FILED 2/18/2020
DOCUMENT NO. 00964-2020
FPSC - COMMISSION CLERK

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DOCUMENT NUMBER ASSIGNMENT*

FILED DATE: 2/18/2020

DOCKET NO.: 20200001-EI

DOCUMENT NO.: 00964-2020

CONFIDENTIAL

DOCUMENT DESCRIPTION:

TRANSCRIPT (CONFIDENTIAL) - Volume 3, pages 291 to 427, of 2/5/20 final hearing held at DOAH before The Honorable Lawrence P. Stevenson [Case No. 19-006022]

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STATE OF FLORIDA
DIVISION OF ADMINISTRATIVE HEARINGS

RE IN: FUEL AND PURCHASED POWER COST RECOVERY CLAUSE WITH GENERATING PERFORMANCE INCENTIVE FACTOR,

Petitioner,

vs. CASE NO. 19-6022

**,

Respondent.
_____/

VOLUME 3

PAGES 291 - 427

PROCEEDINGS: Administrative Hearing

BEFORE: Honorable Lawrence P. Stevenson

DATE: February 5, 2020

TIME: Commenced: 8:55 A.M.

LOCATION: Division of Administrative Hearings
1230 Apalachee Parkway
The DeSoto Building,
Tallahassee, Florida

REPORTED BY: DEBRA R. KRICK
Court Reporter

APPEARANCES: (As heretofore noted.)
PREMIER REPORTING
114 W. 5TH AVENUE
TALLAHASSEE, FLORIDA
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*Huh-uh is a negative response
*Uh-huh is a positive response

P R O C E E D I N G S

THE COURT: I will swear you in.

Whereupon,

RICHARD A. POLICH

was called as a witness, having been first duly sworn to speak the truth, the whole truth, and nothing but the truth, was examined and testified as follows:

THE WITNESS: I do, sir.

THE COURT: All right. Have a seat.

MR. REHWINKEL: Your Honor, before we get started with Mr. Polich. Yesterday, when we concluded, I think everyone was ready to take a break from engineering 101 yesterday. We neglected to take care of a housekeeping measure that we usually do with the Commission, which was after a witness leaves the stand, his exhibits are moved in.

THE COURT: Exhibits?

MR. REHWINKEL: Yeah, so I think Duke needs to move his, and then we need to address ours.

THE COURT: That's fine. I can tell you, yeah, what I have got here -- well, I thought I had them here.

MR. REHWINKEL: I have his direct.

THE COURT: Yeah, what -- the testimony,

then -- I am just going through in the order that these exhibits came up. I have got 115 and 116, that was I think was Public Counsel's exhibits; is that right?

MR. REHWINKEL: Yes. And I think we would move actually the earlier -- 101 through 109 were identified for identification purposes. We would now move 101 through 109 and 115 and 116 into the record.

MR. BERNIER: So without going through them individually, Judge, we raised objections to some of them yesterday as we brought them up, and we would just stand on those objections and bring them up again in the PRO.

THE COURT: That's fine. We will show them admitted with the understanding that there are aspects.

So we will show 101 through 109 and 115 and 116 admitted.

(Whereupon, Exhibit Nos. 101-109, 115 & 116 were received into evidence.)

THE COURT: And let's --

MR. BREW: Excuse me, Your Honor. Your Honor, PCS had offered Exhibit 113 for identification, and we would move that for admission as well.

THE COURT: Okay, and not 112?

MR. BREW: We haven't discussed 112 yet.

THE COURT: Okay, that's right. That was -- that was your -- okay. So we will show 113 admitted.

(Whereupon, Exhibit No. 113 was received into evidence.)

THE COURT: And then I think the Commission talked about 110 and 111.

MS. BROWNLESS: Yes, and we would ask that that be admitted at this time.

THE COURT: We will show 110 and 111 admitted.

(Whereupon, Exhibit Nos. 110 & 111 were received into evidence.)

THE COURT: And I think that brings us up-to-date.

The witness has been sworn, and so whenever Public Counsel is ready.

MR. DAVID: Thank you, Your Honor.

EXAMINATION

BY MR. DAVID:

Q Please state your full name for the record, and spell your last name, please.

A Yes, Richard A. Polich, P-O-L-I-C-H.

Q Thank you.

And what is your educational background?

A I have a Bachelor's in Engineering in Mechanical Engineering, a Bachelor's in Engineering in Nuclear Engineering and an MBA, all from the University of Michigan.

Q And what is your current occupation?

A My current occupation is as consultant. Job title is managing director. I work for a company by the name of GDS Associates.

Q And what service or services were you retained to provide in this case?

A I was requested by the Florida Office of Public Counsel to review the failures at Duke Bartow in regards to the steam turbine, perform an assessment of those failures and do a calculation of revenues that could potentially be recovered.

Q All right. And have you testified as a witness before in a regulatory proceeding, a utility regulatory proceeding?

A Many times.

Q And can you give us some examples of the venues in which you have testified?

A I did a significant amount of worked in Michigan associated with rate design and regulatory. Part of that started with Consumers Energy when I was

manager of rates. And so I was involved in that in several aspects both with consumers and also with -- with an entity called Energy Michigan, which oftentimes was filing in opposition to the utility's.

I have also testified in proceedings in Indiana. It was actually a Duke case involving a failure of a generator. There is -- I also testified in Georgia and also at FERC.

Q All right. And did you -- in those, did you appear for the utility, the regulator or --

A A variety of aspects. In Georgia, I was on behalf of MARTA, which is the transportation organization in Georgia.

In the case of -- I also neglected, I also testified in North Carolina on behalf of the Attorney General's Office. And then I have also testified that the -- the case at FERC involved actually testifying on behalf of a group of utilities in a reactor power case.

Q And can you give me just a general description of the materials that you used to develop your opinions, or your analysis in this case?

A Yes. In general, I mean, most of the material that -- okay, 99 percent of the material that I reviewed was material provided by Duke in discovery, as well as testimony and various other documents that were made

available to me.

Q All right. And did you file or cause to be filed direct testimony in this case on or about September 13th of 2019?

A Yes, I did.

Q And did you file or cause to be filed with that testimony nine exhibits identified on the comprehensive exhibit list filed within those exhibits 68 through 76, inclusive?

A Yes, I believe so.

Q All right. And do you have any changes or revisions to that testimony, or to any of those exhibits?

A Yes, I do.

Q What are those?

A Okay. The first change is on page seven, line 19, there is a percentage in that line that says 25 percent. I would like to change that to 13 percent.

Q Okay.

A The second change and all subsequent changes are associated with the revision to Exhibit 9. After filing testimony, I was reviewing the calculations I used for determining the replacement power costs that -- that -- that -- associated with the derated Duke of the Bartow unit, and I discovered that inadvertently my

calculations had included the replacement power costs during the time periods when the plant as in an outage. And so I deleted those costs from the calculations and it resulted in changes in both the recommended amount of the cost that could potentially be recoverable.

And so going to page nine, the first change associated with that is on page nine, line two. The sentence reads right now: Caused by installation of the pressure plate is over 16.84 million. I would like to change that to, after the word is around 12 million.

Q What was -- excuse me, could you clarify that again? Is from installation of the pressure plate is over --

A Is around 12 million.

Q 12, okay.

A I am sorry. No, 16 point -- 16 million. I am sorry. 16 million.

Q Okay. So just for clarity, is over 16.12 million, is that what you were --

A Yes. There is two -- I worded it as around 16 million.

Q Oh, okay.

MS. BROWNLESS: Excuse me, can you just read that whole sentence the way it ought to be?

THE WITNESS: Okay, I can. Yes.

The replacement -- the sentence which begins on line one should read: The replacement power costs associated with the 2017 outage and derate caused by installation of the pressure plate is around 16 million.

Sorry for the confusion.

Moving to the next set of changes, starting on line -- on page 27, starting on line five, there is a figure of 2,005,536. That figure should be 1,675,561.

On the next line, on line six, there is a megawatt figure of 162,040. That figure should be 150,400.

All right. Moving to line 12, there is a dollar amount of 2,545,049. That number should be changed to 2,215,648. There is also a megawatt figure on that same line of 213,280. That number should be changed to 199,680.

Moving to line 20, there is a dollar amount of that 1,189,552. That number should be changed to 1,125,573. The megawatt figure on that line of 128,480 should be changed to 125,800.

And the last change is on page 28, line four. There is a dollar amount in there of 16.84 million. That figure should be changed to 16,116,701 -- 781.

BY MR. DAVID:

Q Okay. Are those all the changes you have to --

A In addition, there should be a revised Exhibit 9.

Q Correct, okay.

The RAP exhibits -- I mean, identified in your testimony as RAP-9 and identified on the comprehensive exhibit list as 76 has corresponding calculation changes?

A Yes.

Q Okay. Okay. And with all of those changes made, if I asked you today the same questions as I asked in your direct testimony, would your answers be the same other than, of course, like I said, the aforementioned changes?

A Yes, they would.

Q And the changes that were made to CLE exhibit -- CEL exhibit, excuse me, 76, RAP-9, did you supply that information before today to, in discovery, to Duke and staff?

A I believe we have.

Q Are you prepared to give a summary of your testimony and its conclusions?

A Yes, I am.

Q Okay. Go ahead.

A Okay. To understand my testimony, it's important to understand some of the background of the Bartow project, as well as how it's been configured. And what this leads towards is the fact that the statement contained in my testimony that 420-megawatt output is a design limit on which the Bartow plant was designed.

Having designed thermal cycles for multiple power plants, the designer always wants to gets the maximum output for a given plant investment at the best heat rate. It's a fundamental principle of what you do in design. It has to do with how you put the project together and what you want to do with it.

The Bartow project was Progress Energy's first combined cycle project and would have -- and they would have wanted the most output for their investment. They had already decided on installing four CTs when three would have sufficed to power the Mitsubishi turbine.

One of the things about this design is that you can fully power that steam turbine with three combustion turbines and heat recovery steam generators.

Can I approach the Exhibit for a second here?

THE COURT: Sure.

THE WITNESS: All right. So the way this

project is designed is you have four of these. Four combustion turbines and four heated recovery steam generator, and of course, all the ancillary services supplying steam to just one steam turbine.

And this project was designed such that you could provide all the steam requirements for this and produce 420 megawatts with just three CTs and HRSGs. So essentially, you have 25 percent redundancy. You also have 25 percent additional steam available to put into the steam turbine.

And if that were the case, as a designer, and as Progress Energy, in terms of designing this project and putting it forth before the Public Service Commission, you want to build a project and tout its dollars per kW as low as possible, because it shows the value of the project. You as the designer want to develop a project that, for every dollar you are putting into it, produces the maximum amount of megawatts.

With as much steam capability to power the steam turbine, if that unit could produce 450 megawatts, the designer and the utility would have wanted that from day one.

They, Kiewit and -- Bibb/Kiewit performed over 300 different heat analyses of how this whole thing

is going to work. Not one of those analyses ever showed this steam turbine producing more than 420 megawatts. If that steam turbine had that capability, they would have produced a thermal analysis to that effect.

Bibb worked very close with Mitsubishi on how this whole process works. There is correspondence between Bibb and Mitsubishi as to what this package can put out. There was information about how much steam can go to -- can be provided.

Mitsubishi responded with this is the output. 420 megawatts was a design limit. If Mitsubishi thought this unit could produce more, they would have told Bibb that and they would have designed it with higher output.

You had a case where this was an aftermarket unit. It was not designed to handle the amount of steam that was built that was available to this steam turbine. It was designed for a much smaller steam flow. And it is my experience that Mitsubishi knew that there were limitations as to how much power and steam this could take, and that they factored that into how this plant was designed. And so did the EPC Kiewit/Bibb. This is a critical issue, because Duke has contended very

often and throughout their testimony that 420 megawatts was not a design condition.

Now, I have worked in this industry many, many years, too many to tell sometimes, but the fact that this proj-- that you had so much steam available gives you amazing amount of flexibility in how you operate it. And I think this is a great plant design. Don't get me wrong, but there are limits. And when you have a plant of this type, of this type of design, you, as an operator, have to be careful as to how you utilize that capability.

It is my feeling that, and my experience that when you have a situation like this, it is important that you understand how it's going to function. And if you discover that, hey, you know, I can get potentially more out of this, you should always pause, because steam turbines have a lot of forces and dynamics that are happening inside of them that we've discovered afterwards, you know.

And I agree that some of this analysis work is all, you know, after-the-fact, but fundamentally, you have a responsibility to contact the OEM and ask a single question, can I get more out of this unit?

It's an insurance policy, because you get an

answer that if, yes -- if the OEM comes back and says, yes, you can get more out of this and it breaks, then the issue is on their shoulders. It's an insurance policy. A simple question, get it in writing and then the issue is settled.

If Duke had done that, we would not be here today, in simple terms, because the onus would have been on Mitsubishi at that point. It would have been totally their responsibility. The fact that Duke did not do that is a fundamental flaw in what they chose to -- how they chose to operate this unit.

And other projects I have been associated with -- I have a project in Arkansas that we oversee, and they had a steam turbine that was designed for 670 megawatts. That was the design conditions. We went through a turbine upgrade recently -- or a refurbishment I should say, a standard outage.

We came out of that outage and discovered we had the potential for more megawatts out of that unit. It was only 10 megawatts, so we went from 670 to 680. Before we did that, we contacted the manufacturer of the steam turbine and said, do we have any problems if we do this? We got the

insurance policy, proceeded to upgrade the oper-- the operate output of the plant. It's just something you should do.

And other projects I have been associated with -- utilities will push a steam turbine, and I understand that. It's a legitimate thing to do because it's cheap capacity. But you also have responsibility to get back with the OEM and verify that there isn't something inside of that unit that will break if you do it. And this is a fundamental issue in my testimony.

The other thing, too, is that the reason why I am strongly of the opinion that 420 was the megawatt limit is that when Duke finally did ask Mitsubishi, can we produce more than 420 megawatts? Mitsubishi said, we need to do a study for that. They came back and proposed a dollar amount that -- of -- in one that says we don't know, we need to study this.

Again, that tells me that Mitsubishi felt they had a limit on this unit. And to -- and so I don't -- I feel that that should have been an operating condition from day one.

All right. If Duke had paused before going after 420 and asked Mitsubishi if the steam turbine

could operate above 420 megawatts, and put it in writing, as I said, this would just take this whole issue off the table.

Instead, Duke ignored the red line on the unit, and they took their Ferrari and ran it, and something broke, but the interesting thing is it didn't break right away, all right.

If you look at what happened in Periods 1 and 2, they operated that unit for 62 months between the two periods, approximately 43,000 hours of operation, using the Type 1 blades, and only saw minor damage. And, in fact, on the generator end -- I am going to approach the diagram again.

We talked yesterday about the fact that we have one set of L0 blades here and one set here. These L0 blades during Periods 1 and 2 had no failures, even though this unit had been operated at 450 megawatts for over 2,000 hours at significant stresses much higher than what the manufacturer had ever seen in any of their L0 blades.

And it is our contention that if you had not overstressed those blades, there is no evidence that those blades would not still be in operation today.

Duke contends that, you know, that what happened in Period 5 when you put the L1 -- the Type 1 blades back in, is evidence that this is not a true fact. But let's look at some issues here.

Those Type 1 blades in Period 5 failed in 1,561 hours of operation. That's less than four percent of the hours that those same set of blades were able to operate in Periods 1 and 2. The reason why that's significant is -- and the other thing is that those Type 1 blades that they put in in that time period failed quicker than any of the other blades that they put in.

MR. BERNIER: Your Honor, I apologize, but I have to object. Nowhere does this testimony that he is summarizing appear in his direct testimony. I believe that is what we are doing here is, summarizing his direct testimony. This simply does not appear there. And that is the practice that we follow in front of the Commission, which I think we all agreed is what we are here to do.

THE COURT: So far I am only hearing him sort of do the math. I mean, if he goes beyond that and come to some different conclusion than he said in his testimony, I might be inclined to strike it, but so far he is just -- you know what I am saying,

this all sounds like stuff he is pulling out and just doing the numbers.

MR. BERNIER: I do understand what you are saying, Judge, and not to be argumentative, but he is now rebutting the rebuttal testimony to his testimony, and there is simply not -- that is not part of his direct testimony.

If that's something that's solicited on cross, that's one thing, but that is not something that he has provided any testimony to in writing, so he has just gone beyond the scope.

MR. REHWINKEL: Your Honor, we would -- I would, to some degree, acknowledge Mr. Bernier's point, but yesterday, Mr. Swartz took great liberties.

For us, in a proceeding where the judge is not intimately familiar with the way the Public Service Commission operates or the issues on a day-to-day basis, we thought it was appropriate for Mr. Swartz to take great liberties to expand on his testimony, and I think Mr. Polich is doing the same thing.

It probably would be a good time for us to conclude his summary and go to cross-examination.

THE COURT: Okay. That sounds like a plan then.

THE WITNESS: All right. So let me cut to this -- move forward on this.

