexicon – I don't think a couple of years ago I'd heard of malware, now there is ransomware – it seems like there is a new term or a new type of attack all of the time.

So in addition to the standards that are basic protection we have to be extremely vigilant in real time and have a strong set of procedures to share information between private sector actors, who see what is happening on their systems, and the government so that we can adapt rapidly to things that are happening.

BORDOFF: You said you have to move quickly to be able to respond to how quickly these threats are changing and the technology is changing. The federal government is not always a fast-moving

organization. You docket cases; you have lengthy notice-and-comment processes. How can you at FERC move quickly enough to respond to these risks?

COMMISSIONER LAFLEUR: Well, while I think the mandatory standards are an important protection, they are not nimble enough in real time to respond to a risk because by design we have a complicated set of due process to make sure they are carefully considered, they are voted on before anything goes into effect. But in a case of an emerging threat, other non-standards-based, more voluntary and cooperative processes take over.

Last December there actually was the first documented power outage caused by a cyber incident in Ukraine, where 230,000 customers lost power because of an apparently rather sophisticated attack through the corporate systems to the operating systems that took out a rather large number of substations. When that happened, the North American Electric Reliability Corporation, which works under FERC's authority to oversee the grid, really immediately jumped in to identify lessons learned and what we could learn from that. It went over to Ukraine, was involved in learning from it and responding to it.

What we learned in that instance is some of the basic protections we have in place would have protected that from happening here, but there were still things we could learn, important lessons to do things differently.

BORDOFF: Is there good international coordination on these issues?

COMMISSIONER LAFLEUR: Pretty good. We are a domestic agency so I am not an expert on what happens. We have very strong coordination with Canada and Mexico because they are all part of the North American grid. But I think a lot of that happens in other agencies of the federal government that are considerably more international in their orientation because we are learning on some of these things from our partners.

BORDOFF: And so I suspect some of those new risks emerge from how quickly technology is changing and the role it is playing in the grid when you look at technologies like the Nest thermostat, the ability to have your appliances linked to the grid through the internet or maybe eventually your electric cars linked to the grid. Can you talk about what vulnerability that sort of increasing technology and networking poses?

COMMISSIONER LAFLEUR: I think all of that increased technology poses both a challenge and an opportunity. What we are seeing right now is that distributed technologies that are at the distribution level and in some cases even behind the meter in the customer premises, be they industrial or residential, can collectively behave like central station technologies. You can have demand response that can ramp up or down to help balance the grid in the same way that a power plant could or a distributed large network of rooftop solar that collectively provides as much energy in the middle of the day as several power plants.

That means that potentially you have more entry points into the system where a cyberattack could happen, meaning that we have to have cyber protection at that level as well as a strong protection of the high-voltage grid so any problem won't cascade.

But that also means that we have the potential for more modular operation and restoration of the grid.

BORDOFF: Can you say more? What do you mean by that?

COMMISSIONER LAFLEUR: Well for example, in Hurricane Sandy – there is a term, sometimes thrown around a lot to mean different things, of a "microgrid," which really means a piece of local infrastructure that has the potential to operate islanded from the larger grid; keep itself in balance with load and supply.

Princeton University runs a very sophisticated microgrid with its cogeneration facility that heats the dorms, they have solar, they have demand response and a lot of other energy resources strung together that on any given day is hooked into the high-voltage grid selling products to the PJM integrated market. But during Hurricane Sandy it islanded itself and kept up, and was used as an emergency center for first responders and others at a time when they were just putting the state of New Jersey back together. That's enabled by new technology and has some upside for the grid.

BORDOFF: So the other risk you mentioned is different resource mix and the fact that we are using a lot more renewables. Great potential for low carbon and other ways but intermittent, right, the sun is not always there, the wind's not always there. The industry talks a lot about the so-called" duck curve" showing how in the middle of the day when demand peaks there is less need to draw from the grid and it has to ramp up quickly at night. How big an issue does that present for reliability and how is that being managed today?

COMMISSIONER LAFLEUR: Well, for any of your listeners who don't know what the duck curve is – whoever coined that term should have copyrighted it, they would be rich by now – it is a plotting in the California Independent System Operator of what happens with the grid when solar, all the rooftop and central station solar around the state of California, comes on when the sun comes up and in the middle of the day, and then turns off when the sun goes down or it becomes very cloudy and stormy. That means we have a tremendous resource at some times that's relatively affordable and clean, but it means that you have to have other resources ready to ramp down when the sun comes up or up very quickly – be they fast-acting gas turbines or demand response, potentially battery storage, which is a growing technology – to fill in.

And it also means that those other resources that you are using in the other parts of the day in the future probably have to get paid a different way because they just can't make money volumetrically by selling energy if the solar is going to take away the big part of the day from them. We have to think differently about how we run the grid and pay for things.

