PLACE: Dobbs Building, Raleigh, North Carolina

DATE: March 5, 2020

DOCKET NO.: E-2, Sub 1185

TIME IN SESSION: 1:59 p.m. to 3:22 p.m.

BEFORE: Commissioner Daniel G. Clodfelter, Presiding
Chair Charlotte A. Mitchell
Commissioner Kimberly W. Duffley

IN THE MATTER OF:

Application of Duke Energy Progress, LLC, for a Certificate of Public Convenience and Necessity to Construct a Microgrid Solar and Battery Storage Facility in Madison County, North Carolina

Volume 1

A P P E A R A N C E S:

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P R O C E E D I N G S

COMMISSIONER CLODFELTER: Good afternoon, everyone. Let's come to order, and at this point we'll call Docket E-2, Sub 1185.

I am Commissioner Dan Clodfelter, and I have been assigned to preside over this panel proceeding. With me this afternoon on the panel are Commission Chair Charlotte Mitchell and Commissioner Kim Duffley.

The docket before us is E-2, Sub 1185, which is the Application of Duke Energy Progress for Approval of a Certificate of Public Convenience and Necessity to Construct a Hot Springs Microgrid Solar and Battery Storage Facility pursuant to General Statute 62-110.1 and Commission Rule R8-61.

At this point, in compliance with the requirements of Chapter 163 of the State Government Ethics Act, I remind the Commission members of our duty to avoid conflicts of interest, and inquire whether any member of this Panel has a known conflict of interest with regard to this docket?

(No response.)

COMMISSIONER CLODFELTER: Madam Court Reporter, let the record show that no conflicts were identified.

We're going to skip preliminary recitations of

the history because this is the continuation of an open docket already in existence. And let me have the parties first announce their appearances, starting with the Company.

MR. SOMERS: Good afternoon, Commissioner Clodfelter, members of the Commission. I am Bo Somers, Deputy General Counsel, on behalf of Duke Energy Progress.

COMMISSIONER CLODFELTER: Thank you. Ms. Downey?

MS. DOWNEY: Good afternoon, Commissioners. Dianna Downey on behalf of the Public Staff.

MR. LEDFORD: Good afternoon. Peter Ledford on behalf of the North Carolina Sustainable Energy Association.

COMMISSIONER CLODFELTER: Great. We're going to, as I say, skip a lot of the preliminaries because we're in an open docket. There is nothing before the Commission this afternoon for decision or for action. This is simply an information presentation and an information briefing by the Company. We may have some Commission questions, and I think that's the reason for the hearing, is we have received the written progress reports from the Company about the implementation of the

project and where it stands to date, and there were a couple of topics that we wanted to hear a little more detail in depth about how the project was coming along and developing.

One of those, I think, has been communicated to the Company previously. In fact, both of them. One of them is -- relates to a little more understanding about how the solar component of the project is developing and in relation to the battery storage piece of the project. Your written report was very thorough on the battery storage development, and we wanted to hear a little bit more about how the two were coming together.

The second topic, and Mr. Somers, I think you have been communicated this, it's a little bit outside the docket, but we understood that you might have some education to share with us this afternoon. Last week or, actually, two weeks ago we had an information briefing on the issue of safety codes, safety standards, and safety protocols to deal with the hazards associated with battery storage systems, and we thought this -- since the Company was going to be in here today, this might be an opportunity to hear the Company's perspective on those issues, and we may have a couple of general questions on that.

Again, if you're not prepared to talk about that this afternoon, it's not part of the docket, but since this docket does involve a battery storage installation, we thought it would be a convenient opportunity to kill two birds with one stone.

So if I've got it set out right, that's really where we are. We may have a couple of detail questions for you, but let's start with whatever presentation Mr. Somers, the Company, wants to make, and then we'll see what questions develop out of that. Is that fair?

MR. SOMERS: Yes, sir.

COMMISSIONER CLODFELTER: Ms. Downey, Mr. Ledford, that okay with you?

MS. DOWNEY: Yes.

COMMISSIONER CLODFELTER: Great. Okay. You're on.

MR. SOMERS: Thank you, Commissioner Clodfelter. If I may, we have seven Duke employees who are here today sort of as a panel. You'll note four of them are sitting to my right because we don't have enough room up at the top. We wanted to make sure we had folks here who could address a status update, as well as any Commission questions, so we've got folks from various areas, and I'll call them forward and introduce them. Do

you want to swear them or do you want me to just introduce them?

COMMISSIONER CLODFELTER: Well, as I say, this -- we don't have anything to decide or, actually, Orders to issue coming out of this proceeding, but I think for good order sake, since we have the court reporter with us, let's put the information on the record, so let's do get them sworn.

MR. SOMERS: If the Duke folks would come forward to the stand, please. I'm going to introduce you one at a time. We also have some slides that are being projected on the screen. I've also handed out copies of those. If anybody didn't get a copy and wants one, just let me know. Gentlemen, please have a seat.

Also, in our progress report that was filed with the Commission, there were certain portions of it that were redacted as confidential, primarily relating to cost information as well as some simulations that are proprietary to the Company. To the extent -- we don't have any of the confidential information in the slides. To the extent, certainly, if the Commission wants to ask about that, we'll just need to address that in a closed session if we get to that point.

COMMISSIONER CLODFELTER: Great. I think we

can take that up if we get to it. We do have, as I say, a few questions, but I'm not sure they go to the confidential material. I don't know whether the Public Staff or the Intervenor may have questions on the confidential material. We'll take that up at the appropriate time.

MR. SOMERS: All right.

COMMISSIONER CLODFELTER: Okay.

MR. SOMERS: If I could, I'll just start with Mr. Kuznar. If you would, just please state your name and your position with Duke Energy.

MR. KUZNAR: Right. My name is Zak Kuznar. I'm a Managing Director in our Renewable Generation Business Development.

MR. SOMERS: All right. And Mr. Abdelrazek. And would you spell your name, please?

MR. ABDELRAZEK: Sure. Sherif Abdelrazek. Abdelrazek, A-B-D-E-L-R-A-Z-E-K. I work with Distributed Energy Technologies Engineering, focusing on energy storage and microgrid projects.

MR. SOMERS: Mr. Hoffman.

MR. HOFFMAN: Bryan Hoffman, the Operations and Maintenance Manager in Customer Delivery.

COMMISSIONER CLODFELTER: Great. Okay. If you

three gentlemen, now let's get you all -- get you introduced; now let's get you all sworn, and if you can do it at the same time, that'll save us some time. You've got four more?

MR. SOMERS: I do.

COMMISSIONER CLODFELTER: Let's do these three because we're going to have to move the Bible over to that table. So I want to do them in groups; that way it's a little more efficient. So there's a Bible there in front of you. If the three of you will put your left hands on the Bible and raise your right hand, please, all three of you.

MR. SOMERS: Or affirm.

COMMISSIONER CLODFELTER: You prefer to affirm?

MR. ABDELRAZEK: I just want to state I'm a proud Muslim, but I can swear on the Bible.

COMMISSIONER CLODFELTER: That's fine. Let's just have all three of you affirm. How about that? That works just as well.

(BRYAN HOFFMAN, ZACHARY KUZNAR AND SHERIF ABDELRAZEK WERE DULY AFFIRMED.)

COMMISSIONER CLODFELTER: Now you want to introduce your other four, and we'll get the Bible over there.

MR. SOMERS: Sure. Thank you. We'll start out with Mr. Bhagat. And if you would spell your name, please.

MR. BHAGAT: Sure. My name is Neil Bhagat, B, as in boy, H-A-G-A-T. I'm the Manager for our Distributed Generation engineering team.

MR. SOMERS: Mr. McNeill.

MR. McNEILL: Jack McNeill, Director of Asset Management.

MR. SOMERS: Mr. Lowder.

MR. LOWDER: I'm Will Lowder. I'm the Director of Distributed Energy delivery team.

MR. SOMERS: And Ms. Farver.

MR. FARVER: I'm Maura Farver, Distributed Energy Technology Strategy and Policy Director.

COMMISSIONER CLODFELTER: Well, let's just all do them the same way; that way we don't have to do multiple, so just we'll have you all four affirm, if that's all right.

(NEIL BHAGAT, JACK McNEILL, WILL LOWDER, AND MAURA FARVER WERE DULY AFFIRMED.)

COMMISSIONER CLODFELTER: Mr. Somers, you may proceed.

MR. SOMERS: Any other -- okay. Any other

preliminary matters?

COMMISSIONER CLODFELTER: I don't know unless you have some.