So in my analysis, I looked at all of the information that was provided in Duke's root cause analysis, and I felt that there was a fatal flaw in that analysis, and that is why I came to the conclusion that you have to look at what happened in Period 1.

And the fatal flaw in their analysis is the fact that Period 1 and 2 was an outlier. The blades lasted longer during those two periods than in any other period of operation of this unit. Nowhere in Duke's RCA do they explain why those blades lasted so long. All their RCA addresses all -- is just the failures.

And in my testimony, I came to the conclusion that that is a very important factor in the operation of this unit. There was something about those blades' designs in Period 1 that allowed them to last longer. There is something about those blades that the Period 5 blades were not identical enough to last as long.

And it is for this reason that we came to the conclusion that the failures in Period 1 were due to overstressing the unit by putting too much steam

through it and operating at 420 -- in excess of 420 megawatts, and that Duke should be responsible for the replacement power costs.

MR. DAVID: Thank you.

Your Honor, I would like to move Mr. Polich's direct testimony into evidence, please. And after that, I would tender him for cross-examination.

THE COURT: Show that done.

(Whereupon, prefiled testimony was inserted.)

DIRECT TESTIMONY

OF

RICHARD A. POLICH, P.E. (STATE OF MICHIGAN)

On Behalf of the Office of Public Counsel

Before the

Florida Public Service Commission

Docket No. 20190001-EI

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME, TITLE AND BUSINESS ADDRESS.

A. My name is Richard A. Polich. I am a Managing Director at GDS Associates, Inc. ("GDS"). My business address is 1850 Parkway Place, Suite 800, Marietta, Georgia, 30067.

Q. WHAT ARE YOUR DUTIES AND RESPONSIBILITIES AT GDS ASSOCIATES?

A. My primary duties are within GDS's Power Supply Planning Department. While employed by GDS, I have provided consulting services for areas such as:

- Generation Asset Management,
- Engineering analysis of generation projects,
- Engineering evaluation of waste to energy projects,
- Energy management consulting services,
- Nuclear decommissioning cost evaluation,
- Modular nuclear project cost evaluation,
- Renewable energy project cost assessment and economic evaluation,
- Testimony on rate of return, cost of service, regulatory disallowances, determination of prudence, revenue requirements and plant in service, and
- Review of generation project design and construction.

Q. MR. POLICH, PLEASE SUMMARIZE YOUR FORMAL EDUCATIONAL.

A. I graduated from the University of Michigan - Ann Arbor in August 1979 with a Bachelor of Science Engineering Degree in Nuclear Engineering and a Bachelor of Science Engineering Degree in Mechanical Engineering.

Q. PLEASE BRIEFLY DESCRIBE YOUR PROFESSIONAL EXPERIENCE.

I have over 40 years of work experience in the energy sector, performing duties and services for a myriad of companies and organizations, and representing the interests of private and public constituencies throughout the country.

In May 1978, I joined Commonwealth Associates, Inc., located in Jackson, Michigan, as a Graduate Engineer and worked on several plant modification and new plant construction projects.

In May 1979, I joined Consumers Power Inc., (now called Consumers Energy), located in Jackson, Michigan, as an Associate Engineer in the Plant Engineering Services Department.

In April 1980, I transferred to the Midland Nuclear Project and progressed through various job classifications to Senior Engineer. I was also part of a small team that evaluated the potential to repower the nuclear steam turbine with combustion turbines. One of my responsibilities was to provide the initial thermal design for the combined cycle project, utilizing one of the two existing nuclear steam turbines while still providing process steam for Dow Chemical Company. This project is now known as the Midland Cogeneration Venture, a 12-combustion turbine and steam turbine project capable of providing 1,633 MW of capacity.

In July 1987, I transferred to the Market Services Department as a Senior Engineer and reached the level of Senior Market Representative. While in this department, I analyzed the economic and engineering feasibility of customer cogeneration projects.

In July 1992, I transferred to the Rates and Regulatory Affairs Department of Consumers Energy as a Principal Rate Analyst. In that capacity, I performed studies relating to all facets of development and design of Consumers Energy's gas, retail, electric and electric wholesale rates. During this period, I was heavily involved in the development of Consumers Energy's Direct Access program and in the development of Consumers Energy's Retail Open Access program. I also participated in the development of Consumers Energy's revenue forecast.

In March 1998, I joined Nordic Energy, LLC ("Nordic"), located in Ann Arbor, Michigan, as Vice President in charge of marketing and sales. My responsibilities included all aspects of obtaining new customers and enabling Nordic to supply electricity to those customers. In May 2000, my responsibilities shifted to Operations and Regulatory Affairs and my responsibilities included management of supply purchases, transmission services, and development of new power projects. My Regulatory Affairs responsibilities also included overseeing regulatory and legislation issues for the company.

In March 2003, I formed Energy Options & Solutions, based in Ann Arbor, Michigan, as a consulting concern focusing on providing engineering services and regulatory support. Through my work with Energy Options & Solutions, I gained extensive experience consulting in the areas of project development and economic

analysis with renewable energy companies across the country, including: Noble Environmental Power located in Centerbrook, Connecticut; Third Planet Windpower, LLC located in Palm Beach Gardens, Florida; TradeWind Energy, LLC located in Lenexa, Kansas; Windlab Developments USA located in Canberra, Australian Capital Territory, Australia; and Matinee Energy Inc. located in Tucson, Arizona, among others.

Other examples of my consulting work include evaluation of the Arkansas Weatherization Assistance Program for the Arkansas Energy Office and providing the West Michigan Business Alliance with an evaluation of the business opportunities for Western Michigan businesses in the renewable energy business sector.

In 2007, I served as primary author of a report on the economic impacts of renewable portfolio standards and energy efficiency programs for the Department of Environmental Quality – State of Michigan.

In 2011, I joined KEMA, Inc. ("KEMA") located in Burlington, Massachusetts, as a Service Line Leader responsible for developing its renewable energy consulting business. While at KEMA, I performed multiple renewable energy studies for the Electric Power Research Institute, including a renewable energy options study for the country of Saint Maarten (a constituent country of the Kingdom of the Netherlands). I also assisted Lake Erie Energy Development Corporation in its successful application to the U.S. Department of Energy for a multi-million dollar grant to develop an offshore wind project in Lake Erie.

In 2013, I joined CLEAResult, located in Little Rock, Arkansas, as Director of Operations. My primary responsibility involved supporting program operations in

assisting the company's Arkansas unit to successfully meet a 400% increase in energy efficiency goals that it managed for Entergy. I was also responsible for managing the company's natural gas energy efficiency programs in the State of Oklahoma.

In 2015, I joined the Georgia office of GDS Associates, Inc., a consulting group focusing on utility engineering and consulting services, as Managing Director.

I have been a registered Professional Engineer since 1983 and I am licensed in the State of Michigan.

My resume is included as Exhibit No. ___(RAP-1).

Q. HAVE YOU TESTIFIED IN OTHER REGULATORY PROCEEDINGS?

A. Yes, Exhibit No. ___(RAP-2) contains a list of regulatory proceedings in which I have provided testimony.

Q. WHAT IS THE NATURE OF YOUR BUSINESS?

A. GDS Associates, Inc. ("GDS") is an engineering and consulting firm with offices in Marietta, Georgia; Austin, Texas; Corpus Christi, Texas; Manchester, New Hampshire; Madison, Wisconsin; Manchester, Maine; and Auburn, Alabama. GDS provides a variety of services to the electric utility industry including power supply planning, generation support services, rates and regulatory consulting, financial analysis, load forecasting and statistical services. Generation support services provided by GDS include fossil and nuclear plant monitoring, plant ownership feasibility studies, plant management audits, production cost modeling and expert testimony on matters

relating to plant management, construction, licensing and performance issues in technical litigation and regulatory proceedings.

Q. WHOM DO YOU REPRESENT IN THIS PROCEEDING?

A. I am representing the Florida Office of Public Counsel ("OPC").

Q. WHAT WAS YOUR ASSIGNMENT IN THIS PROCEEDING?

A. I was asked by the OPC to conduct a review and evaluation of Duke Energy Florida, LLC's ("DEF's") operation of the Bartow Combined Cycle Power Plant ("BCC") located in Pinellas County, Florida. The review and evaluation included assessment of the BCC steam turbine ("ST") mechanical problems which led to several outages and derates. My testimony also includes an assessment of replacement power costs for 2017 and 2018, an estimate for part of 2019 associated with periods in which the BCC was not available to provide full capacity, and the cost of that replacement power that DEF is seeking to recover from its ratepayers in this proceeding.

Q. DID OTHER GDS PERSONNEL ASSIST YOU IN THE ANALYSIS AND DEVELOPMENT OF YOUR TESTIMONY IN THIS MATTER?

A. No.

Q. ARE YOU SPONSORING ANY EXHIBITS?

A. Yes, I am sponsoring the following exhibits:

1. Exhibit No. ___(RAP-1) Richard A. Polich, P.E. Resume

2. Exhibit No. ___(RAP-2) Richard Polich Regulatory Testimony List
3. Exhibit No. ___(RAP-3) Bartow Combined Cycle Thermal Cycle
4. Exhibit No. ___(RAP-4) Turbine Generator Output Curve
5. Exhibit No. ___(RAP-5) BCC ST Operation Greater than 420 MW
6. Exhibit No. ___(RAP-6) Bartow ST#1 L0 Blade Upgrade to Achieve 450 MW, dated September 18, 2013
7. Exhibit No. ___(RAP-7) Bartow RCA Review, dated March 15, 2017
8. Exhibit No. ___(RAP-8) Update on 40" Last Stage Blade, dated 2015
9. Exhibit No. ___(RAP-9) Bartow Combined Cycle Replacement Power Costs

II. TESTIMONY SUMMARY

Q. PLEASE SUMMARIZE YOUR TESTIMONY.

A. My review of various documents provided by DEF regarding the BCC low pressure turbine L0 blade failures reveals that the cause of the blade failures initially experienced in 2012 was DEF's operation of the BCC ST beyond the ST's 420 MW design. The Root Cause Analysis ("RCA") provided by the steam turbine manufacturer, Mitsubishi Hitachi Power Systems ("MHPS"), explains that Duke's operation of the BCC ST to produce sufficient horsepower to generate more than 420 MW, subjected the L0 blades to forces that were ~~25%~~ **13%** higher than the designed operating conditions. DEF operated the ST at BCC in excess of 420 MW from June 2009 until the February 2012 outage for a combined 2,973 hours. As of the time of filing this testimony, DEF has failed to provide any documentation that demonstrates they communicated with

Court Reporter: DK

MHPS about operation of the ST in excess of 420 MW, until after the failure of the L0 blades was discovered.

DEF operated the BCC ST with the original design L0 blades for 63 months after the plant entered initial operation—a period of only slightly over five years. After the February 2012 outage, DEF operated BCC in a manner that generated an ST output at or below the design of 420 MW with the original design L0 blades, for an additional 28 months (within that first 63 months of operation). Inspection of these L0 blades in 2014 did not find snubber or z-lock damage as was found in February 2012. The additional stresses on the L0 blades caused by DEF's operation of the ST in a manner that generated output above the 420 MW design conditions impacted the L0 blades in a way that shortened blade life. If DEF had operated the ST at BCC in accordance with design output of 420 MW or less, I believe there is no engineering basis to conclude that the original L0 blades would not still be in operation today. Likewise, DEF would not have needed to undertake any of the subsequent outages to repair L0 blades, including the outage in February 2017 to replace the L0 blades with the pressure plate. Consequently, the BCC ST would currently be capable of producing its full output of 420 MW instead of being derated to 380 MW and operating with a less-than-optimal pressure plate.

As a result of the 2017 outage and the 40 MW reduction in BCC ST output (derate) due to installation of the pressure plate, DEF incurred power costs for the replacement MWh. DEF has failed to demonstrate that ratepayers should be responsible for these costs since the 2017 outage and subsequent derate were the result of DEF imprudently operating the BCC ST in excess of the manufacturer's 420 MW design

conditions. The replacement power costs associated with the 2017 outage and derate caused by installation of the pressure plate ~~is over $16.84 million~~ **is around 16 million**. The Florida Public Service Commission should not allow DEF to recover these costs from its rate payers.

Court Reporter: DK

Q. PLEASE DEFINE THE TERM "DERATE" AS USED IN CONNECTION WITH REDUCTION IN ST OUTPUT.

A. Derate is a term commonly used in the utility industry when a generation facility is unable to generate MW at its normal operating level. The reduction in generation output is usually temporary and caused by equipment degradation or failures. For the purposes of my testimony, I will be using the term "derate" specifically to refer to reduction in the BCC ST generation capability from 420 MW to 380 MW. This is a derate of 40 MW for the BCC ST.

III. DESCRIPTION OF BCC POWER PLANT

Q. PLEASE PROVIDE A GENERAL DESCRIPTION OF THE CONFIGURATION OF DEF'S BARTOW COMBINED CYCLE PLANT.

A. BCC is commonly referred to as a 4-on-1 combined cycle plant composed of four Siemens SGT6-5000-FD3 combustion turbines/generators ("CTs") and one Mitsubishi Hitachi Power Systems steam turbine/generator. Exhibit ___ (RAP-3) shows the general configuration of BCC. Each CT is capable of producing almost 230 MW gross output with injection of steam into the CT for power augmentation. Non-steam augmented power output of each CT is in the range of 180 MW. The exhaust of the CT enters a Voit Power VPPR2 heat recovery steam generator ("HRSG") that

produces steam to power the ST and provide steam augmentation to the CTs. The HRSG is composed of three different pressure sections: a high pressure ("HP") section (approximately 3,000 psig maximum), an intermediate pressure ("IP") section (approximately 1,100 psig maximum) and a low pressure ("LP") section (approximately 135 psig maximum). Steam production in the HRSG can be increased by using installed natural gas fired "duct burners" located within the HRSG. The ST was designed to produce 420 MW gross generation. Exhaust steam from the ST enters a condenser where the steam is cooled to liquid phase and then pumped back into the HRSG. The generator output appears to have an upper gross generation limit of about 465 MW at a 0.95 power factor based upon the output curves in Exhibit No. ___ (RAP-4).

Q. PLEASE PROVIDE A GENERAL DESCRIPTION OF THE BCC STEAM TURBINE.

A. The BCC ST contains three turbine sections, a generator, and various other components used to control steam flow and operate the ST. HP steam from the HRSG is first injected into the HP section of the steam turbine through the turbine control valves. Exhaust steam from the ST HP section is sent back to the HRSG IP section to be reheated and then sent back to the IP section of the ST. Exhaust steam from the IP section of the ST then combines with steam from the HRSG LP section to enter the LP section of the ST, exiting through the last set of turbine blades into the condenser.

Q. PLEASE PROVIDE A GENERAL DESCRIPTION OF THE BCC LP ST SECTION.

A. The BCC LP ST section is a tandem flow ST with steam entering the middle and flowing in opposite directions through mirror image LP sections. Each side of the LP ST has four sets of blades, the last of which is the 40" L0 blade set that has experienced the failures.

IV. OPERATING DESIGN OF BCC STEAM TURBINE

Q. WHAT FACTORS ARE CRITICAL TO THE DESIGN OF A STEAM TURBINE?

A. Steam turbine design begins with the end users desired gross MW output and the steam characteristics available to power the steam turbine. The design conditions considered during the initial ST design include maximum steam pressure, temperature and flow rate. From this, the ST manufacturer will work with the project thermal design engineer to develop a set of HP, IP, and LP steam conditions that maximize ST efficiency, minimize water content of the steam within the ST, and are capable of allowing the ST to produce the desired MW output. There are a myriad of HP, IP, and LP steam conditions for steam turbine design that allow production of a given MW. Experience in plant and ST design, manufacturer-available ST packages, and engineering parameters reduce the number of solutions, sometimes to one.

Q. WAS THIS THE APPROACH USED FOR THE BCC PROJECT?

A. No. Progress Energy, the original owner of BCC, purchased a "secondary market" steam turbine that was designed and manufactured for a Tenaska combined cycle project. However, the ST was never installed for that project and was instead placed in storage by MHPS. The steam turbine was already constructed—presumably to meet the needs of Tenaska—so the design parameters were already fixed when it was purchased by Progress Energy, DEF's predecessor. Therefore, as DEF knew or should have known, intractable design limitations were incorporated into the as-built ST. Discussions with MHPS apparently led Progress Energy, now DEF (references to DEF through the remainder of this testimony interchangeably refers to Progress Energy and Duke Energy Florida), to determine this steam turbine generator package would be suitable for use in the BCC project. These discussions led to a project design in which the ST maximum gross output was to be 420 MW. None of the analyses of ST operations performed by MHPS ever showed the ST package producing more than 420 MW.

Q. WHY IS IT IMPORTANT THAT THE ST PACKAGE DESIGN ANALYSES ONLY INDICATED A MAXIMUM OUTPUT OF 420 MW WHEN THE GENERATOR WAS CAPABLE OF POTENTIALLY PRODUCING 465 MW.