The other big challenge with renewables is that a lot of the best opportunities for central station renewables, the big wind corridor – you know they call the United States the Saudi Arabia of wind – from the mid-South up to North Dakota. And some of the best opportunities for big central station solar in places like eastern California, Arizona, and Nevada are not necessarily where people live. So we need transmission to connect the best opportunities to the population centers, and transmission is not always easy, in fact, it is very rarely easy to site and build. And as we make this transition that is something you have to do more of.

BORDOFF: You raised an interesting point. I mean, in the past you pay your electric bill, you pay for megawatt hours and you pay for generation and the wires that bring it to your house. Now as we have more distributed sources of energy, people are not buying as much electricity from the grid but they still want the ability for the rapid ramp up in gas-fired generation at the end of the day, they still want wires

to their house. This is a source of a lot of disagreement about exactly how to restructure pricing of electricity. Just kind of tell us where that stands today and where it might be headed.

COMMISSIONER LAFLEUR: Well there are a couple of different things going on. One is that at the state level, primarily not at FERC, there are a lot of debates about how pricing for rooftop solar fits in with a larger distribution system. Many states have something called net metering, which is if you are producing some of your own electricity you can just deduct it from what you pay the electric company as long as you are still buying more than you are producing under some period of rate measurement. When that has been in place for a while, what's happened is that in some regions of the country there is so much rooftop solar that if you are deducting all of that from what it costs to run the distribution system the people who don't have rooftop solar are potentially paying considerably more than their share to keep the grid running that everyone uses some of the time.

We use to always think of electricity as a volumetric product. When you think of it, you don't pay for your cell phone volumetrically. I mean most people pay by some other – you know, up to a certain amount or they pay by the month or they pay by how fancy their phone is, but you don't necessarily pay by the call. But we've always thought of electricity volumetric and we are starting to think of it differently. So a lot of battles are happening in the state houses over how we should restructure payment for rooftop solar.

The other thing is we use to run the system, I don't want to say simply but you'd have your city; you'd put the big power plant 45 minutes or an hour away; you'd build a line; lines coming off it where the people live. And you'd just paid one bill to one vertically integrated utility. That paid for your electricity, and they did everything with that money.

Now, so many of those services are being pulled apart, and you might be paying one person for the generation, maybe in the middle of the day you are using your own solar, in the night you are paying somebody, you are paying somebody else for the voltage that keeps the system running because that use to come from the spinning inertia of the power plant. Now maybe you are using a battery to supply your voltage. What we use to think of as one integrated product we've kind of pulled out the spectrum and paying for all these different ancillary services separately. It is not beyond our ability to price that, but transitions require thought.

BORDOFF: It sounds similar to how drivers would pay for the roads by a fee that was put on gasoline and if we had a sharp increase in electric vehicles, electric vehicle drivers still should be paying for roads that they are using. Is that an apt analogy?

COMMISSIONER LAFLEUR: That's a good analogy, and that's a good analogy in another way. I dare say we would not have the federal highway system that goes from coast to coast without the federal action in the Eisenhower administration to build it. We do not have a structure to enable that kind of coast-to-coast transmission grid. The authority is distributed and decentralized, and so the grid gets built in a more kind of complicated and de-structured way.

BORDOFF: You mentioned the short ramp-up time for natural gas. Natural gas is playing an increasingly important role in our electricity system, displacing coal, helping to balance renewables. Obviously the shale revolution has given us a large supply of relatively inexpensive gas. And then recently we saw the environmental disaster with Aliso Canyon in California, this massive methane leak. That is a whole separate issue about how to deal with those things and try to reduce the likelihood that a leak likes that

happens. But now that storage facility, which I think stored about two-thirds of the gas supply for the region, is out of commission. Are there reliability issues that we should worry about or new risks that may be presented by an increasing reliance on natural gas in the electricity system?

COMMISSIONER LAFLEUR: Yes, I think there are. I mean gas is a cleaner fuel than coal. If you look at some of the EPA studies when they first put out the Clean Power Plan, coal-to-gas conversion was one of the single biggest drivers to getting that carbon reduction. So in that way it enables response to global climate change. But it is a just-in-time fuel. There is some gas storage, you mentioned Aliso Canyon, there is LNG storage in some parts of the country. But it not like coal, where you look outside the window of the power plant and it is sitting there in a pile, or nuclear where literally the fuel in the plant is probably going to outlive all of us.

Gas has to be bought and shipped in real time, and it only moves 30 miles an hour. It's not like electricity that goes at the speed of light. So what is happening is that in some regions there is so much dependence on natural gas as a fuel, the loss of a particular pipeline or a particular storage facility might become the single biggest contingency in the region. So as they do their regional planning for planning for what could go wrong, that has to be taken into account.