MR. SOMERS: I don't -- I do. I would like to -- as I noted, we do have some slides. I thought it would be helpful. We were trying to repetitive. As you noted, the background in this case, the Commission is aware of that, but we thought we would go through some slides to give a general overview of the project and then get into detail with some more topics. So I believe Mr. Kuznar is going to start with the first slide.

MR. KUZNAR: Great. Thanks so much for having us here today. We're excited to talk about -- give you an update on our microgrid in Hot Springs. So as you see, we've got a number of folks here who will touch on the different points we have, you know, touches a lot parts of the Company from, you know, our engineering group to operation and maintenance and, you know, our construction PMC or grid modernization group that's going to build the asset.

But it's kind of a natural progression in some of the microgrids we've been working on over the years. So some of you are familiar with the Mount Sterling microgrid. It's very similar. It's an inverter-based

microgrid battery and energy storage, where in that particular instance we're really just islanding one radio tower. And then we also have one in Charlotte, our McAlpine microgrid which Commissioner Clodfelter is familiar with, where in that particular instance we're using an inverter-based microgrid to provide backup power to one customer. It's just a fire station.

And so with this project it's, you know, again, scaling and becoming larger, where now we're pairing a much larger solar farm with a battery storage facility, and in this case we're going to island an entire town to provide backup power.

So with that, I just want to kind of jump in. You know, if you look at slide two, you know, this is really the Agenda we have. You know, project overview, talk a little bit about our involvement with the community, schedule -- the schedule update, talk a little bit about the operations, and then we are going to go into some detail on the safety. I know that was -- that was a question that came up just on the precautions we're taking from a fire -- fire protection standpoint.

And then we'll talk a little bit about the interconnection which Neil talked about. You know, it's different in the fact that this is an inverter-based

microgrid. It's not, you know, a traditional kind of gas turbine or coal plant, so talk a little bit about some of the evaluation that has to go in when studying that.

So if you jump to slide three, again, I'll go through this pretty quickly. You know, this is just some background to kind of level set everyone on the project. So we've got a 3 MW battery and 2 MW of solar which will be located at Peerless Blowers, which is located and found at Hot Springs. Or 3 MW DC/2 MW AC solar. The battery is about 4 MW. We've got a microgrid controller, so when you have these systems, you're putting your intelligence out really at the edge of the grid where decisions are going to be made and then kind of fed back into our local distribution control center which Brian will talk about in more detail. And then a number of other pieces of equipment, you know, your circuit breakers, different conductors, inverters, and the disconnect switches.

So if you look at the overall life of the asset, it's about -- the life of the asset is 25 years. Now, as part of that, with batteries, batteries will degrade over time, so after 10 years we build in the cost to replace those lithium ion batteries. And, again, you'll have a degradation over time similar to, you know,

with a cell phone or a computer, the longer you have it, the shorter the battery life is.

And, again, this is located --

COMMISSIONER CLODFELTER: Mr. Kuznar?

MR. KUZNAR: Yes.

COMMISSIONER CLODFELTER: I think we can hear you up here fine, but I have a hunch --

MR. KUZNAR: They can't hear me.

COMMISSIONER CLODFELTER: We can hear you okay, but I have a hunch that folks at the very back of the room might need you to have a little more volume.

MR. KUZNAR: Okay.

COMMISSIONER CLODFELTER: Okay.

MR. KUZNAR: I can talk --

COMMISSIONER CLODFELTER: That's great.

MR. KUZNAR: -- talk louder here.

COMMMISSIONER CLODFELTER: Very good. That's better.

MR. KUZNAR: Great. And so it's located at a 15-acre site in Madison County. It's going to be located -- we engaged the customer Peerless Blowers. It's a company that's located in Hot Springs, and they're very excited to participate with us, and gave us a land lease for this project which covers the life of the asset. Any

questions on the overview?

COMMISSIONER CLODFELTER: Just one question. If you don't mind, Mr. Somers, if it's okay with you, again, this is an informational briefing.

MR. KUZNAR: Yeah.

COMMISSIONER CLODFELTER: It's not a formal adjudication. So if the parties are okay with it, we'll take questions as we go. Now, maybe Commission questions as we go, but I'll give you guys a chance to ask your own questions in your own time, if that's all right, if that's acceptable.

MR. KUZNAR: Sure.

COMMISSIONER CLODFELTER: I do have one question for you.

MR. KUZNAR: Yeah.

COMMISSIONER CLODFELTER: On the -- just it's triggered by the fact that your replacement cycle for the cells, how far are you into the other microgrid projects that you've got going? How far -- how many years into those are you?

MR. KUZNAR: Right. It's a good question. So we've got most of our large grid-scale projects like this in other jurisdictions are basically just getting built right now. However, we've got like our McAlpine

microgrid is a -- that's been in operation for five or six years.

COMMISSIONER CLODFELTER: Right.

MR. KUZNAR: So the way these are designed, though, is we basically have a -- if you don't mind if I go into just a little bit of detail on this.

COMMISSIONER CLODFELTER: That's fine. What I was interested in was just sort of how -- what your experience is --

MR. KUZNAR: Yeah.

COMMISSIONER CLODFELTER: -- about where the cell life is holding up the way you're --

MR. KUZNAR: Right.

COMMISSIONER CLODFELTER: -- projecting it to hold up in your existing projects.

MR. KUZNAR: Right. I would say with our pilots it is. With these projects here, we work very closely with the battery vendor on the design on kind of the usage profile. So the one thing with the project -- with the technology we're using, you know, we work with very reputable companies, Samsungs of the world who, you know, design these systems to meet the cycle life that we show, because each one is unique, in a way, where, you know, you might operate this project differently than

we're going to operate another project based on the use case. So we're very -- on the design we work very closely with our manufacturers on that to ensure that we've got that. And we build in these available energy and availability guarantees when we're procuring the assets as well.

If you go to the next slide, again, really the next two slides, all this is showing, this is almost size wise an identical project to what we're going to be building in Hot Springs. So this is a very -- this is kind of a similar use case. It's located in Indiana and it's, again, in partnership with a -- with Camp Atterbury, which is a military base located in Indiana that we serve. And so it's very similar. We have land from them. The solar farm which you see on the first slide is almost exactly the same size, roughly, 3 MW DC and then 2 MW AC, similar to the size of this one.

And then the batteries as well, which are on the next slide, are 4 MW of lithium ion batteries, so you can see basically each of these containers contains 2 MW, so they each fit in about a 40-foot shipping container, so very small footprint for the battery.

And, again, similar use case, and this particular project is in a market so it participates in

the MISO frequency regulation market, but then during a grid outage, what this will be able to do is provide backup power to the military base, so it will provide them critical infrastructure with backup power. But from a size standpoint and the fact that it's going to island, it's almost identical to the Hot Springs project.

COMMISSIONER CLODFELTER: In the second slide there, is that what I -- is the battery -- what you have on the third slide, is that all I'm seeing in the upper right-hand sort portion of that second slide? Is that the battery installation I'm seeing there?

MR. KUZNAR: Yeah. Are you on slide five? Oh, yeah. Sorry. Sorry. That's the installation there.

COMMISSIONER CLODFELTER: That -- what I'm seeing on the slide, is that what I'm seeing, is the white area in the upper --

MR. KUZNAR: Right.

COMMISSIONER CLODFELTER: Is that --

MR. HOFFMAN: Yes.

COMMISSIONER CLODFELTER: Okay. That's what the battery -- the battery storage --

MR. KUZNAR: Yes. The upper right-hand corner there. That's right.

COMMISSIONER CLODFELTER: Okay.

MR. KUZNAR: And then the next slide is just kind of a zoom in of that. And, again, each of these containers, to put it in perspective, it's a -- it's like what you'd call a 40-foot container that you'd almost see like on a back of a truck.

COMMISSIONER CLODFELTER: Great. Continue.

MR. KUZNAR: And then really the last slide that I'm going to go through and then pass it off to Will to kind of go through some of the schedule is really, you know, we're -- as part of our -- you know, we've been very involved kind of up in the Asheville region as part of this Western Carolina modernization initiative, and so, you know, we've been up to the site a number of times. We're very engaged with that community.

And, you know, one of steps which Bryan will touch on is kind of the fire, kind of first responder training that will occur. These are different, but they can be dealt with safely, and so we'll be working very closely with the fire departments, as we do whenever we develop these systems. Very similar to how we approached it with McAlpine in Charlotte, which in that case it was right next to a fire station.

COMMISSIOER CLODFELTER: Right.

MR. KUZNAR: Okay. So what we want to do next

is really just kind of go through as the next step and go through kind of the schedule where things stand, kind of where they started from, and Will Lowder is going to walk through that for us.