A. Steam turbine internal components are subjected to steam conditions which cause significant stress, erosion, and other dynamics which the manufacturer has incorporated into the component design. Gross MW output is directly proportional to the horsepower the ST produces. As with a car engine, parts in the ST are designed to

provide that horsepower on a basis that is reliable and does not induce failure. Otherwise, increasing the ST horsepower output can only be accomplished by placing higher stresses and dynamic forces on the ST components. In most turbines, one of the critical components subject to very high stress and steam induced dynamics are the turbine blades. The turbine blades are connected to the turbine shaft, which spins at 3,600 RPM in the BCC ST. The steam impinging on these blades exerts pressure and dynamic forces that are not uniform. This lack of uniformity may be caused by the spinning turbine blades, the way the steam is channeled to impinge on the blades, the changes in steam characteristics between sets of blades, and the formation of water in the steam as pressure and temperature drop. In addition, a ST does not always run at full load and steam does not always have the same characteristics throughout the operating load range as it does at full load. The ST manufacturer understands and takes these steam dynamics into consideration and designs the ST blades to function without failure over the design life of the blade, presuming the ST is operated within the manufacturer's design conditions. It should also be understood that it is standard within the industry for the manufacturer to include a level of design margin into the ST components. Some of these design margins are mandated by code; others are based on experience with operation and manufacturing processes and the expectation that higher stresses likely will be placed on components when the power plant experiences an upset such as a plant trip. This is why a ST package designed for 420 MW may not be able to operate above the horsepower level needed to produce 420 MW without inducing component failure. Component failure may not occur or be discovered right away, but

the component life will be reduced and the increased likelihood of failure is introduced into the ST at especially susceptible places—like the L0 blades.

V. OPERATION OF BCC ST UP THROUGH FEBRUARY 2012

Q. PLEASE DESCRIBE THE TYPICAL STARTUP AND TESTING PROCEDURES FOR A POWER PROJECT SUCH AS BCC.

A. In early 2009, the BCC project began operation prior to the commercial operation date. Typical of a new power generation project, the plant proceeded through various systems testing and progressed through various phases of testing of the CTs and ST, including raising the ST MW generation up to designed output of 420 MW. Also, during the testing and startup period or shortly after the project is declared to be in commercial operation, various components will undergo testing to see if the equipment meets specific guaranteed operating conditions contained in the equipment contracts. Steam turbines go through a rigorous testing in accordance with American Society of Mechanical Engineers ("ASME") test procedures to determine if the ST meets the contractual performance guarantees. Based upon information provided by DEF, the BCC ST was subjected to the ASME test procedures, and MHPS reported on the June 16, 2009, test that the BCC ST met its guaranteed gross output of 420 MW.

Q. HOW WAS THE BCC ST OPERATED IN 2009 AFTER THE PLANT ENTERED COMMERCIAL OPERATION?

A. In June 2009, the BCC ST maximum output was 404.3 MW in accordance with data provided by DEF, as shown in Exhibit No. ___ (RAP-5). In July 2009 DEF

operated the ST for approximately 23.3 hours in excess of 420 MW design conditions and in August 2009 for approximately 27.2 hours, reaching a maximum output of 429.2 MW. DEF operated the ST in excess of 420 MW for approximately 374.2 hours in September and October of 2009, with peak generation of approximately 440 MW. In November 2009, DEF operated the ST at maximum output of 440.2 MW. In summary, for calendar year 2009, DEF operated the BCC ST for approximately 433.2 hours in excess of 420 MW, peaking at 4.8% over design conditions.

Q. HOW DID DEF OPERATE THE BCC ST DURING 2010?

A. Compared to 2009, DEF significantly increased the BCC ST output in January 2010 with the unit producing a maximum output of 446 MW, 6.3% higher than design conditions. DEF operated the BCC ST in excess of 420 MW during each month in 2010 through November, with a maximum output of almost 455 MW, over 8% higher than design conditions. In total, the BCC ST was operated approximately 940.3 hours in excess of 420 MW in 2010.

Q. HOW DID DEF OPERATE THE BCC ST DURING 2011?

A. DEF operated BCC ST in excess of 420 MW during every month except February during 2011, accumulating 1,521.2 hours of operation over 420 MW. Peak operation of the BCC ST appears to have been in April 2011, with the ST producing 457.6 MW, 9% in excess of design conditions. In total, the ST was operated in excess of 440 MW for over 1,160 hours in 2011.

Q. HOW WAS THE BCC ST OPERATED IN 2012 UP THROUGH THE FEBRUARY 2012 OUTAGE?

A. The ST was operated close to 450 MW in both January and February 2012, accumulating 77.9 hours of operation over 420 MW. Total operation in excess of ST design conditions since plant commercial operation in 2009 through February 2012, was almost 2,973 hours out of 21,734 hours of operation (from DEF Exhibit No. ___JS-1 (Docket No. 20180001-EI)). Over 13% of the operating hours in that initial period of operating the newly completed BCC plant were in excess of design conditions.

Q. DID DEF INFORM MHPS IT INTENDED TO OPERATE THE BCC ST ON A REGULAR BASIS IN EXCESS OF 420 MW?

A. In response to OPC Fourth Set of Interrogatories, Interrogatory 21, DEF states; "DEF did not correspond or discuss operating the steam turbine at 450 MW." As of the filing of this testimony, DEF has not produced any documentation from MHPS that shows MHPS acknowledging or agreeing that the BCC ST could be operated in excess of 420 MW. In his 2018 testimony, DEF witness Jeffery Swartz includes Exhibit No. ___(JS-1) (Docket No. 20180001-E1) which contains a Table A, titled "Bartow L-0 Events Summary" which breaks down the history of the BCC ST operation into five (5) periods. In the first column, labeled "Period 1" under the row titled "Key Notes from Period," the following note is provided:

> At the start of this period, MHPS approved 4X1 (unfired) operations at 392 MW output, as well as 3X1 (duct fired) operation at 420 MW, supported by MHPS-provided heat balance documentation.

This is further indication that MHPS was unaware of DEF's intent to operate—or DEF's operation of—the BCC ST in excess of 420 MW. DEF has failed to provide documentation as of the time of my testimony that MHPS provided DEF documentation indicating that the ST could operate in excess of 420 MW.

Q. WHY DID DEF STATE IT FELT THERE WERE NO ISSUES WITH OPERATION OF THE BCC ST IN EXCESS OF 420 MW?

A. MHPS provided DEF with operating conditions that specified operating parameters for the ST. These operating parameters included a variety of conditions, including HP and IP ST section inlet pressure and temperature conditions and condenser design conditions. After DEF performed a review in 2017-2018 of its initial operation of the BCC ST, DEF was of the opinion that, if steam conditions to the ST were within the HP, IP, condenser pressure, and temperature operating parameters, output of the BCC ST could be increased until these parameters were reached. DEF has provided no contemporaneous documentation from the period prior to the February 2012 outage of DEF's operating the newly installed BCC that MHPS concurred in DEF's retrospective claim. The result of DEF's decision was that it raised the horsepower output of the ST such that it was producing over 450 MW, which is 9% higher than MHPS design conditions.

Q. WHAT HAPPENED IN FEBRUARY 2012 AT BCC?

A. DEF scheduled a planned outage for valve work and inspection of the LP ST blades. During the inspection of the L0 blades, damage was found on five of the L0

blades located on the generator end of the LP ST. The L0 blades are the last row of blades the steam passes through prior to entering the condenser and are the longest blades in the ST at 40".

Q. WERE THERE SUBSEQUENT BLADE FAILURES AFTER FEBRUARY 2012?

A. Yes, as shown in DEF's 2018 Exhibit No. ___(JS-1), there were subsequent blade failures, including failures of MHPS redesigned blades. In February 2017, BCC experienced an outage due to L0 blade failures, and DEF decided to install a "pressure plate" to replace the L0 blades until a solution was found to the blade failures. A pressure plate is a disk with engineered holes to reduce the steam energy, allowing it to decrease in pressure to condenser pressure. The pressure plate does not convert any of the steam force into turbine horsepower and results in a loss of turbine horsepower. This resulted in the BCC ST maximum output being limited to only 380 MW. This, in turn, is what caused a derate of the ST from 420MW to 380MW. This derate was a natural consequence of the cascading series of blade failures precipitated by DEF's operation of the ST in Period 1.

VI. <u>EVALUATION OF BCC STEAM TURBINE BLADE FAILURES</u>

Q. HOW MANY TIMES DID DEF DISCOVER PROBLEMS WITH THE BCC ST?

A. DEF found damage to L0 blades on three other occasions after the initial blade damage was discovered in February 2012. As alluded to above, DEF separated the ST operating history into 6 periods. Period 1 starts with commercial operation and extends

until the problems were found during the February 2012 outage. Period 2 began after the February 2012 outage and extends until November 2014 when new L0 blades (Type 2 blades) were installed. Period 3 begins at the end of the 2014 outage and lasts until April 2016 when problems were found with the Type 2 blades. Period 4 begins with the installation of the second redesigned L0 blades (Type 3 blades) in June 2016 and ends when blade failures were found in October 2016. Period 5 starts when DEF decided to reinstall the original design Type 1 blades in December 2016 and ends in January 2017 when the component called the burst diaphragm was damaged by parts from these L0 blades. Period 6 began in April 2017 after the L0 blades were replaced by a pressure plate and is expected to continue until the end of September of this year.

Q. WHAT ACTION DID DEF TAKE AFTER THE BLADE DAMAGE WAS DISCOVERED IN FEBRUARY 2012?

A. Upon finding the 2012 blade failures, DEF engaged MHPS and several other entities to determine the cause of the blade failures. MHPS conducted a Root Cause Analysis ("RCA") of the failures. MHPS first stated in a report dated September 18, 2013, that "Mitsubishi estimated the cause of the [blade] cracking was overloading the LP section based upon 450 MW which is over the design point of 420 MW." In this report, MHPS estimates the ST was operated in excess of 420 MW for 2,600 hours, over 15% of the operating hours. This is consistent with, but still understates, the 2,973 operating hours derived by totaling the hours in column 420 for Period 1 in Exhibit No. ___(RAP – 5).

Since all the damaged blades in Period 1 were on the generator end of the ST, the L0 blades were replaced only on that end of the ST with Type 1 blades. MHPS informed DEF not to operate the ST above 420 MW and limited IP section exhaust pressure to 118 psig. During Period 2, DEF only exceeded the 420 MW limit for 1.7 hours. Average maximum monthly load was only 396 MW during Period 2. The ST was removed from service in September 2014 to install the Type 2 blades.

Q. WHAT WAS THE CONDITION OF THE L0 40" BLADES AT THE END OF PERIOD 2?

A. The Type 1 L0 40" blades used during Period 2 did not experience any broken snubbers or z-locks. According to DEF documents, no significant damage was found.

Q. BASED UPON THE VARIOUS DOCUMENTS PROVIDED BY DEF, WHAT WAS THE CAUSE OF THE L0 40" BLADE FAILURES UP UNTIL THE END OF PERIOD 2 (NOVEMBER 2014)?

A. The cause of the 40" L0 blade failures in the BCC LP ST during period 1 was the result of DEF operating the unit in excess of the 420 MW design output. MHPS has stated in multiple documents that operation of the ST, at horsepower levels sufficient to generate greater than 420 MW resulted in overloading of the L0 blades. After over 2,600 (or up to 2,973) hours of operation in excess of 420 MW over a 63-month period, the only type of failure that had manifested itself up to that point was the snubbers on five blades of the generator end of the ST (See Exhibit No. ___(JS-1). MHPS estimates the loading on the L0 blade at BCC ranged from 15,000 lb/FT^2-h to 17,000 lb/FT^2-h

(Exhibit No. ___(RAP-6), at 7, 19, and 20). Notably, the Period 1 snubber failures in the L0 blades experienced at BCC had not been experienced at other MHPS plants equipped with 40" L0 blades (See statements by MHPS in Exhibit No. ___(RAP-7), at 7 and Exhibit No. ___(RAP-8), at 8). Likewise, the range of operation and significantly higher loadings imparted on the ST by DEF operating the ST in excess of design conditions, was unique among the MHPS ST units. Operation of the BCC ST to produce an output appreciably in excess of 420 MW resulted in forces on the L0 blades that were 13% to 25% higher than the other MHPS units of similar design. Thus, it is obvious that DEF's operation of the BCC ST above the 420 MW design was a material cause of the failure of the L0 blades.

Q. WHAT WOULD ST OPERATIONAL OUTCOME HAVE BEEN IF DEF OPERATED THE BCC ST AT OR BELOW THE ORIGINAL DESIGN CONDITIONS DURING PERIODS 1 & 2?

A. Based upon the information provided in various documents and the RCA conducted by MHPS, DEF has not demonstrated that the original L0 blades would have experienced even minimal degradation over the design life of these blades if it had operated the BCC ST at or below the original design output of 420 MW. The Type 1 blades lasted for a period of only about five years after being subjected to stresses significantly beyond original design. The impact of stress on steam turbine blades is a cumulative effect and when a blade as long as the L0 blades is subjected to much higher than design forces, the impact is not linear.

VII. EVALUATION OF REPLACEMENT POWER COSTS ASSOCIATED WITH BCC GENERATION LOSSES

Q. HAS DEF DEMONSTRATED THAT ITS RATEPAYERS SHOULD BE RESPONSIBLE FOR THE REPLACEMENT POWER COSTS ASSOCIATED WITH OUTAGES AND REDUCED PRODUCTION FROM THE BCC PLANT AS A RESULT OF THE LP ST L0 BLADE FAILURES?

A. No, DEF has failed to demonstrate that it should not be responsible for the costs resulting from its operation of the ST. As presented earlier in my testimony, the failures of the original L0 blades are the result of DEF operating the ST above the 420 MW design condition. All subsequent outages and derates since 2012 have their origin in the operation of the ST in excess of 420 MW. DEF has failed to demonstrate that had it operated the ST within original design conditions the original blades would not still be in operation. If the original L0 blades had not failed due to DEF's operation of the BCC ST beyond the 420 MW design, DEF would not have installed the Type 2 and Type 3 blades, nor experienced the associated outages. In addition, if the original L0 blades had not failed due to DEF's operation during Period 1, the pressure plate would not be currently installed, and the ST would be capable of producing its designed output of 420 MW. DEF knew or should have known the designed generation capability of the ST was only 420 MW from the thermal analysis performed prior to operation and from the contract documents for the MHPS ST. These documents show the unit was designed for output of 420 MW. If DEF had discussed operation of the ST above 420 MW with MHPS prior to the initial operation at higher load,

the problems encountered with the ST at BCC likely would have been avoided. As of the filing of my testimony, DEF has not provided documentation that such discussion actually occurred.

Q. HOW DOES THE REPLACEMENT OF THE L0 BLADES WITH THE PRESSURE PLATE IN THE BCC LOW PRESSURE TURBINE AFFECT THE ST OPERATION?

A. The replacement of the ST L0 blades in the LP with the pressure plate results in a derate of the ST to 380 MW, according to DEF. This is a derate of 40 MW from the 420 MW original design condition.

Q. HOW DOES A DERATE OF THE BCC ST TO 380 MW AFFECT THE SUPPLY OF POWER TO DEF CUSTOMERS?

A. The reduction in BCC capability to produce full output has caused an increase in power costs for DEF. Utilities schedule plant operation with the most economical plants dispatched first. If a plant is derated, another plant with higher power costs is used to replace the lost MWs, subjecting DEF's ratepayers to higher power costs.

Q. HOW SHOULD THE COST OF REPLACEMENT POWER FOR THE MWH BCC IS UNABLE TO PRODUCE DUE TO THE ST BEING DERATED BY 40 MW BE CALCULATED?

A. BCC is one of DEF's most efficient and lower-cost operating units. Once it is scheduled to produce power at full load, approximately 1,140 MW, any additional generation needed to meet DEF's load will be more costly. As load increases, so does the cost of generation up to the point the daily peak load occurs. Since BCC is unable to produce the full 1,140 MW, the highest cost power in every hour should be used to calculate replacement power costs. Thus, the replacement power costs for the 40 MW derate of the BCC ST would be the cost of DEF's highest 40 MW block of power supply. This is the correct method of replacement power cost calculation for this derate because, if the ST were able to produce the additional 40 MW, DEF would not be paying the highest cost 40MW block in that hour. In response to OPC Interrogatory 35, DEF provided the highest cost power for each hour during the period of April 1, 2017 to August 31, 2019. If DEF's highest hourly power cost was higher than the generation cost of BCC, then BCC should be operating at maximum output during that hour. Using the hourly BCC heat rate and daily natural gas prices provided by DEF in response to OPC Interrogatory 44, the hourly generation cost for BCC was calculated. If the hourly BCC generation cost was lower than the highest hourly power price for DEF, then it is assumed DEF would be running at full load. The replacement power cost is equal to the highest hourly price minus BCC's generation cost times 40 MW.

Q. HAS DEF PROVIDED AN ESTIMATE OF THE REPLACEMENT POWER COSTS FOR THE BCC OPERATIONAL PERIOD AFTER

INSTALLATION OF THE PRESSURE PLATE IN THE LP SECTION OF THE ST?