BORDOFF: So what do you think the role for government is? I mean, in the oil market we have 700 million barrels of oil sitting in the Gulf Coast. I don't know if we need a strategic gas reserve, but what do you think, are there things the federal government should be doing.

COMMISSIONER LAFLEUR: Well I think that some of what we are doing is, first of all, trying to help gas infrastructure be built where it is needed, whether pipeline or storage infrastructure. That is highly controversial because even though gas is cleaner than coal it is a fossil fuel, and there are some people that are opposed to its use at all, even though we are highly dependent on it now. So we have to make sure the infrastructure is there.

We are also doing some work – FERC tends to work on what I call the unsexy underbelly of all the big issues. We are working on the communications channels and rules between the transmission grid operators and the gas pipelines on the scheduling, what times of the day you buy gas to make that work better for gas-powered generation, the gas pricing and some of the other things to make it work better when gas and electric are becoming so interdependent. I think that is a role for government.

BORDOFF: We also saw, I mentioned Aliso Canyon in California, we also saw a gas pipeline explosion, obviously not the only one, it's happened elsewhere in the country. As we increasingly use gas – we have an old pipeline system in parts of the country – how much should we worry about leaks and the potential for those sorts of incidents to take place? And what can we do about it?

COMMISSIONER LAFLEUR: Well I think as with other pieces of aging infrastructure, be they bridges or water pipes, older gas pipelines are not built as well as newer gas pipelines. FERC, my agency, does look at safety issues when a pipeline is put in, but the authority to inspect pipelines going forward is under the Department of Transportation, something called PHMSA – the Pipeline and Hazardous Materials Safety Administration. After the San Bruno explosion that you mentioned, Congress passed a new and stronger pipeline safety law and new regulations are being rolled out all the time that require increased testing of the maximum pressures and various changes to the pipeline grid to make sure that it keeps up to what we know about gas safety. I should also credit the state of California has done a great deal in the regard.

BORDOFF: We have a couple minutes left. I wanted to close by asking you a little bit about physical threats to the grid. First, natural disasters, with climate change in particular, Hurricane Sandy, frequent storms. How vulnerable is the grid to severe weather events, and are there steps that utilities and the federal government are taking to try to make it more resilient?

COMMISSIONER LAFLEUR: Well the grid has always been vulnerable to severe weather. Ice storms, major hurricanes, tornados are usually responsible for the biggest outages in any given year, and climatologists will say the incidence of severe storms is increasing, so that is something we have to be ready for. I define resilience as the ability to bounce back when something bad happens. Just like you want your kids to be resilient, you want your grid to be resilient.

A lot of what we are doing is things like looking at the stockpiling and sharing of the high-voltage transformers that are very long lead-time items. Looking at how the grid is built, so maybe there is more redundancy so if you lose a particular substation to a physical attack or something else that you can have more ability to run the grid without a specific critical asset. Looking at more standardization so that we can have more sharing. The industry has a long history of mutual aid – sending line persons to the region of the country where a hurricane happened – but looking at how we can share equipment and make things more modular. I think that is the key to resilience.

We are also seeing a lot of work done on climate adaptation in the coastal areas. As with so many things, the places that have had a big storm are the first ones to step up. So Louisiana and coastal New York have done a great deal to harden the substations and the pieces of infrastructure along the coast, looking forward to potential sea rise. Hopefully we will get climate change under control, but adaptation is a piece of being ready.

BORDOFF: There was also, when it comes to physical threats, a highly publicized physical attack I think on a substation with rifles and news reports about how a coordinated effort like that could take out a large share of the grid. Can you tell us about that incident and how big a threat that is and what steps are being taken for a threat like that?

COMMISSIONER LAFLEUR: Well, physical security has always been a threat because, for the most part, the electric grid is visible. It is not hidden. You can see the lines. We've always had kids shooting at transformers to make a bang and, I don't want to say little threats, but things that are smaller in scale.

What happened in the Metcalf substation that you referred to was what appeared to be a very sophisticated attack where people disabled a communication system and attacked in such a way as to bring the substation down. In response to that, the Federal Energy Regulatory Commission required industry to develop a very specific set of standards for physical security for substations, requiring the identification of the most critical pieces of the grid and customized plans to prepare and mitigate against physical attack at those substations.

But as with all of these things it is something where we have to stay vigilant.

BORDOFF: Great. Well I'm afraid that's all the time we have. The energy sector is changing remarkably quickly and staying ahead of all these challenges to ensure the security and reliability of our grid is not an easy task, but it is a critical one. Cheryl LaFleur, commissioner at FERC, I want to thank you for joining

us today to discuss these challenges with our listeners. For Columbia Energy Exchange, I'm Jason Bordoff. Thanks for listening.