COMMISSIONER CLODFELTER: Okay.

MR. LOWDER: Thank you, Zak. Good afternoon.

COMMISSIONER CLODFELTER: Good afternoon.

MR. LOWDER: I assume everybody can hear me. With my name, Lowder, I get accused of speaking loud all the time.

I just want to introduce myself. I am the Director of the distribution side of Duke Energy Project Management and Engineering team for construction and operations of our battery sites that will be connected to the distribution grid. And in -- I've been working with Zak's design team for energy storage since 2015. And in 2016 we did some studies in several of our jurisdictions, one being the Asheville region, to determine, first, opportunities for business cases that would bring benefits to our customers for battery storage or microgrids, battery plus solar. And Hot Springs microgrid was one of the very top ones for benefits to our customers, so we began to design that project as early as late 2016.

By 2017, March of 2017, as you see on the slide we submitted a design into our interconnection -- Duke's interconnection pipeline request into the pipeline. There is a long lead time, as you might know, for distributed energy, and we had to get them to the back of the line. And so --

COMMISSIONER CLODFELTER: We didn't know that.

MR. LOWDER: Yes. So we put our project into the back of the line early to hopefully have it ready with interconnect agreement by time we got to construction time.

Then we proceeded on with further developments of the project, finding an EPC vendor for engineering, procurement, and construction, because those skillsets are not readily available within the Duke Energy organization. These are specific skillsets that are within consulting firms at this time. We are fast growing those capabilities in our organization. But back in 2017, 2018 we were just starting.

COMMISSIONER CLODFELTER: Who is the EPC contractor for this project?

MR. LOWDER: For Asheville -- excuse me -- for Hot Springs it is Wärtsilä, which is a --

MR. HOFFMAN: Parent company of Greensmith.

MR. LOWDER: I'm sorry.

MR. HOFFMAN: Parent company of Greensmith.

MR. LOWDER: Yes. It is the parent company of Greensmith, but I was trying to remember what country they're from.

MR. ABDELRAZEK: Finland.

MR. LOWDER: Finland. Thank you. I knew it was Scandinavian. Thank you.

Eventually, we finished enough of the design and estimating, cost estimating and schedule -- and schedule estimating to submit our CPCN in October of 2018 to the Commission and then, again, continued to work on contracts and things of that nature, awaiting the CPCN to come forward -- approval to come forward.

In the meantime, in April of 2019, many of you know that there was a significant battery failure event at Arizona Public Service, at which a battery caught on fire, a lithium ion battery, which our sites are all lithium ion. A battery caught on fire. The fire was extinguished, but the batteries are still superheated and continue to create gas, which at a later point when the fire marshals and teams showed up and opened the door to the unit, there was an explosion.

We had built a lot of safety into our battery

designs at the time, and Sherif Abdelrazek, who is one of our key Ph.D. designers in the Duke group and DET, can share any information about that. But gas explosions really kind of caught us off guard, quite frankly, and so we immediately stopped what we were doing and said we have to go learn everything we can about what happened at APS and make sure that our designs can stop that from occurring.

And so we started that immediately. We hired American Fire Technologies to come in as a consulting -- utility fire consulting engineering group, and we built some or defined some new standards that Bryan will talk about in detail in just a few minutes.

Just after we started that process in May, the Commission provided Duke Energy with the CPCN Order to proceed with the project. And we, at that point, could have started construction; however, we chose to push off the start of construction or submitting the notice to proceed to our EPC Wärtsilä. We decided to push it off from March, which was what we had -- what we had supplied in our CPCN documentation as the start date for construction; we decided to push that off to July for a couple reasons. A, we could not -- we could not have done it any sooner than May when we got the CPCN Order --

excuse me -- but we were still investigating the APS issues, and we had come up with some designs that needed to be built into these projects, some additional safety designs that needed to be built into these projects, and with that we needed to negotiate -- renegotiate with Wärtsilä those items into the contract. So we decided to hold the project up, and before we started construction to go ahead and do that. We felt like that was prudent.

We had two projects in Indiana that were caught midway in construction, and we already found out we were going to have more cost to redo things that were already built, and we did not want to redo that in the Asheville -- excuse me -- in the Hot Springs project. So that was one of the, I guess, first delays that we had on the project, but for good reason, in our mind.

In July -- we chose to push the March date out to July for start of construction, and we did push -- and we did submit the notice to proceed in July to Wärtsilä, at which time they finished -- they began finishing the final engineering design, including all of the new safety recommendations that were in the contract.

The project continued on into construction after the engineering and -- excuse me -- I'm getting Asheville, Rock Hill, and Hot Springs mixed up. The

project got completed -- excuse me -- with a 90 percent engineering design. This is the design that is approved, and at that point you can begin construction. The EPC does a final design on the site, on the battery system itself. It goes through our engineering departments and is approved for construction as the final quality step.

At that point we were learning, along with Neil Bhagat and Jack here to my right, about -- more about what needed to be done to develop the -- to complete the system impact studies and the protection studies to connect this microgrid to our distribution grid. We had been going through a lot of learnings at Duke with inverter-based systems, and it is not something we have readily attached to our grid. You heard Zak speak about Mount Sterling, and we implemented that one in 2017, but that one is not connected to the grid, it's an island, so we didn't have these issues back in 2017 to deal with.

But Neil and his team had been working for quite a while, and it just -- it became obvious to us, because we were having engineering differences of opinion within our own organization, which were good -- good -- good give and take, push and pull, to make sure we do the right things for our customers and for the safety of our employees, and we learned that we needed to -- we decided

that we needed to redo our studies and pull in some additional expertise, consulting expertise, at which time we hired Pike Engineering to come in and help us relook at our system impact studies.

In doing this, we pushed our date for our interconnection agreement from August 2019 out to March of 2020. And I know that sounds like a long time, but what we were learning is that these studies took a long time, and because resources were very scarce with the right skillsets to do these studies, they had to be done linearly, and there were two projects at the time in front of the Hot Springs project that had to be -- that had to be completed with their studies first, so this pushed -- this pushed the Hot Springs project for interconnection agreement, final system impact interconnection agreement, out to March of 2020.

This all occurred in the November time frame. With this push in our interconnection agreement, the Hot Springs project construction which was ready to begin -- remember, I said a few minutes ago the 90 percent engineering had been approved -- was paused. We put it on hold. And we did this for a reason, a good reason, because we knew if we began to construct the site as engineered, as 90 percent approved, and the system impact

study found different protection and system impact designs that had to be incorporated, we could face a lot rework, a lot of removing what we had already done and rebuilding it, and that would have cost our customers more money to do that. So we decided to take a break and get our system impact studies done appropriately and then pick back up on construction when we were a hundred percent sure that what we were going to construct was the right -- was the right thing.

Our commercial completion date, which had originally been January 2020 submitted to the Commission, was at that time pushed out to September of 2020. And in our January filing, that's the information we had, and we shared a September 2020 completion date of -- construction completion date with the Commission.

In the last month, month and a half, mainly late January into February, we have continued with our learnings. We've pushed Hot Springs up in the schedule to try and move it along faster, but we've also found that our system impact studies, because of our -- because of the newness to us, are taking longer than we expected, and so our commercial operations date that we believe will be achievable, as we speak today, is December of 2020. So we have -- we have shifted it from September of

2020 to December of 2020, which is on the map there -- on the chart here on -- there on the screen.

We do believe this date is very achievable. We have all of our executive leadership behind us to make this date and other dates that are critical to other sites, like the ones in Indiana that are being constructed generally at the same time, but we do run some risk for that date. The system impact study for Hot Springs is underway, is in the middle, and if they find something, those engineering studies find something that requires us a more lengthy construction than we expect, i.e., a long lead time piece of equipment that takes four months to get once you've ordered it, that happens sometimes, then that December date could be in jeopardy. We don't expect that to occur, but it's a possibility.

The other thing that we may face is this pushes our construction end into the bad weather in the mountains in the Asheville area, and weather could become a smaller delay, though it could push our December date into the first of the year.

That's the information I have to share with you on how the project has progressed from a schedule perspective. I'll be glad to answer any questions.

COMMISSIONER CLODFELTER: Another member of

your team is going to talk about -- specifically about interconnection issues?

MR. LOWDER: Absolutely, in detail, yeah. I meant to say that, sir.

COMMISSIONER CLODFELTER: Yeah. We've got -- may have a couple questions on that that we want to pursue. We'll leave them for whoever --

MR. LOWDER: Absolutely.