A. Yes, DEF provided in response to OPC Interrogatories 33 and 44, an estimate of the replacement power costs due to the installation of the pressure plate on BCC ST for the period April 10, 2017, through August 31, 2019. DEF's calculation of the replacement power costs include an estimate of the portion of the 40 MW derate that would have been generated if the L0 blades had been installed, for each hour of the period, considered to be the hourly replacement power. The estimated replacement power in DEF's calculation is not consistent with how plants are dispatched based upon power costs. For example, DEF's calculation shows ZERO replacement power on June 1, 2017, between the hours of 11:00–22:00 despite the replacement power costs averaging $33.55/MWh, reaching a peak of $46.62/MWh, and despite the cost for BCC to generate power during this time period being only $22.68/MWh. The replacement power price over this period was more than $10.00/MWh higher than the BCC operating costs; yet DEF did not include any replacement power costs for this period in its replacement power cost calculation. If the BCC ST had been available for full load during this period, the additional 40 MW would have reduced power costs by $5,579. Review of the analysis by DEF finds many periods like this in which the replacement power cost was higher than BCC's cost of generation and that DEF did not include any replacement power costs due to the installation of the pressure plate on BCC ST, in the total replacement power cost calculation. As such, DEF's replacement power costs are not a realistic representation of the

replacement power costs DEF incurred as a result of the BCC ST 40 MW derate. DEF has clearly failed to demonstrate that its method of calculating derate related replacement power costs is reasonable.

Q. WHAT TIME PERIOD IS COVERED BY YOUR ANALYSIS OF REPLACEMENT POWER COSTS?

A. My estimate of replacement power costs for BCC covers three time periods: 2017, including the 2017 outage of the BCC ST; 2018, including the outage to repair the LP casing cracks due to the operation of the ST with the pressure plate; and the 2019 forecasted replacement power costs for the lower ST output associated with operation of the ST with the pressure plate, up to the fall outage planned to begin September 28, 2019.

Q. HOW WERE THE REPLACEMENT POWER COSTS DETERMINED FOR THE BCC OUTAGE THAT OCCURRED BETWEEN FEBRUARY 9 AND APRIL 8, 2017 ("BCC 2017 Outage")?

A. In Docket 20180001-EI, in Document No. 07025-2018, DEF witness Mr. Christopher A. Mendez provided testimony on page 5 for the replacement power costs incurred during the BCC 2017 Outage. Based upon his testimony, the replacement power costs were $11.1 Million. I do not take issue with this number, nor have I run production cost modeling analyses to verify it.

Q. WHAT WERE THE REPLACEMENT POWER COSTS DUE TO BCC OPERATING WITH THE PRESSURE PLATE FOR THE REMAINDER OF 2017?

A. The replacement power costs for the BCC 40 MW derate in 2017 after installation of the pressure plate in the LP section of the ST was ~~$2,005,536~~ **$1,675,561**. This represents the costs for ~~162,040~~ **150.400** MWh of replacement generation. The calculation of these power costs are provided in Exhibit No. ___(RAP-9), lines 1-9.

Court Reporter: DK

Q. WHAT WERE THE REPLACEMENT POWER COSTS DUE TO BCC OPERATING WITH THE PRESSURE PLATE FOR 2018?

A. The replacement power costs for the BCC 40 MW derate in 2018 were ~~$2,545,049~~ **$2,215,648**. This represents the costs for ~~213,280~~ **199,680** MWh of replacement generation. The calculation of these power costs are provided in Exhibit No. ___(RAP-9), lines 10-21.

Court Reporter: DK

Q. WHAT WERE THE REPLACEMENT POWER COSTS DUE TO BCC OPERATING WITH THE PRESSURE PLATE FOR 2019, THROUGH AUGUST 31?

A. The replacement power costs for the BCC 40 MW derate in 2019 was ~~$1,189,552~~ **$1,125,573**. This represents the costs for ~~128,480~~ **125,800** MWh of replacement generation. The calculation of these power costs are provided in Exhibit No. ___(RAP-9), lines 22-29.

Court Reporter: DK

Q. WHAT IS THE TOTAL REPLACEMENT POWER COSTS SINCE DEF REPLACED THE LP ST L0 BLADES WITH THE PRESSURE PLATE?

A. The total replacement power costs for the 2017 outage and the BCC ST derate for years 2017, 2018 and 2019 is ~~$16.84~~ **$16,116,781** million.

Court Reporter: DK

Q. DOES THAT CONCLUDE YOUR TESTIMONY?

A. Yes, it does. However, I reserve the right to file supplemental testimony to the extent any material new information is subsequently filed that was requested and was available, but was not provided prior to my testimony filing.

THE COURT: And I guess, did we need to move a revised Exhibit 9?

MR. DAVID: Yes.

MR. REHWINKEL: Your Honor, staff has requested, and I think correctly so, that we identify an exhibit, and we would just give it the next exhibit number, and this would be his revised RAP-9, which would be whatever the next number is.

THE COURT: 118.

MS. BROWNLESS: 117.

THE COURT: Okay, 117. We will mark it as 117, and without objection show it admitted.

(Whereupon, Exhibit No. 117 was marked for identification and received into evidence.)

MR. DAVID: And, Your Honor, just to be clear, when I moved the testimony in, that that includes the updates he made.

THE COURT: He has got a notice on the record. Yeah, we got that.

And how do we handle, Duke leads it off?

MR. BERNIER: Yep.

THE COURT: Okay.

EXAMINATION

BY MR. BERNIER:

Q Good morning, Mr. Polich.

A Good morning.

Q Good to see you again. Just a couple of preliminary questions.

You do not have any experience designing steam turbines, is that correct?

A I have experience -- I -- let me rephrase this. My experience with design of steam turbines involves the thermal cycles and how they match up with the existing steam turbine that I was provided.

Q Thank you.

But when it comes to physically designing the steam turbine, you don't have any experience doing that?

A Not direct.

Q Thank you.

Do you have any experience designing -- you do not have any experience designing steam turbine blades, is that correct?

A That is correct.

Q Okay. You do not have any direct operational experience with steam turbines, is that correct?

A Define what you mean by direct.

Q Have you ever -- you do not have any experience sitting at the control panel operating the steam turbine?

A I have supervised those who are at the control

panel.

Q But any experience operating the steam turbine?

A No.

Q You don't have any specific operational or design experience with a Mitsubishi steam turbine in particular, is that correct?

A I have never operated a Mitsubishi steam turbine.

Q You have never provided expert testimony regarding the design of steam turbines, is that correct?

A I have not provided expert testimony on the design of steam turbines.

Q And you have never provided expert testimony regarding the operation of steam turbines, is that correct?

A That is correct.

Q I believe you testified earlier during your summary that you reviewed documents and testimony in forming your opinions?

A Yes, I did.

Q Did you physically examine any of the damaged blades?

A No, I did not.

Q And you did not speak or correspond with

anyone from Mitsubishi as part of your testimony for preparation, is that correct?

A No, I did not.

Q And you would agree that the steam turbines should be operated within the operating parameters provided by the unit's manufacturer, is that correct?

A All the operating parameters, yes.

Q And you also agree that the megawatt output of the steam turbine is largely dependent on how you operate the unit within those parameters?

A I do not.

Q You do not?

A I do not. The megawatt output is an operating parameter.

Q Do you remember when I took your deposition in October?

A Yes, I do.

Q And when I asked you in October, the question was: My understanding -- let me ask you what your understanding of the difference between the expected output and the operating limits?

And you said: There actually is not a direct correlation. The operating limits are dependent upon various conditions of operation, generally defined a set of operating parameters providing you an envelope in

which you are to operate the steam turbine within, and for the most part, the megawatts is dependent upon how you operate within those limits.

A And I will still stand by that testimony that I still contend that the megawatt output has limits because it is a critical factor in defining how much horsepower a steam turbine is producing and what the stressers are within that steam turbine. And so megawatt output is a critical factor in operation of the steam turbine.

Q Based on information you reviewed, did Duke Energy operate the steam turbine within the pressures and temperatures provided by the OEM?

A Based on the data that I have reviewed, yes.

Q And am I correct that your opinion regarding DEF's operational prudence is limited to operation during what is referred to as Period 1 in Mr. Swartz's exhibit?

A I reviewed the operation through all the periods.

Q That's correct. My question is, am I correct that your contention in your testimony is that DEF was imprudent in its operation in Period 1?

A Correct.

Q Okay. And you agree that DEF was prudent when

operating the steam turbine in Period 2, correct?

A The pause is because I am recollecting some of the conditions during Period 2. Let me look at something here.

Q Sure.

A Based upon the information provided by Duke in which -- with the exception of September of 2013 in which there was actually some testing being done, the operation of that unit at all times was below the 420-megawatt limit, so I would say yes.

Q And notwithstanding that DEF prudently operated the machine during Period 2, at the conclusion of Period 2, DEF still found damage to the blades; is that right?

A The damage was described as minor, but, yes, there was some minor.

Q And you agree that DEF was prudent when operating the steam turbine in Period 3, correct?

A To the best of my knowledge, yes.

Q And notwithstanding that prudent operation during Period 3, at the conclusion of Period 3, DEF still found damage to those blades; is that correct?

A Those were a different design blade, and so they are not correlated to Periods 1 and 2.

Q Thank you.

At the end of Period 3, was there damage to the blades?

A Yes, there was.

Q Okay. And those blades were also supplied by Mitsubishi, is that correct?

A Yes.

Q And you agree that DEF was prudent in operating the steam turbine in Period 4, is that correct?

A Yes.

Q And notwithstanding that prudent operation, at the end -- at the conclusion of Period 4, DEF still found damage; is that correct?

A That's true.

Q And you agree that DEF was prudent when operating the steam turbine in Period 5, is that correct?

A Period 5 is an anomaly that I am not certain I can agree with.

Q Do you remember when I deposed you in October, sir?

A Yeah.

Q Okay. And I asked you: Was Duke prudent, in your opinion, prudent in its operation of the unit in Period 5? And your answer was: Yes.

A Yes.

MR. DAVID: Your Honor, if he would show the witness the deposition testimony, I think it might help.

THE COURT: Yeah, it might be helpful.

MR. BERNIER: I will have to give you my copy, but I will show it to you real quick.

May I approach, Your Honor?

THE COURT: Sure.

MR. BERNIER: I should have asked first.

THE COURT: That's fine. You know the answer is yes.

BY MR. BERNIER:

Q Right there.

A Thank you.

Q So would you agree with me that that was your response?

A If you notice in my deposition, there were several caveats in regards to that issue. I mentioned the fact that the correlation between Period 1 and Period 5 do not make sense. And as I mentioned in my opening, there is no -- the fact that they failed, those blades failed so quickly in Period 5, indicates there were other dynamics happening, or that those blades in Period 5 were not identical to the ones in Period 1.

When you get only four percent or less of the hours of the same, quote/unquote, design set of blades as you did in the first period, then it is not a direct correlation. And the reason why I am not certain as to whether Duke prudently followed everything is I don't know all the dynamics that were going on inside of the condenser at the time, and I don't know if there were any conditions that might have happened. And, yes, this is in hindsight.

Q And just to circle back on that, you are speculating that there were other conditions in there that you are not aware of but you don't know that for fact?

A I agree.

Q Okay. And just to make sure that I understood your answer correctly, you agree that the operation of Period 5 was prudent?

A I agree that the inlet pressure conditions to the IP, HP and LP, as well as the megawatt limits were maintained by Duke, and that they did their best effort as I could tell of staying out of the avoidance zone mentioned by Mitsubishi.

Q I am going to just ask that one more time another way.

You don't have any evidence that Duke operated

the unit imprudently in Period 5?

A I will agree with that.

Q Okay. Thank you.

So from the beginning of Period 2 through the end of Period 5, which spans approximately April of 2012 to February of 2017, approximately five years, you would agree that the steam turbine was operated prudently, correct?

A I am sorry, could you repeat that question again?

Q I would be happy to.

So from the beginning of Period 2 through the end of Period 5, which spanned approximately five years, you would agree that the steam turbine was operated prudently, correct?

A I would agree that it wasn't operated imprudently.

Q Fair enough. Thank you.

Now, if I understand your testimony correctly, your contention is that the blade damage discovered in Period 1 was caused by operating the steam turbine in a manner that produced over 420 megawatts; is that correct?

A That is correct.

Q And you would agree with me that during Period

1, the steam turbine was operated both above and below 420 megawatts at various times?

A Yes.

Q And I believe on your Exhibit RAP-5, and Mr. Swartz testified to this yesterday, that it appears that it was roughly half the time above 420 and roughly half the time below 420; without doing the math, does that sound about right?

A That's close enough.

Q Okay. So using your definition that operation over 420 was imprudent, and because the steam turbine was operated below 420 megawatts in Period 1 at some points, you have to agree that at some points during Period 1, using your definition, the steam turbine was operated prudently?

A Yes.

Q Okay. And you cannot identify when the Period 1 blades were damaged, can you?

A I cannot identify the exact instance in which they failed, and based on Mr. Swartz's testimony, he was not able to in Period 1 also.

The issue here, though, is the types of failures we are talking about more than likely were cumulative based upon the fracture pictures I saw. Even though I did not inspect the blades, there were plenty

of pictures and evidence in it, and my contention is that when they failed was immaterial.

Q But you would agree with me that the Period 1 blades could have been damaged when the unit was being operated below 420 megawatts, correct?

A There is always that potential.

Q So you would agree with me that the Period 1 blades could have been damaged during prudent operation, correct?

A Yes.

Q But we do know that the damage in the later periods occurred when the steam turbine was being operated prudently, correct?

A The damage did occur when the -- when it was operated within the operating parameters.

Q And have you seen any evidence that there was any damage to any steam turbine component other than the L0 blades?

A Other than -- other than, you know, subsequent damage associated with parts moving around, no.

Q I am not sure I understand.

A Well, for example, in Period 5, when the failure occurred, it threw the part out through the steam turbine. So, yes, there was something else that was damaged in the process.

Q Fair enough. Okay. Just a couple others real quickly.

You indicated that Bartow was Progress Energy's first combined cycle?

A I believe it was.

Q But would you agree with me if I told you that the Hines power blocks were commissioned prior to Bartow?

A I was not aware of that.

Q And does the steam turbine itself produce megawatts?

A No.

Q It's the generator that produces --

A The generator does produce the megawatts.

Q Thank you.

And in general, are there factors beyond the operation of the steam turbine that impact the megawatt outputs of the generator?

A One of the key ones that was discussed yesterday in Mr. Swartz's testimony, which is the issue of power factor, he brings up a very interesting point, although I think it's a red herring in this case, and that is because power factor is a very interesting animal in a power plant.

You have four -- you have five different

generators on this power plant, each of which is capable of producing a different power factor, and you have the ability to adjust power factor based upon what's going on. There is also dynamics associated with the generator output which determines the power factor the generator typically is producing.

Now, Mr. Swartz yesterday brought up power factor which is a rather interesting issue, because if Duke is trying to raise this unit's output to 450 megawatts, if you were to adjust that to the unity power factor that he discussed yesterday, that unit could be producing 500 megawatts, which exceeds the generator capability.

So I -- and if you look at all the documentation that's provided in this case, that power factor was never introduced. The 420 and 450 megawatts are the only numbers that are discussed in this case, and I think power factor is something that has not been factored into any of the evidence, the RCA or anything else.

Q You would agree with me that power factor was included in those documents that were discussed yesterday?

A Only in terms that they were specified as .95 or .90.

Q And are there other variables beyond power factor that impact generator output?

A The efficiency of the steam turbine, of course, is always one. There is -- you know, it's ancillary. The numbers that we talk about, 420 megawatts, is a net output. So to the extent that ancillary loads that are associated with that steam turbine can affect that 420, quote/unquote, but, you know, in transferring the horsepower from that steam turbine to the generator, there aren't many aspects that can change that number.

MR. BERNIER: If I could have just one minute.

THE COURT: Sure.

MR. BERNIER: Could we have five minutes?

THE COURT: Sure. Absolutely.

(Brief recess.)

THE COURT: Okay. Back on the record.

MR. BERNIER: Thank you for that break, Your Honor. Just a couple more.

BY MR. BERNIER:

Q Mr. Polich, you would agree with me that Mitsubishi was aware that Duke planned on operating the steam turbine in a 4-on-1 configuration, correct?

A Yes.

Q Do you know that DEF didn't contact Mitsubishi

about operating the unit over 420 megawatts in Period 1?

A There is no evidence that they asked Mitsubishi to operate over 420.

Q But you don't know whether or not it did occur or not?

A No, I don't.

Q And if I understand correctly, your contention is that the blade damage discovered in the spring of 2017, after Period 5, was originated or caused by the operation in Period 1, was that correct?

A No.

Q No. I am not sure I understand.

A Repeat the question one more time.

Q Sure. Am I correct that your contention is that the damage that occurred in the spring of 2017, after Period 5, was caused by Duke Energy's operation of the unit above 420 megawatts in Period 1?

A No.

MR. BERNIER: Okay. We have nothing further. Thank you.