COMMISSIONER CLODFELTER: -- is going to address that. Commissioners? Yeah. Okay. You guys roll on. As I say, I'm going to give Ms. Downey and Mr. Ledford a chance to ask you questions, too, but we'll let you go on through.

MR. LOWDER: Thank you.

MR. ABDELRAZEK: All right. So I believe this is my portion of the presentation. So I'll be going over the design aspects of the Hot Springs microgrid. So first what I'm going to do is I'm going to just give an overview of the figure you see in front of you on the screens, and then I'm going to talk about how the microgrid is intended to operate in grid parallel mode. And grid parallel means that our asset is connected to the grid, both the battery and the solar, and injecting power directly into the Duke Energy grid where it's

interconnected.

Then I'm going to talk about operation in island mode, so how does the system operate when we isolate the Town of Hot Springs from the rest of the utility grid and feed them power directly from the battery energy storage system and the solar system.

So to begin, if you look at the figure where it says Hot Springs substation there, that is the substation located near the Marshall hydroelectric plant. The line between that plant and the Town of Hot Springs is approximately 11 miles. The line is an overhead line. It traverses very heavily vegetated land, mountainous terrain, and thus will exhibit a more than usual, more than normal number of outage events or faults that result in the Town of Hot Springs losing power.

The microgrid itself is located very close to the Town of Hot Springs. Both the battery and the solar facility are co-located, connected at the same point of common coupling, the point of interconnect. The solar --

COMMISSIONER CLODFELTER: There's a single point of interconnection? They're not separately --

MR. ABDELRAZEK: Correct.

COMMISSIONER CLODFELTER: -- interconnected?

MR. ABDELRAZEK: It's just one point of

interconnect, but they are both connected through separate inverters. So this is what's called AC-coupled solar-plus storage system, so each system has its own inverter.

As many of you may know, the solar inverters are only unidirectional; power goes one way from solar panels into the grid. The battery inverters are bidirectional. That means power can go from the grid to the battery, thus charging it. And the power can go the other way around from the battery to the grid, thus discharging it.

Any questions about the figure itself, understanding the infrastructure that we're building? Okay.

So in grid parallel mode, the thought is and the strategy is to have the solar facility inject all the solar power that it is collecting based on the radiant temperature in real-time unless there is a system constraint, be it a cable thermal constraint, a transformer thermal constraint at the substation, for example. In that scenario the battery system will charge excess solar. Okay. So in that scenario the energy wouldn't be lost; it would be, rather, stored in the battery system for either the town to use it later on or

the general Duke Energy grid to benefit from it.

Now, to kind of explain more on when the battery is charging from the solar and when it's charging from the grid, it really depends on the real-time power dispatch, both from the solar and from the battery. So at any point the battery system is charging, and the solar production is greater than what the battery is discharging. So let's say the battery is charging at 1 MW and the solar facility is producing its maximum capacity of 2 MW, or 1.85 to be exact, then all of that power will be coming from the solar into the battery system. The full 1 MW that the battery is charging is going to be coming directly from the solar.

Now, in the event where there is -- the battery is charging -- is charging less than what the solar is producing, the rest of that solar production will be injected into the grid. Does that make sense? Any questions on that point?

COMMISSIONER CLODFELTER: So the solar production generation charges first to the battery if the battery is charging, and any excess then goes to the grid secondarily?

MR. ABDELRAZEK: Yes.

COMMISSIONER CLODFELTER: Right.

MR. ABDELRAZEK: If the battery system is charging, yes. And there could be a scenario where the battery is not charging at all, so it's at zero, so all the solar production is going into the grid.

COMMISSIONER CLODFELTER: Right. Commissioner Duffley?

COMMISSIONER DUFFLEY: So who determines when the battery is charging and when it's not charging?

MR. ABDELRAZEK: We have partnered with a top tier controller manufacturer, Greensmith, after a very thorough RFP event I think back in 2016. Right, Will?

MR. LOWDER: (Nods affirmatively.)

MR. ABDELRAZEK: And they have designed a local controller for us that will be used in all of our sites, Camp Atterbury, Nabb, and Rock Hill and Hot Springs, and that is the controller that will be controlling automatically how the power is getting dispatched. So the controller basically has a set of applications that the operator will choose from, and based on that selection, it would operate autonomously. If there are no further --

COMMISSIONER CLODFELTER: But let me pursue that a minute just, again, to understand, because these are more technical concepts than this lawyer is

accustomed to dealing with on a regular basis. So let's suppose that we're in a situation where you're not islanded, you're not in an island situation, and so you're able to transmit to the grid from solar and you're at a period of peak load where the grid says I can take all the solar you want, and it's a sunny day and you're in peak hour, and the grid wants all the solar you can get, who's got priority if the battery needs to be in a charge state?

MR. ABDELRAZEK: So if the battery -- they are independent.

COMMISSIONER CLODFELTER: They're running independently?

MR. ABDELRAZEK: Independent.

COMMISSIONER CLODFELTER: So if the grid controller says I want that solar, but the battery says I want the solar, who is making the decision?

MR. ABDELRAZEK: So, again, they're independent, so the battery system will basically operate based on the use case. It is intended to. So one of the primary use cases that we're intending for this battery system is to provide frequency regulation for the bulk system, right? So in that scenario it will be operating, both charging and discharging based on the ramp rate

needed by the system based on the frequency, BAAL, CPS1 score, these grid control parameters. If it just so happens that while the battery is charging, the solar was producing, that charge will be collected from the solar, not from the grid.

COMMISSIONER CLODFELTER: Okay.

MR. ABDELRAZEK: So you're getting the energy that you needed from the solar because it's an uncontrollable resource. You just -- as a grid operator you want to benefit the ratepayer from that energy because you're not going to burn fossil fuels if you get that energy from this asset, and you're getting also the benefit from the battery system by it providing its ancillary service of frequency regulation.

COMMISSIONER CLODFELTER: Okay.

MR. ABDELRAZEK: So moving -- and then, I'm sorry, it's a bit complicated, and I wish I had more time to dig in -- more into details, but it, you know --

COMMISSIONER CLODFELTER: Take as much time as you think would be helpful. Don't worry about time. Commissioner Duffley?

COMMISSIONER DUFFLEY: But I just want to confirm that this is all automated based on settings that Greensmith --

MR. ABDELRAZEK: Correct.

COMMISSIONER DUFFLEY: -- has indicated for the system.

MR. ABDELRAZEK: Correct.

MR. LOWDER: Sherif, can I add something?

MR. ABDELRAZEK: Oh, please.

MR. LOWDER: I'm very sorry. Yes. The answer to your question is yes. Generally, the majority of the time is that way. However, Bryan is going to cover the distribution generation operations center shortly, and from his op center, if we see a major storm coming toward Hot Springs and we know we need that battery for reliability, his team can reach out to it remotely from downtown Charlotte where the center is and tell that battery to charge and be ready for this storm by 7:00 p.m. or whatever.

So we do have the ability to prioritize reliability, and we will do that. And eventually we will use weather information to automate that process to say -- the weather information will say there's going to be a big storm here, higher likelihood for outages, and it will trigger that automated site to make that change in its schedule on the fly.

So I just wanted to -- I wanted to point out we

can control it manually.

MR. KUZNAR: Yeah. And Commissioner Clodfelter, your point about the peak, like one of the applications we could use it for, and that's the nice thing about the flexibility is we could push all the solar and then everything in that battery to the grid at the same time. So you could -- you know, depending on what use case you need, it's what application you're going to use.

MR. ABDELRAZEK: So one of the reasons we're working with one controller manufacturer is because as we develop more sites, we're adding more use cases or applications, application logic into that controller, so we want to be able, as we build more sites, to implement any application we already implemented in past sites.

So we talked about the primary use case being frequency regulation, but if needed, let's say four years from now after it's been operating for four years, the load of the Town of Hot Springs become peaky, and as a utility we would normally just upgrade the substation transformer. They would need a bigger one. We could use the battery to provide a peak load shaving application to defer that upgrade to the future, thus benefiting the ratepayer at the end by reducing the cost of operation of

the distribution system.

And to the point that Will mentioned, that, yes, the -- that was one of the points in the islanded operation piece, and I'll touch on that in more detail.

But before I talk about that, one of also the other secondary kind of functions that the -- our controller will be doing is trying to reach a 75 percent ratio of charge of the energy storage system from the solar to try and get the 30 percent ITC for the battery system, thus reducing the cost of the system for our ratepayers. So we have a very flexible tool. We're trying to use it to the best of its functionality.

COMMISSIONER CLODFELTER: Seventy-five percent is the number you've got to ring in order to qualify for the ITC?

MR. ABDELRAZEK: In our -- yearly, yes, in order to qualify. So as the system is operating, our controller is constantly calculating how much energy was charged from the grid versus from the solar. And as time progresses, the state of charge is being steered so as to try to maximize that percentage to reach by the end of the year that 75 percent mark. All right.

COMMISSIONER DUFFLEY: I had a quick question about the state of charge. So I take it, it's

fluctuating based on the parameters set or is there a certain amount, you know, 50 percent, that you're trying to keep the battery, because I know you mentioned when a storm is coming in, you want it to be 100 percent fully charged.

MR. ABDELRAZEK: Uh-huh. So we have been working with Greensmith to implement an algorithm that will work in conjunction with our meteorological team's automatic service and detection of inclement weather for each region our battery systems are. So as Zak explained, we have a system just like this in Camp Atterbury, so if there's a hurricane or a snowstorm in Indiana, we want our batteries to be prepared for the benefit of Camp Atterbury.

Similarly, here, when inclement weather is detected, the intention is to have the system automatically perform its function, but at a higher state of charge, which means while you may not use the entire system for its fullest potential for frequency regulation, but you're performing that function while ensuring that if that unplanned outage occurs, you have enough energy to prolong the time of backup for the Town of Hot Springs to the fullest extent.

So, of course, in island mode how will the

solar be operating? So in island mode, basically if you look at the figure -- if you look at the figure, that -- where it says Islanding SW, that means islanding switch. So that switch will basically be open, thus isolating the Hot Springs town with the microgrid, and the battery system will start up, thus providing power to the town. And shortly after, in the order of a couple minutes, the solar inverters will come on if the sun is up to maximize the amount of energy that can be delivered to our customers.

So if the power from the solar is greater than the load of the Town of Hot Springs, that will mean the batteries will start charging while the Town of Hot Springs is being fed. So really, it's a combination of how big is the town load and how much is the solar producing at the time of the outage that will dictate how long of a backup time we will be able to provide to the Town of Hot Springs.

And just to put things into perspective, the average power of the Town of Hot Springs over the period of 2015 to 2018 was 1 MVA, all right, for that specific period. The maximum power for that period as well was 2.8 MVA. Our battery system is 4.4 MW at -- that is 4.4 MWh. And we are sure, or we have performance guarantees

from our manufacturer, that guaranteed us that it's not like your cell phone, you're going to start with 4.4 and by Year 12 you're going to have less. We actually have actual cell count 7 MWh in the cells, so that we're starting off with 4.4 MWh, Year 12 we will have 4.4 MWh. The only difference is that 7 MWh will degrade over time, but we will always be guaranteed 4.4 MWh at the point of interconnect that the town can benefit from. Any questions?

COMMISSIONER CLODFELTER: So while you've anticipated, I think maybe anticipated something I was sitting here wondering about, is when you don't really know how the battery is going to run an operation, how you're really going to be able to predict life cycle and cell degradation, but you've really done that by oversizing, right?

MR. ABDELRAZEK: Correct.

COMMISSIONER CLODFELTER: Essentially oversizing.

MR. ABDELRAZEK: Correct. And we've spent a significant amount of time with our -- that's a very good question because we've run into this issue where most of the systems that are being installed out there, you have one specific function that you're performing, and you

guarantee to your manufacturer that you will perform this every day, you will not do anything different.

COMMISSIONER CLODFELTER: Right.

MR. ABDELRAZEK: In our case, we're trying to use these systems to the fullest of their capability, so we had to work very hard with Samsung to get what we call flexible performance guarantees. So if we deviate from a most likely profile that we shared with them, we would not lose our performance guarantee. We'd only -- we would rather be -- we would just get less usage as we go on. And we built our base case profile on a very, very conservative case, where we are using the battery very hard so that we're absolutely sure that we will be able to use this system for any ancillary service we anticipate in that specific site for the entirety of the 12 years we have an energy guarantee over.

COMMISSIONER CLODFELTER: Is this the way you designed the other facilities in Indiana or is this --

MR. ABDELRAZEK: Yes, sir.

COMMISSIONER CLODFELTER: -- is this something you're experimenting with on this one?

MR. ABDELRAZEK: No. This is the exact same thing we did for --

COMMISSIONER CLODFELTER: The same --

MR. ABDELRAZEK: -- for Camp Atterbury.

COMMISSIONER CLODFELTER: Yeah.

MR. ABDELRAZEK: It took us nine months to finish that contract. It was hard.

COMMISSIONER CLODFELTER: Keep going.

MR. ABDELRAZEK: All right. Thank you. So at this point I'll turn it over to Bryan Hoffman.

MR. HOFFMAN: Thank you very much. All right. So I'll continue the discussion on the operations. Once the site is built, we'll have the batteries. The red circle there on the left kind of refers to where they're located at Hot Springs. That will also hold the power plant controller, so we mentioned that previously with Sherif, the PPC. That will speak to the fleet director. So when we say the GEMS Fleet Director, that refers to the Greensmith Energy Management System Fleet Director.

There will be one of these in each jurisdiction, and they are located on servers on Duke Energy's network so that is how we will speak to those sites. And each jurisdiction will have a production server and then a QA or development server, so it's kind of like a backup for each fleet director. That system will speak to the Distributed Generation Operations Center, so this will be located in Charlotte at 400 South

Tryon, and we will be able to speak to really all sites across all of our jurisdictions, but in this example we'll speak directly back to Hot Springs.

We will monitor that site 24/7. We have a 1-800 number that's been dedicated to our operations center. If there are any issues from the public, they can call us. We -- you know, we refer to the use cases or the rule engines. That's where we will have visibility into the site. It will be autonomous, but we can change it into manual mode if we deem fit.

And we are in constant contact with our Distribution Control Center. So they're the grid operator. They would be in concert with us on if we were to take it out of autonomous mode into manual mode, when should we do it, why should we do it. So we will have control of the facility, but most of the time it will run autonomously through the fleet director back to the PPC which holds the logic for the site.

So I said a mouthful there. I'll just pause for a second. A relatively simplistic view of how we will run the operation side of this program.

COMMISSIONER CLODFELTER: Well, help me again --

MR. HOFFMAN: Yes, sir.

COMMISSIONER CLODFELTER: -- because this is the area that's probably the least familiar to us here on the panel. So when the facility is operating in islanded mode --

MR. HOFFMAN: Uh-huh.

COMMISSIONER CLODFELTER: -- would that be predominantly -- would you be running it manually then or would that be predominantly automated?

MR. HOFFMAN: No. So --

COMMISSIONER CLODFELTER: That would be almost all automated.

MR. HOFFMAN: Yes, sir. Uh-huh.

COMMISSIONER CLODFELTER: When it's islanded, you would -- would there be any ability or any reason why you would want to manually override?

MR. HOFFMAN: No.

COMMISSIONER CLODFELTER: If it's islanded, you wouldn't want to touch it?

MR. HOFFMAN: It's doing its thing. So I'll make another -- the DCC always has --

COMMISSIONER CLODFELTER: Yeah.

MR. HOFFMAN: -- control authority --

COMMISSIONER CLODFELTER: Right.

MR. HOFFMAN: -- of the DER recloser, so --

COMMISSIONER CLODFELTER: Right.

MR. HOFFMAN: -- distributed energy resource recloser.

COMMISSIONER CLODFELTER: Of course.

MR. HOFFMAN: So they will open and close, as preprogrammed, to island.

COMMISSIONER CLODFELTER: But there really wouldn't be any reason for as long as it needs to be islanded for you to mess with it at all.

MR. HOFFMAN: No, sir.

COMMISSIONER CLODFELTER: It's going to operate a hundred percent automated.

MR. HOFFMAN: Correct.

COMMISSIONER CLODFELTER: Yeah. Okay.

MR. HOFFMAN: That's what it's meant to do. Yeah.

So, again, the DCC being the grid operator will function more as the generator operators most of the time running autonomous mode, but we have the ability to change the rule engine, if necessary, out of our operations center in Charlotte.

And then as future sites are built, of course, they would all speak back to the fleet director, back to our op center, and the program will just continue to

grow.

COMMISSIONER CLODFELTER: What's the capacity -- how many additional sites can the fleet director you're going to have here, how many additional sites?

MR. HOFFMAN: The servers are very powerful.

COMMISSIONER CLODFELTER: So you don't really foresee any bumping up against any limits in the number of sites you have?

MR. HOFFMAN: No, sir. There's, again, one in each jurisdiction, so Carolina being two jurisdictions, and there's a production and a backup for each jurisdiction, so --

COMMISSIONER CLODFELTER: Yeah. Commissioner Duffley. Sure.