THE COURT: Okay. Who's next? Okay.

MS. PUTNAL: No questions from FIPUG.

THE COURT: Nothing?

MS. PUTNAL: No questions from FIPUG.

THE COURT: Well, I guess redirect then.

MS. BROWNLESS: Excuse me, we have two questions.

THE COURT: Oh, I am sorry. I am sorry.

MS. BROWNLESS: Thank you.

EXAMINATION

BY MS. BROWNLESS:

Q Your Exhibit No. 5 in your testimony shows operating data for the Bartow unit from June 2009 until August of 2019, is that correct?

A Yes.

Q And you used this data to calculate the derate replacement power cost that you are seeking to recover, as found on your exhibit RAP-9, right?

A No.

Q You didn't use this data as the basis to develop the replacement cost?

A No. The data in RAP-5 is strictly associated with operation greater than 420 megawatts. Duke provided another set of documents that showed what the operations were on an hourly basis during the time periods in question.

Q And that's what you used?

A And that's what I used for calculating replacement power.

Q Is it your testimony that ratepayers should be

compensated for megawatts that were not generated due to DEF's operation of the steam turbine under 420 megawatts?

A Yes.

Q And should DEF also receive credit for the megawatts it produced over 420 megawatts in Periods 1 and 2?

A No, because that wasn't subject of the proceeding, if I am correct.

Q Well, I guess what I am trying to ask is you believe they should be -- they should pay for megawatts they did not produce, but isn't it true that customers also got the benefit of megawatts in excess of 420 in Period 1?

A My testimony is dealing with periods after 2016, and so Periods 1 and 2 would be prior to that.

Q So you don't think it would be appropriate to use the data in RAP-5 to figure out how many megawatt hours were produced in excess of 420 in Periods 1 and 2?

A Okay, to answer that question appropriately we would have to get into compensation and payments associated with power cost recovery cases. To the extent that power cost recovery cases typically are dollar for dollar what the utility spends is what the customer pays for.

Your supposition is that there was net benefit that Duke was not compensated for as a result of that. If we were to follow that line of questioning to its conclusion, you would be espousing that because the operation above 420 potentially reduced replacement -- or reduced the power cost that customers were paying for and Duke should be compensated for that is actually contrary to the regulatory compact between utilities and their customers.

And in rate-making and rate proceedings, utilities normally don't get a profit, which that would be, for replace -- for power cost. But if utilities imprudently incur power costs, they will be docked -- they can be docked in fuel cost recovery proceedings.

Q So if I understand what you are saying, the standard is 420. If they do less than 420, they are operating imprudently, and therefore should -- customers should be compensated for that, and if they are operating above 420, you are not saying that customers didn't benefit from those megawatts, are you?

A I didn't say that, no. Customers did -- I mean, customers -- to the extent -- and truth of the matter is I -- you know, without having the actual data, all right, my guess, based on the fact that Duke did operate the unit more than 420 was that their cost

occurs associated with the stacking of their various generation units indicated that it was more prudent to operate Bartow above 420 to reduce the overall power cost to customers. And so that was a prudent decision from that perspective, absent the fact that they were violating the operating parameters of the unit, all right.

Now, that is factored already in your power supply cost recovery proceedings, all right.

The second thing is that what I am talking about, and it's in my testimony, is associated with the installation of a pressure plate and associated derate as a result of that. And my contention is, is that the reason the pressure plate was put in place was due to improper operation above 420 megawatts in Periods 1.

Q Okay.

A And so it's not the same animal from my perspective.

Q I understand.

And I just want to ask one question. You have indicated that if Duke had called Mitsubishi and said we are going to operate it at this higher level, and Mitsubishi had given them permission to do that, that we all wouldn't be here today; is that correct?

A And that permission would -- should have been

in writing.

Q Okay.

A It should have been something that allowed Duke to go back to Mitsubishi from a warranty perspective, so that, you know, okay, we asked you. We gave you the parameters we were going to operate under, and you came back and said that's okay, then the onus is on Mitsubishi.

Q And if they simply asked Mitsubishi and got permission but never got written permission, would that change your opinion?

A No, because we are dealing with regulatory proceedings here, and the additional step of getting it in writing is minimal. It doesn't take any effort to do that. And so the prudent thing to do, especially when you are dealing with a regulatory or a contractual issue is you get it in writing. Any attorney that I have ever been associated with would tell you that.

Q All right. Thank you so much. That's all we have.

A Thank you.

THE COURT: Ms. Putnal, I apologize, I was -- I was promoting you to the Commission. That's why I thought we hadn't met. I just realized she's in Mr. Moyle's chair.

MS. PUTNAL: Thank you.

THE COURT: I think we are to redirect.

MR. REHWINKEL: Yes. Thank you, Your Honor. Just a few questions.

EXAMINATION

BY MR. REHWINKEL:

Q Mr. Polich, can you tell me, I think you were asked by Mr. Bernier if you had contacted Mitsubishi in any part of this process; do you recall that?

A Yes.

Q In your opinion, in your expert -- in your experience in the business, would it have been appropriate for you to have contacted Mitsubishi in this case?

A No. And, in fact, you know, if I had, I think there would have been some issues by Duke associated with my doing that.

And in addition, I doubt Mitsubishi would talk to me anyways because of the fact that a lot of the information I would have been seeking is probably under confidentiality and would not be -- so it would have been useless for me to contact Mitsubishi.

Q Mr. Bernier also asked you -- do you recall him asking you about whether damage was found in Period 2?

A Yes.

Q In the course of your discovery in this case, did you see any evidence that Duke believed there was either no damage or damage that was pretty typical and the type that could have been smoothed out during the -- during a planned outage?

A Well, in fact, if you go to Duke's RCA Table A, and you look at what was found in Period 2 and you come down to a line that says broken snubbers, there is zero on the turbine end. There was zero on the governor end. You look at the broken Z-lock, zero on the turbine end zero on the governor end. Moderate amount of surface fretting and galling observed, which is normal.

Duke operated the machine within the parameters of -- and below 420 megawatts with the exception of the one test that they performed during that time period, and this was 28 months of operation, 21,000 hours, and basically no damage.

Q Do you recall being asked about damage in Periods 2 through 5?

A Yes.

Q Is it your opinion that the blades throughout Periods 2 -- well, throughout all five periods were similar enough for you to make a direct comparison about prudent operation and impact on the blades?

A No. I mean, when you got to Period 3, Duke was -- you know, not Duke, but Mitsubishi installed the Type 3 blades, which were a different design. Some of the interesting things that they did to the blades in terms of surfaces on the snubbers and the Z-locks I believe contributed to the problems instead of, you know -- instead of resolving them.

And so going back to the comparison between those periods and Period 1, I don't think they are correlatable, and especially when you get to Period 5; because again, you got to come back to why did the Period 5 blades which were, quote/unquote, identical to the Period 1 blades fail in only four percent of the operating hours, and include throwing a piece through the steam turbine casing? Actually, I think it was the pressure disc, but it's -- it's -- from an engineering perspective, it doesn't add up, and so I don't think there is a correlation.

Q Do you recall Mr. Bernier asking you whether you had any knowledge if Duke contacted Mitsubishi during Period 1?

A Yes.

Q Okay. In the process of doing discovery in the proceeding, did you ever hear Mr. Swartz state that, for all I know, there may have been no discussion with

Mitsubishi relative to that period?

A I recall that in a deposition.

Q Do you recall Mr. Swartz saying, I am not sure how much interaction was going on with Mitsubishi with respect to that period?

A I recall.

Q And finally, you were asked a question by staff counsel about going back and looking at 2009 and the value that the customers might have gotten out of operating above 420 --

A Yes.

Q -- do you recall that?

Are you also generally aware that after October 2nd of 2009, Duke had damage to the Crystal River 3 nuclear plant --

MR. BERNIER: I object, Your Honor. This is pretty irrelevant.

THE COURT: Let him finish the question.

BY MR. REHWINKEL:

Q And was -- without 1,000 megawatts or so of base-load generation for the next three years?

MR. BERNIER: Same objection, Your Honor.

MR. HERNANDEZ: It's also beyond the scope of --

MR. REHWINKEL: If I could be heard, Your

Honor.

THE COURT: Sure.

MR. REHWINKEL: There was -- I could ask a question in front of that one so you could understand, but the assertion -- the question by the staff, which I think was an informational question, was to know whether there was a benefit that customers were unduly receiving from this excess generation. But to complete the picture, the Court needs to understand whether there was a replacement power need that Duke might have been filling by running the unit above 420, and thus that would have all been taken care of in the fuel adjustment process and the ensuing proceedings.

MR. BERNIER: I apologize, Your Honor, that is not at all relevant. I think she was asking whether or not customers received the benefit of that added generation, and whether or not there was an outage at another plant at another time is completely irrelevant. That's not what we are here talking about today.

MR. REHWINKEL: I can withdraw the question.

THE COURT: I am going to sustain. I think we are kind of getting into the weeds here.

MR. REHWINKEL: All right. That's all I have.

Mr. David may have a question.

FURTHER EXAMINATION

BY MR. DAVID:

Q Mr. Polich, in your experience -- how long -- once again, how long have you been an engineer?

A Since 1978.

Q Okay. In your experience, do prudent engineers base analyses on oral information?

A My hesitancy is because we will conduct preliminary analyses based upon oral information. But in the case, especially when you are looking at design of a power plant or something like that, you are going to want confirmation especially if that information is being provided by an OEM, because your client is going to expect you to have that documentation and information because utilities are regulated entities. Their operations are always under public scrutiny and questioning. And so an entity such as Duke would expect their -- their owner -- their engineer on a project to have that documentation because if there is questions some point in the future, they are going to want to be able to provide the proper evidence if needed.

Q Thank you.

And to staff's line of questions, in your calculation of damages that was in, I believe it's now

been identified as Exhibit 117, did you only take into account when power was needed, or did you just take into account the fact that they weren't producing 420, so you -- so they -- you docked them for that?

A I did, yes. I did look at only when that power would have been needed. There are definitely hours in there in which, based upon the information provided by Duke, I could identify those hours in which the additional megawatts would not be necessary, and I excluded those hours from my calculations.

Q Okay. Last one.

In your opinion, did the operation of the steam turbine in Period 1, the manner of operation of the steam turbine in Period 1 affect the condition performance of the steam turbine after that period, including Periods 3 and beyond?

A Interesting question from the perspective of how operation of a steam turbine in earlier periods affects opera-- affects the way that steam turbine performs in later periods.

Clearly, you know, by the time you get to Period 5, this unit has been in operation for, you know, eight some odd years, and there will be some wear on components within that turbine. Duke has stated that Mitsubishi did a very thorough analysis of those

components and didn't find anything out of the ordinary. It doesn't mean that there wasn't some wear and tear that occurred. And that wear and tear can affect how the performance of a set of blades put in in subsequent periods. The question is how much that can affect it.

MR. DAVID: No more.

THE COURT: Okay. Thank you, Mr. Polich.

THE WITNESS: Thank you.

(Witness excused.)

MR. DAVID: And, Your Honor, at this point, I would like to move all of Mr. -- the exhibits to Mr. Polich's testimony in there, except I will withdraw what's been identified as -- on the CEL as Exhibit 76, since it was the incorrect one, and offer exhibits 68 through 75 and Exhibit 117.

THE COURT: I think 117 we've already admitted.

MR. DAVID: Okay. I just wanted to make sure we are clear.

THE COURT: Without objection, we will show 68 through 75.

MR. DAVID: And withdraw 76, thank you.

THE COURT: Okay. 76 is out.

(Whereupon, Exhibit Nos. 68 - 75 were received into evidence.)

THE COURT: According to my script, we are up to the rebuttal.

MR. BERNIER: Yes, sir. Duke Energy would recall Mr. Swartz.

THE COURT: Mr. Swartz, I will just remind you you are still under oath.

THE WITNESS: Yes, sir.

THE COURT: I am not going to swear you in again. I think it's like the flu, the vaccine only last a couple of days.

Whereupon,

JEFF SWARTZ

was recalled as a witness, having been previously duly sworn to speak the truth, the whole truth, and nothing but the truth, was examined and testified as follows:

EXAMINATION

BY MR. BERNIER:

Q Good morning again, Mr. Swartz.

A Good morning.

Q I believe the judge has reminded you that you remain under oath, is that correct?

A Yes, that's correct.

Q Okay. Good deal.

On or about September 26th of 2019, did you cause to be filed rebuttal testimony in the 2009 fuel

docket before the Florida Public Service Commission?

A Yes.

Q And do you have of a copy of that testimony with you today?

A I do.

Q And I believe your testimony -- your rebuttal testimony included exhibits JS-2, 3 and 4, is that correct?

A Yes, that's correct.

Q And you have those with you today?

A I do.

Q Do you have any changes to make to your testimony?

A No changes.

Q If I was to ask you the same questions here today, would your answers be the same?

A Yes, they would.

Q Okay.

MR. BERNIER: Judge, at this time, we would ask that his rebuttal testimony be read -- entered into the record as though read.

THE COURT: As if read. Hearing no objection, we will show that done.

(Whereupon, prefiled testimony was inserted.)

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

REBUTTAL TESTIMONY OF

JEFFREY SWARTZ

ON BEHALF OF

DUKE ENERGY FLORIDA

DOCKET NO. 20190001-EI

September 26, 2019

Q. By whom are you employed and in what capacity?

A. I am employed by Duke Energy Florida ("DEF" or the "Company") as Vice President – Generation.

Q. Have you previously filed testimony in this docket?

A. Yes, I filed testimony related to the February 2017 outage of the Bartow Combined Cycle ("Bartow CC") Steam Turbine ("ST") in this docket on March 1, 2019. Additionally, in last year's docket I filed testimony and sponsored DEF's Root Cause Analysis ("RCA") regarding the same outage, which was attached to my testimony as Exhibit No. __(JS-1). This exhibit was then incorporated by reference into my March 1, 2019 testimony in the present docket.

Q. Have your duties or responsibilities with the Company changed since you last filed testimony in this docket?

A. No.

Q. What is the purpose of your testimony?

A. The overall purpose of my testimony is to rebut OPC witness Polich's incorrect conclusion regarding the root cause of the L0 blade failures. DEF acted prudently at all times with respect to the operation of the Bartow plant. I will clearly articulate why the Commission should reject Mr. Polich's argument that DEF should bear any replacement power costs related to either the Spring 2017 outage or operation of the Bartow plant with pressure plates in place of the L0 blades in the steam turbine.

Q. Please provide a summary of your testimony.

A. The Commission should reject Mr. Polich's opinion as to the cause of the steam turbine ("ST") blade failures because he disregarded or ignored key information. Specifically, he only considered operating conditions for the Period 1[1] failure and disregarded key facts obtained from later operating periods that contradict his ultimate opinion. As my rebuttal testimony and exhibits demonstrate, DEF operated the Bartow unit at all times within the operating parameters set forth by the steam turbine Original Equipment Manufacturer ("OEM").[2] After DEF initially discovered damage to the L0 blades, it consulted with the OEM and adjusted operation to within new limits established by the OEM. However, even when DEF operated at lower LP pressure limits with the same type of blades as it did during Period 1, the L0 blades experienced damage. Mr. Polich ignores the fact that the L0 blades later failed even when DEF operated the Bartow unit

[1] My testimony refers to various periods of operation, which are set forth in my Exhibit No. __ (JS-2), Table A.
[2] The OEM for the Bartow CC ST is Mitsubishi Hitachi Power Systems ("MHPS"). I will use "OEM" and "MHPS" in this testimony interchangeably.

at a lower LP pressure and claims that DEF's operation of the Bartow unit beyond its design during Period 1 caused the first blade failure.[3] The basis for his opinion appears to be an earlier root cause analysis that was prepared without the benefit of the additional information learned from continued operation of the unit in later periods. Mr. Polich then concludes:

> If DEF had operated the ST at BCC in accordance with design output of 420 MW or less, I believe there is no engineering basis to conclude that the original L0 blades would not still be in operation today. Likewise, DEF would not have needed to undertake any of the subsequent outages to repair L0 blades, including the outage in February 2017 to replace the L0 blades with the pressure plate. Consequently, the BCC ST would currently be capable of producing its full output of 420 MW instead of being derated to 380 MW and operating with a less-than-optimal pressure plate.[4]

These statements completely fail to account for subsequent failures that occurred without the ST being operated over, or even at, 420 MW of output. Contrary to Mr. Polich's suggestion, it is evident that DEF operated the machine prudently at all times and made a prudent decision to install the pressure plate in the spring of 2017 to allow for event-free operation while a long-term path forward could be designed, tested, and implemented. For those reasons, the Commission should reject Mr. Polich's contention that DEF should not be permitted to collect the replacement power costs incurred as a result of the 2017 outage and operation with the pressure plate and should approve DEF's recovery of its costs as presented in its petitions and testimony in this docket.

Q. Are you sponsoring any exhibits?

[3] DEF's "operation of the BCC ST beyond the ST's 420 MW design" caused the first blade failure. Polich Testimony, pg. 7, ll. 15-16.
[4] *Id.* at pg. 8, ll. 11-18.