COMMISSIONER DUFFLEY: So when -- how do you course correct, because as I understand it, the logic is maybe the most difficult part --

MR. HOFFMAN: -- of the integration of the system.

COMMISSIONER DUFFLEY: And so are you working with Greensmith, and if you feel like you don't have the logic quite right, I mean, you course correct? Could you just describe that process a little?

MR. HOFFMAN: Sure. We are all learning as we

go. Greensmith is very mature with their platform, which is one of the reasons we picked them, but we will most likely adjust the rule engines as we get into operational mode activities, have some run time. In addition, Sherif mentioned some algorithm development that we're using to supplement what Greensmith can do for us. So, yes, we will learn and adjust as we go. I like to say we're going to crawl, walk, run, on purpose because we do not want to, you know, make a mistake, and we want to learn as we go. We know we're going to stub our toe a few times, but that's okay, so --

Okay? So -- okay. We'll step into some of the safety enhancements that we've made at the site. So we learned a lot from the event at APS, Arizona Public Service. We've proactively taken a lot of multiple design steps to incorporate that into our design.

So the first bullet here, when we talk about early detection of abnormal voltage, temperature, or system defect, that really refers to the BMS, so the battery management system at the site is monitoring really the site and the batteries to make sure they stay in a safe condition. We call them guardrails. They will operate the batteries within a certain set of guardrails or constraints.

In addition to that, we have added a Li-ion Tamer system. So it's a combination of lithium ion, we call it Li-ion Tamer. That's the brand name of the system. This is an off-gas detection system, so it will really detect dangerous conditions inside the container that may be the BMS mist, but if the BMS misted, the Li-ion tamer is there in concert with the BMS to shut down the system. So that's one additional safety design that we've put in.

The HVAC units normally used to cool the containers will be used to expel a buildup of gas, so they'll vent to atmosphere in the event that they're told to do so by either the BMS or the Li-ion Tamer. So that's another safety enhancement we've made.

We do have a fire suppression system. It's the 3M Novec 1230 fire suppression system, so that is there to prevent exactly what -- to smother any electrical fires.

We've also installed dry standpiping. So this is piping that will daylight inside the container and it will start out at the fence line of the facility, so in the worst case scenario, a first responder is able to flood the container with water to really remove heat during the thermal runaway of the batteries. So that's

another enhancement we've made there.

And we've also installed --

COMMISSIONER CLODFELTER: And if I understand, they're able to do that without entering an enclosed area?

MR. HOFFMAN: Yes, sir.

COMMISSIONER CLODFELTER: Yeah.

MR. HOFFMAN: That's to purposely --

COMMISSIONER CLODFELTER: Right.

MR. HOFFMAN: -- keep them at the fence line --

COMMISSIONER CLODFELTER: Right.

MR. HOFFMAN: -- to keep them safe. Yes, sir. We also have deflagration panels. So these are panels located in the ceiling of the container that if pressure were to build up, that is where a gas or a pressure event would expel first, so really up towards the sky. That is the safest location for that pressurized energy to go. So we're installing those as well.

Another -- I'll mention this. The physical layout of the container, we access the batteries from the exterior of the container. Previous designs in other applications you would enter the container to access batteries from the inside. We access them from the outside, so another physical barrier that we have there.

So we meet with first responders and firefighters proactively well before the site goes into operation. We've met with first responders at our other facilities multiple times. I'll mention Asheville, Rock Hill. That's a site located up near Asheville. We've already met with first responders twice. That site is not operational yet, but they've already been to the site twice, walked it down. We have educated them. And I'll highlight, we've actually created a brochure that we hand out really to anyone, but meant for first responders. In the event they were called to the site, they would know what to do. We stay in constant contact with them, so every year we'll brush them up on what we've learned, what they've learned, and if we need to change anything.

We have established emergency response plans, so ERPs, which is a programmatic approach to how we deal with catastrophic events. There's an EAP at each site, so an emergency action plan, that if someone were to be located onsite, which normally there is no one onsite, but if there were, it's posted very clearly on the exterior of the building of what they should do in the event of an emergency. And we also, again, have the brochure that we hand out to folks, so a number of documentation that we're developing to make these sites

as safe as possible.

And so the way we got here, we've partnered with lots of different folks across the industry to try to learn what we could. So AFT, I'll highlight them, American Fire Technologies. They are one of our consultants we use that we -- we've used to increase our fire safety spec. So they've helped us increase the spec that we go out for RFP, and it's really been borne out in all the items I discussed on the top of the slide, all the additional enhancements that we've made.

We also partner with industry, so we brought Li-ion Tamer, or Nexceris is their company, to our research development facility in Charlotte on the first generation of Li-ion Tamer. And so we learned -- they learned, we learned from that, and we actually have Generation 2 now installed in our containers, so another way we're learning together as an industry going forward.

We're very involved with the standards and codes development organizations across the whole country. We attend conferences quite often. And not just one of us, but many of us go on a routine basis. And we also work with Samsung. They're our main manufacturer, but we're in constant communication with them on what safety testing are they doing and how can we help them enhance

those features, so --

So, again, I ran through that quick, but I'll just pause if there's more safety questions you'd like to --

COMMISSIONER CLODFELTER: Who provides fire coverage in the area? Is that the town or is it a volunteer department, or what?

MR. HOFFMAN: Well, there are combinations.

COMMISSIONER CLODFELTER: Combinations.

MR. HOFFMAN: We always seek -- usually, there's both, and we always seek out the volunteer folks as well as the paid professionals.

COMMISSIONER CLODFELTER: And so you provided the training to all of the organizations in the region there that would respond, the first responders?

MR. HOFFMAN: Yes. We ensure --

MR. ABDELRAZEK: We will.

MR. HOFFMAN: Right. Not at Hot Springs yet because we haven't started, but our other facilities we canvas the area to ensure to the best of our ability we've covered any first responder that could go to site.

COMMISSIONER CLODFELTER: Are there any special equipment needs that the first responders would need to have in order to respond to an emergency at the site?

MR. HOFFMAN: No. We actually tell them to stay back.

COMMISSIONER CLODFELTER: Okay.

MR. HOFFMAN: Batteries are unique in may ways, as we already know, so normally we tell them to -- and there are signs, large signs, posted right on the gate do not enter the site without really contacting our operations center. And we have that 1-800 number placard right on the gate. So we do not ask them to go in unless they are told by a Duke Energy representative, is what we instruct.

COMMISSIONER CLODFELTER: So there would not --

MR. HOFFMAN: And that's what's said in here (indicating brochure).

COMMISSIONER CLODFELTER: It would not be a situation in which the fire department would be the one who actually executed the suppression unless Duke had said you guys go do it?

MR. HOFFMAN: Correct.

COMMISSIONER CLODFELTER: Okay.

MR. HOFFMAN: Unless instructed, we pretty much tell them to stay away. Yes, sir.

COMMISSIONER CLODFELTER: With respect to the -- sort of the safety standards that you've followed and

the design considerations, how -- at a very high level because, again, we're not really expert in the details of this, but how --

MR. HOFFMAN: Sure.

COMMISSIONER CLODFELTER: -- would you compare those to the standards that are in NFPA 855?

MR. HOFFMAN: Interesting question.

COMMISSIONER CLODFELTER: At a high level.

MR. HOFFMAN: We follow that very closely. We have tried -- again, AFT is one of our main consultants. We've tried to incorporate all of their learnings, all of -- you know, I know the gentleman at APS. I've had many conversations with him. We are trying to incorporate every piece that we feel is prudent into the design of these systems. NFPA 855 is a little political, I won't really go into that, but we are incorporating everything that we feel is prudent in that document.

COMMISSIONER CLODFELTER: Well, I've got to tempt you to go into it a little bit because the question I really want to explore with you is -- and if you're not prepared to or don't want to answer today --

MR. HOFFMAN: No. Well, what I can -- yeah --

COMMISSIONER CLODFELTER: -- the question -- let me get the question out, just is -- if this is not

the appropriate time, that's fine, but I think we have some interest in knowing whether -- what the Company's view is about whether we are not -- we ought to take a look at NFPA 855 as a standard in North Carolina and whether there is a need for such a thing or not. And we don't know if the Company is prepared to take a position on that this afternoon, but it is a topic -- let's just leave it out there for this afternoon -- that's a topic of interest to the Commission, is do we need to actually have an adopted standard and, if so, what does the Company think that ought to be, so maybe you don't want to talk about that today, but it's something that's occurred to us.

MR. HOFFMAN: Right.

MR. LOWDER: So there's many more than -- at Duke other than us that are involved in that, so we can --

COMMISSIONER CLODFELTER: I understand that.

MR. LOWDER: -- circle our wagons and bring our opinions.

COMMISSIONER CLODFELTER: Let's leave it at that this afternoon, then. I think that's sufficient. You know the question that's out there, so we'll leave it at that.

MR. KUZNAR: I would say, though, to what we talked about so far, is we've adopted a lot from NFPA 855 that we thought was prudent for these systems, but like we said, we could take it up, get our experts and -- on the fire safety and really explore this. I think that would be good.

COMMISSIONER CLODFELTER: Great. Okay. Keep going.

MR. HOFFMAN: Okay. I believe that is the end of mine, and I will turn it over to Neil, please.

MR. BHAGAT: All right. Good afternoon.

COMMISSIONER CLODFELTER: Good afternoon.

MR. BHAGAT: So we're going to talk a little bit about today the interconnection piece, specifically around the engineering and the system impact study.

So you're heard a lot of folks talk today. You know, microgrids, they're pretty new. We are learning tons as we're going through the engineering studies and the simulations. You add to that the fact that Hot Springs is an inverter-based microgrid, so that means that there's no spinning machine or rotating mass that's there to provide inertia. And the other piece to that adding to the complexity is that this is actually powering a town, so the electrical characteristics of the

network are a little bit more demanding in terms of doing the simulations and the studies. So all of this with microgrids is in contrast to traditional generation and traditional grid operations that we've seen.

Sherif mentioned that there's two operating modes of the microgrid. One is grid connected and one is an island. So we start getting into the more complex studies when we go into islanded mode. And so what we are trying to do when we go into the islanded mode is look for various fault scenarios that can cause the equipment to either perform incorrectly, or potentially even look at when you do have an outage, does that fault potentially impact any of the workers that are in the network working on the equipment. A fault, in general, is an electrical imbalance, so the traditional protection relaying schemes that are there to detect these electrical imbalances don't always work the same way when you have inverter-based microgrids.

So the studies that are listed here in power flow, protection, stability, power quality, we have to do to make sure that these faults are detected, they're isolated, and that the grid can run properly when it's in islanded mode. And islanded mode is really grid resiliency. It's driving grid resiliency. When you're

in islanded mode, that piece of the grid has to work correctly. So these studies here ensure that the grid is working -- that the asset is working correctly and it reduces the risk of injury to anybody that's working with the actual equipment.

So I'll pause there to see if there's any questions on that.

COMMISSIONER CLODFELTER: Chair Mitchell.

CHAIR MITCHELL: Help me understand just -- the typical interconnection study wouldn't look at an asset being in islanded mode, would it?

MR. BHAGAT: It would.

CHAIR MITCHELL: It would? Okay.

MR. BHAGAT: Yeah. So for these microgrid projects we have to assess both parallel operation as well as --

MR. ABDELRAZEK: I believe she's referring to historically.

CHAIR MITCHELL: Right. Any type of -- so any type of distribution tied resource wouldn't be looked at -- I mean, I understand you have to look at a microgrid in an islanded scenario, but it's unique to microgrids, right?

MR. BHAGAT: This is unique to microgrids --

CHAIR MITCHELL: Yeah.

MR. BHAGAT: -- so other assets wouldn't really island.

CHAIR MITCHELL: And is that the reason why you guys have had to work on the study process, you've seen --

MR. BHAGAT: Yes.

CHAIR MITCHELL: Okay.

MR. ABDELRAZEK: At a high level, if I may add, there's two main new things here. I mean, we're Duke Energy. We have, I think, close to 2 GW of solar on our grid, so we know distributed generation. But there -- at a very, very high level there's two new things. One, that you actually can now operate as a load, right? Solar can just produce, inject power into the grid, right? Two, that now you're isolating from the grid, disconnecting yourself, and feeding actual customers, energizing overhead lines from an inverter-based resource which is, of course, very, very different from being connected to a firm -- you know, in electrical engineering education we call it an infinite bus, because you're connected to hundreds, even thousands of generators that are all working at the same frequency.

So you can imagine the difference between that

state where it's just all one system connected electrically, and now you disconnected a very, very small portion of it and you're feeding it locally. So all the relays that are, I mean, downstream of that point of interconnect within the Town of Hot Springs, we have, I think, four or five relays that are all based on seeing the fault current from the grid, the infinite bus. Now they're seeing fault current in the event of a fault from two inverters, two very sophisticated, very cutting-edge inverters, but still, it's different.

So that's, you know, at a high level two of the things that are contributing to the novelty of these studies and why it's been challenging. And sorry.

MR. BHAGAT: No. That's great.

MR. LOWDER: I want to make a point to add on to what Neil and Sherif have said. And Neil mentioned that the -- you know, protecting the assets from fault conditions where you can get imbalance of voltage and current and burn up a transformer or burn up a piece of switch gear, and that costs money. But at the same time, our traditional system today that we've all lived with our entire lives, when something goes wrong, we have protections that turns the system off so that our folks don't get hurt or the general public can't get hurt, and

that's the way it's designed.

We have to make sure when we're feeding that neighborhood with inverter-based energy that when something happens to the grid out there while it's being fed from that microgrid, that the same protections are in place, and it's harder to do. And that's what's taking us a long time, to learn how to make sure that our equipment is safe and that our customers are safe and that our employees are safe because they could well be out there working on those lines when we're in islanding mode.

COMMISSIONER CLODFELTER: Okay. Commissioner Duffley. Sure.

COMMISSIONER DUFFLEY: So could you try to explain it as best to a nonscientific person, why is it harder? You know, I hear the importance of we need the protections to work for safety reasons, but why is it harder in islanding mode?

MR. BHAGAT: So you're -- when you're in an island, your traditional fault current, your electrical imbalance when you don't have a spinning machine is much lower to detect. So you could -- and, you know, the relays, the set points, aren't sensitive enough to always pick up that there's an imbalance in that -- in your

island. So then that could continue feeding and feeding and feeding until the asset has an issue or if somebody else gets hurt.

COMMISSIONER DUFFLEY: Thank you.

COMMISSIONER CLODFELTER: Continue.

MR. LOWDER: Again, it's not that we can't do it. We are doing it. But I would say it's the first time we're doing it, so we have lots of questions to validate to ourselves that what we have done is accurate and correct and that we're ready to go forward. That's what's, in my mind, driving our timelines. We're not rushing through this on purpose.

MR. BHAGAT: So -- yeah. So we're putting in the correct parameters to detect that low-fault current.

COMMISSIONER CLODFELTER: You guys can continue.

MR. SOMERS: So I think on this last slide, before we go to any further Commission questions, just wanted to highlight for the Commission sort of from our perspective the next steps in reporting. Obviously, the timeline has shifted. You've heard that today. You heard that -- read that in our report. And, you know, I'd be remiss if I didn't express our -- you know, the fact that we -- you know, we certainly wish that the

original report we had filed met the Commission's expectations, and so we hope by filing the revised report and certainly appearing before you today, we have addressed those questions and you have a better understanding of how the project is progressing and how we plan to operate it.

Part of the Commission's CPCN Order included these two progress reports that I want to take just a minute to discuss. One of them is that -- and this was part of the Stipulation among the parties that we submitted to the Commission and was incorporated in the CPCN Order, is part of this obviously as a pilot project is to gain learnings and to present those in a report so that the Commission and the Public Staff have that operational knowledge, but because the operational -- commercial operation date has now shifted to estimated December of 2020, we just wanted to confirm that our plan would be to submit that report 12 months after the microgrid goes into commercial operation.

If we submitted a report on the annual timing of the CPCN Order, which was May, we would have roughly five months of operational information, and our -- in talking with our experts on our team, they believe that having a full year's worth of data and information would

be more beneficial, and so we just wanted to put that in front of the Commission and get any feedback from the Commission on that timing.

COMMISSIONER CLODFELTER: Well, on that point I don't have the actual CPCN Order in front of me, so my question back to you is are you suggesting to us we need to do -- if we were to agree with your position on that, would we need to modify the Order or is it going to self-execute the extension?

MR. SOMERS: I'll represent to you, and I'm reading from the CPCN Order now --

COMMISSIONER CLODFELTER: Okay.

MR. SOMERS: -- that on this condition it said to annually report, update, and file with the Commission -- I believe it's on the screen, too -- to the Public Staff the results of its operational knowledge to demonstrate operational benefits, and it details what those are. It was not specific to the commercial operation date, which this 15-month study that we'll talk about next was specific to commercial operation date, so we -- out of an abundance of caution, we just wanted to make sure we were meeting the Commission's expectations, and we would interpret that to mean 12 months from when it goes into commercial operation, but that phrase was

not used there, and that's why we just wanted to raise it today.