A. Yes. I am sponsoring:

- Exhibit No. __ (JS-2) – *Exhibit No. __ (JS-1) Revised as to Confidentiality Only (Confidential)*;
- Exhibit No. __ (JS-3) – *Duke Energy Bartow ST 40" Upgrade Blade Test in Takasago Validation Rigor at MHPS (Confidential)*; and
- Exhibit No. __ (JS-4) – *Bartow RCA Summary, Sept. 22, 2017 (Confidential).*

Basic ST Operation

Q. Based on Mr. Polich's testimony, do you believe he understands how DEF controls the Bartow ST during operation?

A. No, his testimony shows that he focuses on the MW output of the machine as the control mechanism, where in practice the output is simply the byproduct of operating the unit within the design parameters provided by the OEM. At multiple times in his testimony, Mr. Polich discusses the nominal nameplate rating of the Bartow ST (420 MW) as a "design output" or "design condition"[5] and indicates his belief that the 420 MW nameplate represents the unit's "maximum gross output."[6] However, thinking of the operating parameters of a ST solely in terms of MW output is either an over-simplification or miscomprehension of the true operating parameters of the unit and/or the myriad variables that can impact the unit's output. Despite the fact that Mr. Polich

[5] *See e.g., id.* at p. 8, l. 12; p.8, l. 10 ("generated output above the 420 MW design conditions"); p. 7, ll. 15-16 (noting the "ST's 420 MW design."); p. 8, l. 23--p. 9, l. 1 ("manufacturer's 420 MW design conditions."); p. 10, ll. 6-7 ("The ST was designed to produce 420 MW gross generation.").
[6] *Id.* at p. 12, l. 13.

indicates his awareness of the true design conditions that govern use of the ST,[7] he, nonetheless, returns to the erroneous conclusion that the nameplate capacity is a "maximum" output threshold that cannot be breached.[8] In actuality, the nameplate capacity is simply the OEM's expected output resulting from the operational parameters and other assumed values for variables that are given to fluctuation (such as ambient temperature, humidity, temperature of cooling water, etc.), not a design basis criteria for operating the ST.[9]

Q. If the ST operating parameters are not centered on its output. what are the operating parameters established by the OEM for the Bartow ST?

A. When the ST was commissioned in 2009, the operating parameters were established by the Mitsubishi ST operating manual as related to steam flow through the ST. When DEF realized that operating parameters allowed for additional steam to flow through the ST, resulting in additional megawatts for DEF's customers while staying within those parameters, DEF started increasing the steam flow through the ST staying within the known operational parameters. After the original blade type was found to have cracking issues, DEF worked with Mitsubishi to establish additional operating limits not found in the operating manual. Each operating Period identified in Exhibit No. __ (JS-2) had different operating limitations.

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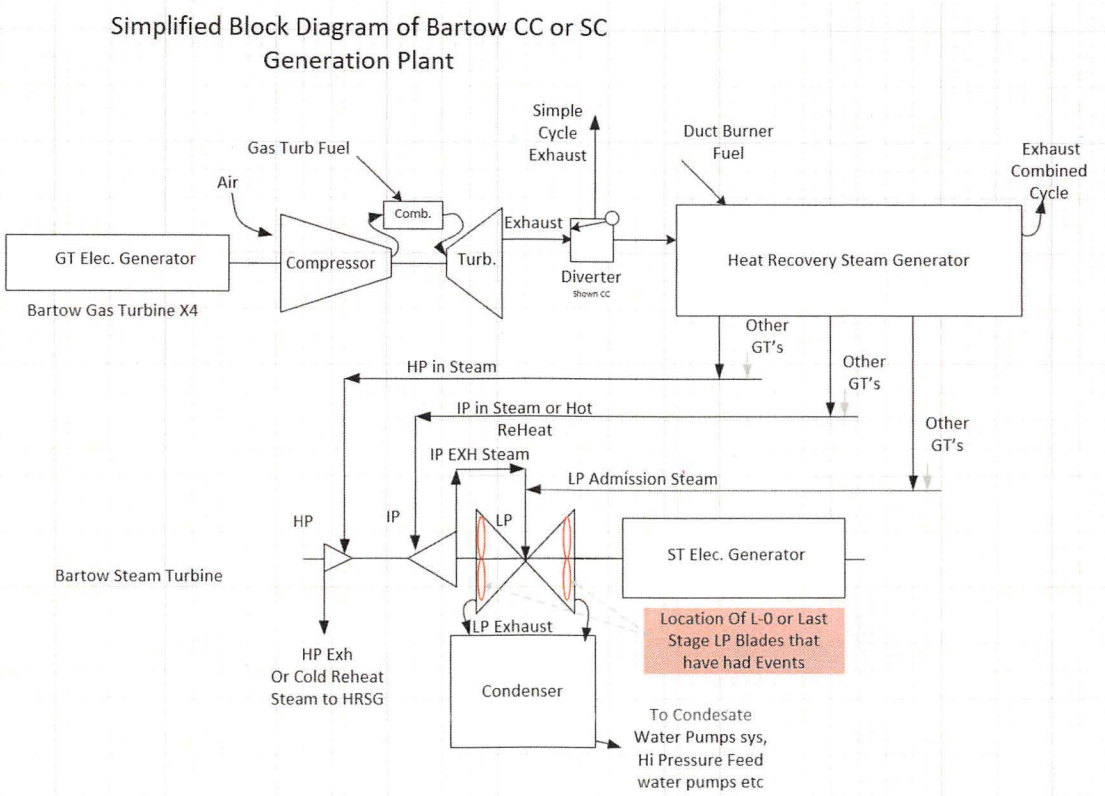
[7] *See id.* at p. 11, ll. 11-17.

[8] *See id.* at p. 12, ll. 17-19.

[9] Considering Mr. Polich's position that the ST had a MW output maximum that could not be breached without risking damage to the unit, it is noteworthy that he does not assign a similar "absolute maximum" to the other components of the Bartow CC. *See id.* at p. 9, ll. 21-22 (noting the "Non-steam augmented power output of each CT is in the range of 180 MW."); p. 10, ll. 9-10 (noting the "generator output appears to have an upper gross generation limit of about 465 MW at a 0.95 power factor . . . ").

- Period 1 - Operational limits given to DEF were based on the turbine nameplate data and those limits typical for steam turbine operation like vibration limits, metal temperature ramp rate limits, seal system parameters, lube and hydraulic system pressure temperature limits and many other parameters that are common to this type of equipment. However, while parameters related to steam pressures and temperatures are part of the nameplate rating, no flow-limits, and in particular, no flow-limit for the LP turbine, were given to DEF. This is not unusual as flow limits will normally be maintained if inlet pressure and temperature limits are maintained. In a combined cycle application, that normally means staying within the pressure and temperature limits of the HP and IP turbines. There is only a small fraction of flow added by the HRSG LP system. In short, there was no operational limit for the LP turbine flow or inlet pressure for Period 1 that was known to DEF operations at that time.
- Period 2 - MHPS established a LP inlet pressure limit for DEF to follow. The LP pressure was inferred from the IP turbine exhaust pressure as no LP turbine inlet pressure instrument existed during this time period. During each succeeding time period, MHPS established a new LP pressure limit based on their analysis for the blade type and modifications installed at that time. A pressure transmitter was added to the LP turbine in the fall of 2016.
- Periods 3-5 - MHPS for the first time established an "Avoidance Zone" ("AZ") related to LP inlet pressure and condenser backpressure. For Period 3, MHPS stated that the AZ should be avoided but did not provide any time limits or recommendations to move the ST out of the AZ.

For the time-period that the Bartow ST has been operating with the installed pressure plate, MHPS has kept the LP inlet pressure parameter as a setpoint to not exceed even though the L0 blades have been removed.



Q. Did DEF operate the Bartow ST within the operating parameters established by the OEM?

A. Yes. Starting with commissioning and Period 1, DEF has followed all the known operational limits for the steam turbine. Post-Period 1, DEF has made every reasonable attempt to maintain the LP inlet pressure limit in place for the given Period. Hours

above the pressure limit do exist for Period 3;[10] however, during the testing period at the outset of Period 3, MHPS needed to explore the entire range of operational parameters in order to determine where dynamic stresses were above their limit at the time, resulting in many of the hours within the then-unknown AZ. MHPS established the AZ (additional instructions which consisted of a combination of LP inlet pressures and condenser backpressures) as a result of the post-test analysis of strain gage data gleaned from this testing, but MHPS was not able to analyze the data and communicate the limits of the AZ until March of 2015, therefore resulting in additional hours in the zone, albeit unbeknownst to DEF at the time of operation. Some additional run hours in the AZ do appear during Period 3, but operators adjusted the CTs and HRSG duct burner outputs to minimize time in the zone as they strove to maintain a high output and benefit from the steam turbine without compromise to the LP turbine. MHPS's instructions on time in the AZ was to limit the amount of time run there; it was not a hard-fast limit, nor did MHPS provide Bartow operators a means to automatically keep out of the AZ.

Q. If the plant operators do not control the ST by trying to reach a given level of MW output, how is the unit controlled?

A. The ST is "controlled" by adjusting the output of the four combustion turbines ("CTs"). For example, in a 1x1 configuration (one CT and heat recovery steam generator ("HRSG") providing steam to the ST), the ST would receive enough steam to produce approximately 100 MW; in a 2x1 configuration, the ST would receive the steam

[10] The chart titled "Excessive Steam Flow" found in Appendix B of Exhibit No. __ (JS-2), shows the hours the unit was operated in the AZ for the respective Periods.

equivalent to approximately 200 MW; in a 3x1 configuration, the ST would produce about 300 MW; and for 4x1 configuration, the ST would produce about 400 MW. In order to produce more megawatts, the auxiliaries (duct burning and Power Augmented Steam ("PAG")) would be used. These auxiliaries are described in more detail below.

The ST is a follower much like a trailer follows a truck. In this example, the trailer can only go as fast as the truck that is pulling it and can only turn if the truck makes a turn. The four CTs exhaust into their respective HRSGs, the four HRSGs produce steam for the three sections of the ST. The HRSG produces high pressure ("HP") steam, intermediate pressure ("IP") steam, and low pressure ("LP") steam. The HP steam enters the HP section of the ST, the IP steam enters the IP section of the ST, and the LP steam in the HRSG enters the LP section of the ST. The LP section of the ST also receives exiting steam from the IP section of the turbine. During the commissioning process, the ST is "matched" with the three steam pipes (HP, IP, LP) coming from the four HRSGs to produce the output of the machine in Megawatts. The output of the ST in megawatts is a product of the steam pressure and flow. If the operator wants to reduce the steam pressure and flow through the ST (i.e., to produce less Megawatts), the operator reduces the CTs' output and thus the steam passing through the ST (and the megawatts produced) is reduced after a short lag in time for the energy to dissipate. The operator can also produce more output from the ST by adding duct burning within the HRSGs to produce more heat and therefore steam that is ultimately passed through the ST. The operator can also use PAG, another auxiliary, to produce more output from the power block. At first, PAG actually extracts steam from the IP section of the ST

using the steam in the CTs like a supercharger in a car and raising the output of the CT generators. If the operator uses PAG, the output of the ST is initially reduced until duct burning is introduced to produce more steam in the HRSG to send to the ST, raising the output of the ST generator.

The ST has two (2) High Pressure stop valves and two (2) Control Valves. When the ST is online and steady state, all four (4) of these valves are open and stay open – no matter what configuration the station is operating in (i.e., 4x1, 3x1, 2x1, or 1x1). A combined cycle plant does not modulate its control valves to limit ST load, the control valves are only used in startup or shutdown to maintain system pressure above a minimum value. There are two automatic sub-systems associated with the ST to prevent too much steam from entering any of the sections of the ST (HP, IP, and LP): the "sky vents" and the condenser bypass system. The sky vents are located on the top of the HRSGs, and they sense pressure in the HRSG and can release steam from the HRSG in the event pressure rises above its setpoint. Use of the sky vents only occurs during an emergency or unit startup. The condenser bypass system is an automatic system designed to blend the HRSGs into and out of the ST. As the name suggests, the condenser bypass system takes steam from the HRSG and, instead of the steam entering the ST, it bypasses the ST and feeds directly into the condenser. The steam path described here can be traced through the diagram attached to Mr. Polich's testimony as Exhibit No. __ (RAP-3).

In summary, the operator controls the CTs and the output of the CTs determine the output of the ST. The operator's job is to make sure that the ST is operating as efficiently as possible, producing the most output for our customers as possible, within the steam pressure and flow limits (operating parameters) established by the OEM.

Prudent Operation of the Bartow CC for DEF's Customers

Q. Is the distinction between operating to achieve a desired MW output as Mr. Polich describes and following the operating guidelines as you are describing important?

A. Yes, it is important because operating with an eye to the proper operating conditions allows an operator to maximize a unit's efficient output for customers. As Mr. Polich notes, the Bartow CC is one of the most efficient and lowest-cost generation units in DEF's generation fleet. Therefore, it is prudent for DEF to maximize its output for customers' benefit, so long as the operating conditions prescribed by the OEM are complied with. Hence, when DEF became aware the unit was not being maximized according to the OEM's operating pressure, steam flow, and temperature guidelines, the prudent course of action for the Company was to bring the unit's operation into line with those guidelines – regardless of whether DEF was achieving the nameplate output previously.

If DEF were to operate the Bartow ST, or any other unit, according to Mr. Polich's concept of never breaching the nameplate "maximum" output, its customers would potentially experience higher costs. A simple way to illustrate the point is to consider winter versus summer operation. Due to cooler temperatures and denser, heavier air

conditions, a given unit can produce more MWs of output during the winter while operating within the same parameters as summer operation. Following Mr. Polich's logic, if DEF operated the unit during the winter without changing any of the operation parameters (e.g., no additional steam is being produced and put through the machine) and the output increased from 419 MW to 421 MW,[11] DEF would be required to "back off" operations in order to get the unit's output down below nameplate capacity; this would "cost" customers the opportunity to receive the otherwise free differential in output and would run counter to the goals of maximizing efficiency and value to customers.

Q. Did DEF's customers benefit from the Bartow ST producing more than 420 MW during Period 1?

A. Yes. When the Bartow ST was generating more than 420 MW during Period 1, it logically would have been dispatching in higher economic order than other generation. Accordingly, DEF avoided operating or buying more expensive generation, and DEF's customers received the benefit of this lower-cost power generation. This is of course how DEF should operate its generating fleet, as I describe above. In general, if DEF were to operate its fleet in the manner described by Mr. Polich, DEF would not be allowed to operate its units, including Bartow CC, in the most efficient manner. This would result in higher energy costs for DEF's customers due to the need to generate or

[11] Although in this example, the hypothetical increase in output for the ST during winter operation is set at 2 MW, in practice winter operations with no change in operation parameters can result in an approximate 95 MW increase for the Bartow CC, with approximately 15 MW of the increase attributed to the ST.

purchase higher cost energy, which is currently being served through lower-cost efficient unit operation.

Root Cause of the L0 Blade Failure

Q. If the LO blade failures were not caused by operation of the unit beyond 420 MW, what was the cause?

A. As explained in my previous testimony and more thoroughly in Exhibit No. __ (JS-1) and Exhibit No. __ (JS-2), the root cause of the blade failures, including the Period 1 failure Mr. Polich focused on in his testimony, was the lack of design margin in the blades. Specifically, a lack of design margin in dealing with the dynamic steam forces present throughout the operating range of the steam turbine – both above and below 420 MW. These steam forces are often referred to as dynamic flutter. MHPS identified dynamic flutter as the main root cause of the L0 blade failures in its later root cause report, conducted after the 2017 outage, as seen on page 12 of my Exhibit No. __ (JS-4). Said differently, the different types of blades used during each period were not designed with sufficient operating margin to handle the steam flows, pressures and transient conditions to handle the dynamic steam forces present in the machine while it was being operated pursuant to the OEM's guidelines. I suspect that one of the reasons Mr. Polich reached his conclusion, which disregards the information gleaned from later operating periods, is because he chose to focus solely on Period 1 operation and he relied on early RCAs provided by the OEM rather than later-produced documents that benefited from this additional information such as DEF's RCA (Exhibit

No. __ (JS-2)) and MHPS' confidential documents, attached as Exhibit Nos. __ (JS-3) and (JS-4). As can be seen from Exhibit No. __ (JS-3), MHPS recognized that its early RCAs did not identify the correct root cause of the damage. MHPS states "multiple forced outrages were experienced due to last stage blade damage caused by high load stimulus and high energy blending in the 4 on 1 configuration which was not fully understood until conducting an extensive collaborative RCA. Once the root cause was understood MHPS developed an upgraded 40" L-0 blade specifically to operate [in] the conditions present at Bartow."[12]

Q. Why is the later-Period operating information important to understanding what occurred in earlier Periods?

A. Because as DEF and the OEM moved through the operating periods and learned more information, the information and conclusions derived were incorporated into later blade designs and operating limitations. After Period 1, MHPS believed as Mr. Polich now believes that the blade failure was a result of over-loading on the blades. However, the later-Period operating data directly refutes this conclusion. At multiple times in his testimony, Mr. Polich states a variant of his conclusion: "If DEF had operated the ST at BCC in accordance with the design output of 420 MW or less, I believe there is no engineering basis to conclude that the original L0 blades would not still be in operation today."[13] Indeed, Mr. Polich opined that DEF had not "demonstrated that the original

[12] Exhibit No. __ (JS-3), page 2, bullets 2 & 3.

[13] Polich Testimony, p. 8, ll. 11-13; *see also id.* at p. 22, ll. 11-13 ("DEF has failed to demonstrate that had it operated the ST within original design conditions the original blades would still be in operation."); *infra* note 8.

L0 blades would have experienced even minimal degradation" had the unit been operated "at or below the original design output of 420 MW."[14]

These statements, and the general conclusion he reaches in his testimony, are conclusively refuted by the Period 5 operating experience. As shown on Exhibit No. __ (JS-2), specifically Table A on page 5 of 18, in Period 5 the ST was operated with the same type of blades that were installed when the unit was operated in Period 1. The contrast between the results found in the two Periods shows why Mr. Polich's conclusion is inaccurate. In Period 1, DEF operated the Bartow unit from June 2009 to March 2012 according to the OEM's original operating conditions (steam pressures, flows, and temperature – not to a maximum MW output), and as Mr. Polich points out, the unit achieved as much as 457.6 MW[15] before DEF discovered blade damage in 2012. In Period 5, DEF operated the Bartow unit per new OEM-provided operating instructions that included reduced exhaust pressure operating limits, specifically a 111.5 psig limit on the IP Exhaust,[16] that resulted in the ST achieving a maximum of 402.1 MW of output.[17] Nonetheless, even with the new operating conditions, the blades failed after only 1,561 hours of operation leading to the February 2017 outage.[18]

This information is crucial to understanding the root cause of the failures, including the Period 1 failure. As noted above, during both Periods 1 and 5 the ST operated with the

[14] *See id.* at p. 21, ll. 16-18.
[15] *See id.* at p. 15, l. 21; Exhibit No. __ (RAP-5).
[16] Exhibit No.__ (JS-2), Table A.
[17] Exhibit No. __ (RAP-5).
[18] Exhibit No. __ (JS-2), Table A.

same type of L0 blades (specifically, Type 1 blades[19]); that is, the same type of blades that Mr. Polich opined would not have failed in Period 1 had the ST not been operated beyond 420 MW failed in Period 5 even though the ST was **always** operated "at or below the original design output of 420 MW"[20] during that Period.

Simply put, Mr. Polich's contention that the original Type 1 blades from Period 1 would still be in operation, without even minimal degradation, had DEF only operated the unit at or below 420 MW of output and that "all subsequent outages and derates since 2012 have their origin in the operation of the ST in excess of 420 MWs"[21] has been conclusively refuted by the Period 5 experience – Mr. Polich may not "believe there is [any] engineering basis to conclude" otherwise, but the facts and experience gained in Period 5 cannot be ignored.

Q. Mr. Polich also contends, based on his conclusion that DEF's operation of the ST caused the original failure, that "all subsequent outages and derates since 2012 have their origin in the operation of the ST in excess of 420 MW." Do you agree with this statement?

A. No. As discussed above, this is contradicted by the evidence of the later-Periods. However, if one were to assume for the sake of argument that Mr. Polich is correct, and DEF improperly operated the machine leading to the 2012 failure, that would not

[19] *See* Exhibit No. __ (RAP-8), page 4 of 12, for an explanation on the different types of blades. Contrary to the assertions in Mr. Polich's testimony, *see, e.g.*, p. 22, l. 15, "Type 2" blades were never installed in the Bartow ST. *See* Exhibit No. __ (JS-2), Table A or Exhibit No. __ (RAP-7), page 3 of 16, for discussions of the different types of blades installed at the unit in the different operating periods.

[20] *See* note 8, *supra*.

[21] *See* Polich Testimony, p. 22, ll. 10-11.

establish a causal link between the original blade failure and subsequent outages – nor does Mr. Polich suggest one. Rather, he offers a conclusory statement that ignores everything that occurred from Period 2 forward. In Periods 2-5, DEF operated the unit according to the OEM's updated operating conditions, and in Periods 3 and 4 installed redesigned blades that were intended to allow operation at the original operating conditions. Mr. Polich does not attempt to challenge these facts, rather he falls back on the logical fallacy of "because the later events followed the first, the first event must have caused them."

Therefore, even if the Commission were to determine Mr. Polich was correct regarding operation of the unit in Period 1, he has provided no basis to conclude and it does not logically follow that the remaining outages and derates were caused by, or naturally flow from, that event.

Q. Are there other areas of Mr. Polich's testimony, beyond his conclusion regarding the root cause of the failures, where you disagree?

A. Yes. I disagree with Mr. Polich's contention that DEF was somehow required to, or imprudent not to, discuss its operation of the Bartow ST with the OEM, specifically regarding the MW output being achieved. As discussed herein, Mr. Polich's focus on this lack of communication is a symptom of his focus on the nameplate rating as a "maximum" output and failure to accept that units such as the Bartow ST are operated based on steam pressures and flows, which is standard industry procedure, and that the output is simply a byproduct of that operation. With that understanding, it becomes

clear that no communication with the OEM regarding output was warranted or to be expected for normal operations within the operating parameters. Moreover, it is important to note that when DEF notified MHPS of the blade failure events, MHPS did not respond by asking what MW output the ST was achieving at the time of the failures.

I also disagree with Mr. Polich's speculative assertion that "[i]f DEF had discussed operation of the ST above 420 MW with MHPS prior to the initial operation at higher load, the problems encountered with the ST at BCC likely would have been avoided."[22] In order to make this assertion, Mr. Polich has to assume a number of premises that are either dubious or, given the experience of Period 5, we know to be outright wrong. First, Mr. Polich assumes that MHPS would have told DEF the machine could not be operated to produce over 420 MW output, when it is more likely from DEF's experience that MHPS would have referred DEF back to the operating parameters (steam pressure, flow, temperature, etc.) with which DEF was complying; thus, it is pure speculation to assert that any such communication would have led to any different action on DEF's part. Second, assuming DEF determined from that communication that operation of the ST needed to be curtailed, the experience of Period 5 cannot be ignored: operation at reduced steam flows and pressures resulted in significant blade damage and the February 2017 outage.

Installation of the Pressure Plates

Q. Are there any other areas of Mr. Polich's testimony with which you disagree?

[22] Polich Testimony, p. 22, l. 22 – p. 23, l. 1.

A. Yes, I disagree with the assertion that operation of the ST with the pressure plates installed has truly resulted in any lost MW when compared to the results achieved prior to their installation. After the February 2017 outage, DEF worked with the OEM to identify and implement an interim solution that would allow the ST to resume operation, ultimately resulting in the installation of a pressure plates in place of the L0 blades on March 22, 2017. The plates allow the ST to operate, thus increasing the energy output of the Bartow CC above what was possible in simple cycle mode while a long-term path forward could be designed, tested, and implemented.

When it became apparent that not even re-installing the original blade design, which had achieved the greatest run time, and operating at reduced operating parameters would result in event-free operation while the long-term solution work was ongoing, DEF was faced with a decision: install an iteration of blades that had previously failed in order to avoid a "derate" scenario (but risk further outages and potential damage to the rest of the ST) or install the plates and receive event-free output, albeit reduced from the nominal nameplate rating.

I believe DEF's decision to install the plates was prudent at the time it was made, and I think the results have benefitted customers as opposed to causing additional costs due to downtime from further L0 blade issues or potential catastrophic failure. Therefore, I do not believe the Commission should order a refund of any costs incurred due to operations after the plates' installation.

Q. Mr. Polich has calculated replacement power costs that he contends should be refunded to customers due to operation of the Bartow CC with the pressure plates. Do you agree with his calculation?

A. Setting aside my belief that DEF's prudent actions should not result in a refund of replacement power costs, if the Commission were to order a refund of replacement power costs due to operation of Bartow CC with the pressure plates, I disagree with Mr. Polich's inflated calculations.[23] He contends that operation of the ST from April 2017 through August 2019 has cost customers approximately $5.74M.[24] In response to a discovery request from OPC, DEF calculated the actual replacement power costs for the MWh's not produced at Bartow for the period (owing purely to the derate, ignoring the question of prudence) of $1,168,613.

Based on DEF's analysis of his calculation as he described his method,[25] and using the values he included in Exhibit No. __ (RAP-9), DEF has identified a number of issues that Mr. Polich's analysis fails to capture. For example, his analysis appears to fail to consider what configuration the Bartow CC was operating in at a given time, potential system constraints impacting dispatch of the unit (including transmission reliability restrictions),[26] ambient temperature conditions, plant conditions such as feedwater

[23] On page 25, lines 10-17, Mr. Polich describes a situation where DEF showed no replacement power costs for an 11-hour window on June 1, 2017. DEF believes Mr. Polich was referring to July 1, 2017, as the other metrics he cites align with that date.

[24] $2,005,536 (2017) + $2,545,049 (2018) + $1,189,552 (2019) = $5,740,137. *See id.* at p. 27, ll. 5, 12, & 20. It should also be noted that Mr. Polich stated Mr. Menendez's testimony in Docket No. 20180001-EI provide the costs of the 2017 Spring outage at $11.1M – this is the system number; the retail portion of the total costs is approximately $11.0M. *See* Document No. 07025-2018, Docket No. 20180001-EI, at p. 7, ll. 1-2.

[25] *See* Polich Testimony, p. 24, ll. 1-20.

[26] For example, there was no replacement power purchased on July 1, 2017 (discussed on page 25 of Mr. Polich's testimony) because the unit was not being dispatched high enough in the order to require replacement power.

limitations and any other environmental limits, to name a few. Failure to account for these additional factors results in an artificially high estimate of the replacement power costs for the MWh's not produced at Bartow. Therefore, DEF's estimate of replacement power costs, which takes into consideration these factors, is a more accurate estimate.

Q. Does that conclude your testimony?

A. Yes.

BY MR. BERNIER:

Q Mr. Swartz, have you prepared a summary of your rebuttal testimony?

A Yes, I have.

Q Could you go ahead and deliver that?

A Good morning again, Judge Stevenson.

The purpose of my rebuttal testimony is to explain why Mr. Polich's conclusions regarding causation are incorrect, and to provide further support for DEF's conclusion that the lack of blade design margin was the cause of the Bartow L0 blade failures.

As you have heard from Mr. Polich, his opinion is that DEF imprudently operated the Bartow steam turbine for two reasons, because the unit was operated in a manner that produced greater than 420 megawatts and because DEF failed to consult with Mitsubishi prior to doing so.

However, DEF did not imprudently operate the Bartow steam turbine. As I have previously testified, DEF operated the steam turbine in accordance with Mitsubishi's operating parameters. Simply put, the megawatt output is not an operating parameter of the steam turbine, rather operators are trained to monitor and comply with original equipment manufacturer-established limits pertaining to steam pressures, flows

and temperatures.

The megawatt output of the generator that results is a function of many factors. In fact, contrary to Mr. Polich's suggestion, DEF, like any prudent utility, was and should be pleased to find that operating within the established parameters was providing greater megawatt output than the minimum that was contractually guaranteed, because that means the machine was operating properly and efficiently. The extra megawatts produced are a benefit to customers, because it means those megawatts don't have to be produced with less efficient and more costly generating units.

Moreover, Mr. Polich's opinion focuses on only Period 1, and completely fails to account for the experience gained and lessons learned from later operating periods.

In order to validly conclude that the Period 1 blades sustained damage because the unit was operated above 420 megawatts, one would have to explain why the later period blades also sustained damage without the unit being operated above that level.

However, Mr. Polich does not try to explain these occurrences. Instead, he speculates that had the unit not been operated above 420 megawatts in Period 1,

the original blades would still be in service, which allows him to conclude that everything that has occurred at Bartow can be traced back to the first period.

This conclusion ignores multiple intervening facts, including the installation of new blades with increased design margins to operate at greater pressures and more conservative operating parameters. What these facts tell us is that, notwithstanding DEF's compliance with the reductions in operating parameters Mitsubishi provided in each period, the L0 blades continued to suffer damage.

Importantly, in Period 5, when the unit operated with the same type of blades as Period 1, and the unit was operated according to the most conservative operating parameters provided by Mitsubishi, never even achieved 405 megawatts of generator output, the blades, nonetheless, suffered damage.

This experience clearly refutes Mr. Polich's conclusion, as is demonstrated by Mitsubishi's later documentation attached to my testimony as Exhibit JS-3. That document provides an overview of Mitsubishi's newest blade design and clearly shows Mitsubishi's ultimate position that it didn't fully understand the cause of the L0 blade failures until after the extensive collaborative RCA was concluded.

That document continues on to say that after the root cause was understood, Mitsubishi was able to design upgraded L0 blades specifically for the Bartow unit.

Mr. Polich also opined that DEF was imprudent because it failed to contact Mitsubishi before operating the steam turbine in a manner that produced more than 420 megawatts of generator output. This opinion rests on the faulty premise that the capacity of the steam turbine generator was somehow an operating parameter that should not be breached without receiving prior clearance from the equipment manufacturer.

As I have discussed, that is simply incorrect. Rather, as long as the operator was staying within the operating conditions established by the OEM, that is the steam flows pressures and temperatures I discussed earlier, no prudent operator would feel compelled to contact the OEM to reverify the previously provided operating parameters.

Additionally, in any conversation with the OEM regarding operation beyond a given electrical output level would revert instead to a discussion of the operating parameters I have discussed above. Operators and equipment manufacturers do not discuss operation of a steam turbine in terms of electrical output, but in

terms of pressures, temperatures and steam flows.

Thank you.

MR. BERNIER: Judge, we would now tender Mr. Swartz for short cross.

THE COURT: With that restriction, Mr. Rehwinkel.

MR. BERNIER: It's on the record, lawyer.

MR. REHWINKEL: I usually don't agree with Mr. Bernier, but I agree with him, this will be short. So I adhere to his restrictions.

EXAMINATION

BY MR. REHWINKEL:

Q Hello again, Mr. Swartz.

A Good morning.

Q Hopefully for the last time in this whole process.

On, I guess, page nine of your rebuttal testimony, you have a -- starting on line six, you have a long discussion about Duke's view, or your view that the steam turbine is a follower?

A Yes, sir.

Q Okay. And is that consistent also with page 17, lines 22 and three, where you say: And the output is simply -- and that the output is simply a byproduct of that operation; are those the same concepts?

A They are.

Q Okay. So can you tell me if the Bartow plant produces sufficient steam with four CTs operating at full capacity and no supplemental filing -- firing of the HRSGs to power the steam turbine to produce 420 megawatts?

A I don't know if it does that. Could you -- without duct firing, is that your question?

Q Yes. Let me just make sure that we get this right. Can the plant produce sufficient steam with four CTs firing at full capacity and no supplemental firing of the HRSGs to power the steam turbine to produce 420 megawatts?

A I don't know what the operating output of the generator would be at 4-on-1 configuration without duct firing. I don't know that operating parameter, or that set point -- or what that capacity would be at the output.

Q If Bibb's heat base -- what do we call those things?

A The heat --

Q Balance --

A Yes.

Q -- case 44 said that, would you accept that subject to check?

A I think heat balance case 24 is 4-on-1 unfired, and it showed 389 megawatts.

Q But would you -- so is it your view that that's probably correct, you wouldn't have enough steam?

A That's correct. For all -- remember each of those heat balance cases have dozens of variables --

Q Sure.

A -- and there is different pieces of equipment that are in service. So, yes, for heat case 24, with all of those different variables, 389 megawatts was the predicted output.

Q Okay. And doesn't the operation of the steam turbine above 400 megawatts require the HRSGs to have some amount of supplemental firing to produce sufficient steam?

A I don't know that.

Q Do you know that not to be the case?

A I don't know that not to be the case either.

Q Well, do you at least need supplemental firing to get above 420 megawatts at the unit?

A Again, I don't know. There is a lot of different combinations we can operate this unit in, and depending if it's a winter operation or a summer operation and what all the variables are, I just don't know.

Q Did Duke ever get above 420 during Period 1 without supplemental firing?

A I don't know.

Q Do you know whether the unit, the steam turbine requires more supplemental firing when it's at 400 megawatts versus 420?

A I don't know. There is a lot of factors that would go into that. And again, I just don't have that in-depth knowledge of all the variables taking place at that station to get a certain output.

Q Isn't it true that Duke can limit the steam turbine output when operating above 400 megawatts by merely controlling the amount of supplemental firing?

A If supplemental firing is in service, that is a control mechanism for output of the power block. That is accurate.

MR. REHWINKEL: Okay. I have no further questions, Your Honor.

MR. MOYLE: I have short inquiry.

THE COURT: Sure.

EXAMINATION

BY MR. MOYLE:

Q Good morning.

A Good morning.

Q The expert witness that you filed the rebuttal

to, that Office of Public Counsel sponsored, you don't take quarrel with any of his qualifications, do you?