COMMISSIONER CLODFELTER: All right. I think we probably will want to talk about that as a panel, but we hear the request. If we need to make that clarification in any respect, we'll get that to you very, very quickly.

Do any members of the panel have a question about what Mr. Somers is suggesting here? Okay.

MR. SOMERS: And the just lastly, the second one, the ancillary services study, that language in the CPCN Order and the Stipulation was clear that it was 15 months from the commercial operation date.

COMMISSIONER CLODFELTER: Okay. Sure. Chair Mitchell.

CHAIR MITCHELL: I'm not sure who is best suited to answer this, so I'll just throw it out to all of you all. So, you know, my understanding is that this installation was selected as an alternative to doing work on the transmission system, but what are the studies that you all have done so far telling you about what work, if any, needs to occur on the transmission system to accommodate the installation? Does that make -- does that question make sense? I mean, we think of them sort

of in the interconnection context as network upgrades. Is any of that going to have to -- are any network upgrades going to have to be completed to facilitate this installation?

MR. ABDELRAZEK: That is part of the system impact study that Neil's group is leading currently.

MR. McNEILL: We expect any upgrades to be primarily distribution based.

CHAIR MITCHELL: Got it.

MR. McNEILL: When we think of transmission, it's the higher voltage, 100 KV and up, and we don't anticipate impacts there.

COMMISSIONER CLODFELTER: All right. At this point, I'm not closing the door, but any other questions? If not, we'll let the Intervenor and Public Staff, see if they have any questions. Okay. Mr. Ledford, you want to first? Anything from you?

MR. LEDFORD: No questions.

COMMISSIONER CLODFELTER: All right. Ms. Downey?

MS. DOWNEY: One thing that you all have not addressed today is the escalating cost of this project. And I'm not going to use numbers so we won't get into confidential --

COMMISSIONER CLODFELTER: All right.

MS. DOWNEY: -- but obviously the Public Staff is concerned, and that's why we asked for a -- I don't know what you want to call it -- cap, rebuttal presumption, or so forth -- and, you know, it started out one place which included a contingency. You're bumping up close to that. What are the major drivers of the increases in cost that you can tell us about?

MR. LOWDER: So with all the challenges that we've discussed today in our learnings with these first-of-a-kind projects, we're actually not very far off of our original estimate for completing. We are a little bit higher, but in that is -- I can't do the percentages in my head real quickly anymore -- but in that we do have a good bit of contingency that is being held in case the system impact study provides a need to do some alterations to the project.

So we expect -- we expect to this point that -- and I'll be glad to share this number with you before I leave -- that we will come in fairly close to what we're projecting right now, unless the system impact study provides us something significant.

MR. KUZNAR: Right. But we don't -- we don't -- I mean, there's nothing that would suggest that that

would happen.

MR. LOWDER: Nothing now suggest that.

MR. KUZNAR: And some of it is also the fire -- the additional fire protection that we added which added to some of that cost.

MR. LOWDER: The fire did add some dollars to that. The extension of the project --

COMMISSIONER CLODFELTER: Those were changes made after the original cost estimates were --

MR. LOWDER: That is correct.

COMMISSIONER CLODFELTER: Okay.

MR. LOWDER: That is correct. The extension of the project, you know, our project team is paid, you know, labor and those kinds of -- AFUDC in the construction is carried out longer, so we have some internal costs, labor and AFUDC funds used during construction that we -- that would increase our cost.

But if we don't use that contingency, our project will come in very close to our original estimate that was submitted at the CPCN, according to the numbers I have right now.

MS. DOWNEY: Okay. That's all I have.

COMMISSIONER CLODFELTER: Anything else up here? We've got -- gentlemen, we've got one technical

question. I think I want to ask it to just be sure we don't miss it, and I think I understand now from what you've already told us. There is -- in the written report there's a figure on page 13 that seems to indicate that the projections are that the battery is going to be discharging instead of charging at the time when the solar output is going to be at its peak, solar output is going to be greatest, but it appears to show that the battery is in a state of discharging at that point. I think I understand now from your earlier testimony why that's happening, but is that what I'm seeing in that chart? Is that actually what I'm seeing, and is there any additional explanation?

MR. SOMERS: May I approach?

COMMISSIONER CLODFELTER: I'm sorry. You may not have a -- yes, you may approach if you've got -- I'm sorry. I lost you in the question without you having a copy of it in front of you. It's on page 13. And I don't know what I'm seeing there. I just want you to explain to me what I'm looking at there because it looks like you're at maximum solar output while -- but the battery is discharging at that point, so what's going on there?

MR. ABDELRAZEK: Okay. So the solar output in

this figure is not really shown unless you're looking at something I'm not seeing. Are you --

COMMISSIONER CLODFELTER: I may be misreading the chart, then. I'm looking at the energy storage dispatch, but that's storage dispatch, right?

MR. ABDELRAZEK: Yes. That's the energy storage system.

COMMISSIONER CLODFELTER: Okay. So this is not actually showing me what's happening with the solar array?

MR. ABDELRAZEK: This is -- yes, exactly.

COMMISSIONER CLODFELTER: Not at all.

MR. ABDELRAZEK: Exactly.

COMMISSIONER CLODFELTER: They don't -- that cleans up any confusion. That's it. Thank you.

MR. ABDELRAZEK: Okay.

COMMISSIONER CLODFELTER: Just needed to be sure we knew what was happening there.

MR. ABDELRAZEK: And just to elaborate on this figure, that you have a combination of three parameters here. The first one is system frequency.

COMMISSIONER CLODFELTER: Right.

MR. ABDELRAZEK: The second one is system ACE. And third one is system CPS1 score.

COMMISSIONER CLODFELTER: CPS1 score.

MR. ABDELRAZEK: So what those basically help our algorithm deduce is what is the most beneficial rate of discharge or charge that our battery needs to do to help out our bulk system. So in other words, if we have a condition where our ACE is too low and we're --

COMMISSIONER CLODFELTER: You're showing how you'll operate the battery relative to system parameters.

MR. ABDELRAZEK: Correct.

COMMISSIONER CLODFELTER: I understand it now.

MR. ABDELRAZEK: Okay.

COMMISSIONER CLODFELTER: Great. Mr. Somers, do you have anything you want to ask your folks to follow up on the questions that they've been presented by the Commission?

MR. SOMERS: I don't have a specific question other than to ask if there was anything else Mr. Kuznar or others wanted to say in summary.

MR. KUZNAR: I don't have anything else.

MR. SOMERS: Just to note that we are -- we appreciate the opportunity to come, and at any time would be willing to come back with this group or additional folks. We are very excited about this project. We believe that the combination of solar and battery has

great promise and is the future for North Carolina, and we are anxious to get this thing up out of the ground and serving our customers in Hot Springs and the entire Duke Energy Progress system.

COMMISSIONER CLODFELTER: Well, as I think you know, we are also -- the Commission is very interested in this project and this technology as well, which is why we were sort of wanting to get a little more in-depth briefing on exactly where things stand.

MR. KUZNAR: Thank you very much for your time.

COMMISSIONER CLODFELTER: We thank you all for coming on that. And we will get you a clarification on the issue about the timing of the report.

MR. SOMERS: And I would also ask, at the appropriate time and forum, we would be happy to answer the Commission's questions about the NFP 855, and if you give us some further instruction on that.

COMMISSIONER CLODFELTER: Well, again, let's just leave that there because this is a topic that first surfaced in one of our storage presentations about two weeks ago, and we as a Commission haven't really yet crystalized any thinking about our own views, so we'll be developing our views as you develop yours.

MR. SOMERS: Thank you very much.

COMMISSIONER CLODFELTER: Great. Thank you. If the parties have nothing else further, then we will recess for the afternoon. Thank you all for coming. We appreciate it greatly.

(Proceedings adjourned.)

STATE OF NORTH CAROLINA

COUNTY OF WAKE

C E R T I F I C A T E

I, Linda S. Garrett, Notary Public/Court Reporter, do hereby certify that the foregoing hearing before the North Carolina Utilities Commission in Docket No. E-2, Sub 1185, was taken and transcribed under my supervision; and that the foregoing pages constitute a true and accurate transcript of said Hearing.

I do further certify that I am not of counsel for, or in the employment of either of the parties to this action, nor am I interested in the results of this action.

IN WITNESS WHEREOF, I have hereunto subscribed my name this 15th day of March, 2020.

Linda S. Garrett

Linda S. Garrett, CCR
Notary Public No. 19971700150