A Not at all.

Q And yesterday, when we were talking, we went through the people that have looked at this issue in the Duke team, seven-member root cause team of which you were not a part, correct?

A That's correct.

Q And also Mitsubishi looked at it, right? They did their own root cause?

A That's correct.

Q And now Office of Public Counsel has hired an expert to look at it, right?

A That's right.

Q And that is the universe of people that have looked at it, correct?

A Yes, that's accurate.

Q And out of those groups, the only one that is, you know, not affiliated or, you know, an independent expert is OPC's witness, correct?

A Yes.

MR. MOYLE: That's all I have.

THE COURT: Anything from PCS, Mr. Brew?

MR. BREW: Yes, thank you.

EXAMINATION

BY MR. BREW:

Q Good morning, Mr. Swartz.

A Good morning.

Q First, yesterday I handed you a document that we didn't get to. Do you have it with you?

A I apparently stole them and put them over there.

MR. BERNIER: Do you have an exhibit number?

MR. BREW: Well, it's going to be 112. It's the thicker one.

THE COURT: It's 112.

THE WITNESS: Okay, I have it.

BY MR. BREW:

Q All right. I just want to identify it first.

Would you agree that this is a document that Duke provided under your signature in response to a Public Counsel data request?

A Yes.

Q And it's entitled on the first real page, Bartow Steam Turbine Path Forward Recommendation, dated May 29th, 2018 do you see that?

A Yes, I do.

Q Okay. So this is a document that Duke provided in discovery?

A Yes.

Q Okay. Thank you.

Your rebuttal has three exhibits, JS-2, 3 and 4. JS-2 is a reprint of the root cause analysis that was provided earlier that was roughly discussed in direct, right?

A Correct.

Q And JS-3 is entitled on the front page, Duke Energy Bartow ST 40-inch upgrade blade test in Takasago, which you would describe as a description of the newest blade design?

A Yes, that's correct.

Q And so is that a description of the 40-inch upgraded blades that have recently been installed at Bartow?

A Yes.

Q Okay. So is that was the winning bid and the technology that was selected?

A It was.

Q Okay. So if I can refer you to that document, page two of two, that's labeled introduction. Do you see it?

A Yes, two of 22.

Q Two of 22, that's correct.

The first three statements in the introduction, which is sort of a statement of the

problem being addressed, do you agree with each of those statements?

A Not completely, no.

Q Okay. And it was based on those statements that Mitsubishi was designing a solution to, right?

A I think it was based on a lot more than those statements, but that's part of it.

Q So moving further down, Mitsubishi says: To achieve confidence in the capability/reliability of a new blade, extensive testing was conducted.

Wasn't it done to resolve the problems that were described up front in the first three bullets?

A Well, testing was conducted to make sure that the new design was adequate to meet the needs of the request for proposal.

Q Okay. Can we agree that the multiple forced outages that we discussed yesterday were experienced due to last stage blade damage caused by high load stimulus and high energy blending of the 4-on-1 configuration?

A Could you say that again, please?

Q I am reading from the third bullet.

A Okay. I think there is a better spot in JS-4 in the Mitsubishi document that also has a similar statement that I think much better explains it. If you turn --

Q Okay. Well, JS-4 is Mitsubishi's root cause analysis, right?

A It's says RCA summary.

Q Okay. So it's a summary of their position, okay. So if you want to refer to a statement there, go ahead.

A If you go to page 12 of 35 of that document. And at the very bottom of page 12 of 35, in a red box in bold print, because it's so important, root cause analysis has identified all blade damage from Period 1 through Period 5 has been identified as dynamic loads from non-synchronous self excited vibration, or flutter.

Q Okay. Do you agree with that?

A I do.

Q The document that I showed you, if you could refer to that now.

A Okay.

Q And could we agree that this is a document prepared by Duke Energy that is a summary of the competing solutions for the permanent repair of the low pressure turbine?

A Yes. As it says, it's a working draft of the team that was working on that.

Q Okay. Could you refer to Bates number page 1606?

A Okay, I am there.

Q Do you have it?

A I do.

Q Okay. And this page contains Duke's categories for weighting and evaluating the proposed solutions to its turbine problem, right?

A Yes, it does.

Q And specifically with respect to future operations, they placed a heavy weighting on restrictions of blending, restriction on condenser back pressure and max flow limitations, right?

A Yes.

Q Okay. And those are precisely the situa -- the concerns that led to the original establishment of the avoidance zone, isn't that right?

A Back pressure was part of the establishment of the avoidance zone. I don't see the LP inlet pressure in that section.

Q Would that come in under max flow limitations?

A It would. Good point. Yes, sir. That's right.

Q Okay. So, in effect, the weighting criteria designed to resolve the underlying problems that had been observed?

A Yes.

Q That had actually been observed based on the blade vibration and telemetry testing that had been conducted in 2014?

A Yes.

Q Okay. And we discussed that, in fact, Duke selected Mitsubishi's proposal to upgrade and redesign the blade as the solution?

A Yes.

Q And the redesign of the blade has not changed the level of loading or the condenser we discussed yesterday?

A Correct.

Q Okay. And as a part of the solution, Duke required and Mitsubishi agreed to permanently install blade vibration monitoring?

A Yes.

Q So that --

A Let me correct that. Duke -- that was part of what we -- it was a big part of the decision. We, Duke, wanted permanently mounted blade vibration monitoring system.

Q Right.

A It wasn't -- it sounded like you were saying Mitsubishi wanted that. Duke Energy wanted that.

Q You wanted it, Mitsubishi agreed to do it?

A Correct.

Q It's been installed?

A Correct.

Q Precisely so that you have an independent way of monitoring potential excessive blade vibration?

A Correct.

Q Okay. So if I can refer you to your JS-4, page 28 of 35. And again, this is -- we are talking about this is a Mitsubishi prepared document, right?

A It is. Yes.

Q Okay. And it's entitled upgraded blade to achieve 450 megawatts available by October 2018, right?

A Yes.

Q Okay. And the upgraded blade is the very upgraded blade that you discussed and is reviewed in JS-3?

A The concept is the same. I don't know whether it's specifically the same, because during the process of moving forward with the -- this is an RCA summary, so Mitsubishi had an idea, but then later in time, Duke Energy issued a request for proposals for the long-term solution. What ultimately came back from Mitsubishi may have been slightly different than this, but the concept is the same.

Q The concept is the same?

A Yeah.

Q So item No. 5 on that page, which is entitled Bypass Operating Guidelines, do you see it?

A I do.

Q Could you read it, what it says under the heading?

A If required based on telemetry test results, operating guidelines for bypass can reduce blade response by minimizing operation of C and D bypass at a mach number greater than 0.55. DCS controls update strategy is an evaluation.

Q So do I take it from that that Mitsubishi was saying that based on telemetry test results, once they are in operation, you could still see operating restrictions during certain high energy bypass?

A That's what they are saying here, is that if the telemetry test shows that, we may have to change the way we blend, especially the C and D HRSGs.

MR. BREW: Okay. Thank you, that's all I have.

THE COURT: Anything?

MS. BROWNLESS: We have no questions, Your Honor.

THE COURT: Okay.

MR. BERNIER: I do have a couple quickly.

FURTHER EXAMINATION

BY MR. BERNIER:

Q Mr. Swartz, Mr. Rehwinkel asked you a number of questions regarding the output of the Bartow plant based on operating in different configurations, do you recall that?

A I do.

Q Does the output of a power plant vary from the nominal rating?

A It does, in fact, significantly. As I talked about yesterday, if you were to look at nominal ratings of the Duke Energy Florida fleet, we are around 10,000 megawatts in the summertime, and around 11,000 megawatts in the wintertime. Huge variation.

Q And if Duke Energy, or frankly, any other utility was to use the nominal rating of a plant or a unit as a limit, what would be the operational repercussions?

A It would be very significant. So using the example I just gave, and we are at 10,000 megawatt summer fleet and 11,000 megawatt winter fleet, if you chose that the net rating has a limit and not use the capability of the equipment, we would have to build more power plants, which would be very costly to customers.

Q And Duke Energy was given operating

instructions for the Bartow steam turbine, is that correct?

A Yes.

Q And they were written operating instructions, is that correct?

A Yes, that's correct.

Q Okay. And at the end of Period 2, the Period 3 blades were being inserted in the machine, did Duke Energy find damage to those Period 2 blades?

MR. REHWINKEL: Your Honor, I am going to lodge an objection. I asked a series of questions that were asked about whether supplemental firing was needed to get the output of the unit above 400 or 420. This recent question has nothing to do with the scope of my cross-examination, and I think it's outside.

THE COURT: That's a little beyond the scope.

MR. BERNIER: I would agree. I withdraw the question.

We have nothing further.

THE COURT: Thank you, Mr. Swartz.

(Witness excused.)

THE COURT: And I believe that brings us to closing statements. Do the parties want to take a break before we get to that, or are you ready

plunge in?

MR. BERNIER: I can tell you, Judge, I didn't intend to make a closing statement. I was thinking we would use that as our PRO.

THE COURT: And that's fine. I mean, if you even want to submit supplemental, you know, a closing statement in writing with the PRO, I mean, that would be fine with me as well if you don't want to do it.

MR. MOYLE: I'm happy to do it. It would be brief, but I think we can do it.

THE COURT: Okay.

MR. BERNIER: In that case, I will reserve the right to make a closing statement based on what Mr. Moyle says.

THE COURT: Okay. Well, who should we start -- well, Mr. Moyle has stepped up, so I suppose --

MR. MOYLE: Yeah --

MR. REHWINKEL: I would say the Public Counsel did not contemplate making any, and I think we would stand on our written filing. And if we need to make a supplemental statement that would have been a closing today, we will do that in our --

THE COURT: I did just have one housekeeping

matter. Mr. Brew, did you want to move Exhibit 112?

MR. BREW: Yes, Your Honor, please. I wanted to move what had been marked as Exhibit 112 for identification into the record.

THE COURT: We will show 112 admitted.

(Whereupon, Exhibit No. 112 was received into evidence.)

MR. MOYLE: Your Honor, another housekeeping matter, the only document we used was the EIA document that we handed out yesterday. I don't think it was marked, but --

THE COURT: The glossary?

MR. MOYLE: Yeah, the glossary. If we could go ahead and give that a number and move it.

THE COURT: Any objection to that? I think we are up to 118 now. We will mark that as Exhibit 118 and show that admitted.

(Whereupon, Exhibit No. 118 was marked for identification and received into evidence.)

MR. BERNIER: I am sorry, Judge, I need to move Mr. Swartz's rebuttal exhibits in as well. I believe they are 80, 81 and 82 -- yes, that's correct -- on the comprehensive exhibit list.

THE COURT: And we will show those, 80, 81 and

82 admitted, that's J-2, J-3 and J-4.

(Whereupon, Exhibit Nos. 80-82 were received into evidence.)

THE COURT: I think that's everything now.

Mr. Moyle.

MR. MOYLE: Thank you, Your Honor.

And thank you, we had, I think, an orderly hearing, and I want to compliment the Public Service Commission, Ms. Brownless, for guiding us guiding us through this, and thank you for the time and attention that you have given to us.

I am a big fan of sticking to agendas, and she had the closing statement in there, so I just want to share a few thoughts. I won't belabor points.

But I think at the outset, you asked a question about burden of proof, and everyone agreed that Duke has the burden of proof in this case. And respectfully, we don't believe that that burden was met for, you know, for a number of reasons.

There have been three analyses of what caused this problem. And there are sometimes different words that were used. Just in the last witness, the maximum flow limitations, the low pressure turbine exceeds the steam flow. Mr. Brew, I think asked the witness, doesn't it mean too much steam?

In my vernacular, too much steam is, if you know a chief cause here.

Duke said in their root cause analysis that the low pressure turbine excessive steam flow. And that has been listed. You have seen that in these documents, both in the drafts, and it appears a lot of places.

And then the OPC expert witness essentially said that they had generated more than the 420-megawatt and subjected the L0 blades to forces 25 percent greater than designed operating conditions.

So in slightly different ways, I think you have evidence before you that suggests that too much steam in an operation was -- surely hasn't been ruled out as a cause. And I think there is a lot of evidence that suggested it was a cause.

The only independent expert to look at this has been OPC's witness. And Duke folks are good folks, as I think we said, but, you know, they had an internal team of investigators that looked at it.

During one of the witness' testimony, they said, well, there might be some litigation. There was a settlement that was reached. You know,

Mitsubishi said, well, Duke, you guys didn't operate it right. Duke said, well, we think Mitsubishi, you know, it was their fault.

And as we said, no one suggested that it's the ratepayers' fault, but in this situation, dealing with an amount that is about one percent of the amount that Duke has already recovered, we think that Duke has not carried their burden of proof.

And there is another issue that I wanted just to bring to the, you know, to the Court's attention is -- and we didn't talk about it, but, you know, hearsay is treated in Chapter 120 as something that can be used if it is corroborated by other non-hearsay evidence. And the root cause report of Duke, I would argue, was hearsay. It was a report that was put together by seven Duke individuals. There was testimony about who wrote it, who the scribe was. And the witness, Mr. Swartz, for Duke, he was asked a whole slew of questions, and he took his best shot at it. But a lot of times he said, well, I am assuming, and I am speculating, and it was, I think, telling that the record, I believe you will find, is full of those hedges on different things when he was asked questions.

And I noted yesterday when I was crossing him,

there was a line in one of the documents that said, quote, we've had bad blends during all five periods of operation. And there has been a lot of discussion about blending, and the steam, and I think it ties into the excessive steam flow. But the witness, he said, well, you know, I interpret that to mean high pressure, I believe.

I mean, he was making an interpretation of the word, bad, that was just his view because he was given a document that he didn't have great insight into when it was being crafted and put together, and is, you know, is rendering an opinion on a hearsay document.

So I think when you consider that in conjunction with, you know, the burden of proof in this case, that the evidence suggests that Duke did not carry their burden, and for that reason, the decision should be that they didn't carry their burden to show that they were -- would be entitled to this money.

And we will submit, either jointly or separately, proposed recommended orders that will, I think, detail some of this, but we wanted to share this with you now while it's still fresh, and we appreciate the opportunity to do so.

THE COURT: Thank you.

MR. BREW: Thank you, Your Honor. I appreciate the time to make a short statement.

In many of our PSC dockets, Mr. Moyle is known for using a car analogy, so pardon me if I steal his thunder.

You can drive a four-cylinder Ford Fiesta like a V8 Ferrari, but it's not quite the same thing. At 4,000 RPMs, in second gear, the Ferrari is already doing 60 and it's just warming up. The Ford Fiesta, however, will be moaning and begging you to slow down and shift gears. And that's kind of what we are talking about here.

It's conceded as fact that the root cause of the Bartow low pressure turbine problems is excessive vibrations caused reputedly over time. The answer to the question is was this due to the way Duke ran the plant or is it due to a design flaw? Well, the answer is both.

The fact is is that Duke bought a steam turbine that was already built for a different configuration that was in storage, and then hooked it up to a configuration, a four-by configuration that it knew could produce much more steam than it needed. It had a generator that could produce more

megawatts, so the limiting factor was the steam turbine.

On its own initiative, it decided to push more steam through the steam turbine to get more megawatts until it broke.

When they asked Mitsubishi about it, and you will see that on the Table A on the root cause analysis that we referred to, the first thing that Mitsubishi asked them do was to reduce the steam flow, reduce the inlet pressure from the turbine.

So in Period 2, you will see that the first thing they established was a limit on the pressure coming into the low pressure segment.

In Period 3, they added to that, by not only limiting the inlet pressure, but looking at the condenser back pressure. So they were still -- Mitsubishi, while they were trying to figure out what do about the blade design, particularly in the 4-x-1 configuration, which is unique to this plant, and Duke had no prior experience operating in that configuration, and Mitsubishi did not have any experience in its entire global fleet with an operation at these steam pressures, the whole point was to establish that avoidance zone.

Now, what they have come up with is another

blade design fix, but they haven't changed any of the underlying conditions that are causing the high energy blending, the limits in the condenser that are causing those conditions in the first place.

So from our perspective, Duke clearly was at fault for pushing excessive steam flow into the turbine in the first place. The repair which has been established which may or may not work, but the early operation clearly impeded Duke's ability to simply claim that Mitsubishi was entirely at fault. And under those circumstances, it's not appropriate to assign the cost to the consumers.

Thank you.

THE COURT: No other takers? Duke?

MR. BERNIER: I will be very brief.

I will discuss, I think, Mr. Moyle's non-contemporaneous hearsay objection in our closing -- or in our PRO.

And I would agree, I think, with part of what Mr. Brew said, that as damage was found in the blades, Mitsubishi did continue to lower the operating parameters, but I think it's clear that the only evidence in the record is that at all times, Duke operated according to the limits that Mitsubishi had provided, which is the industry

standard, and the blades failed. That's what the root cause analysis shows, but the remainder we will handle in our PRO.

THE COURT: Very good.

It's my understanding that the parties have agreed that the PROs will be due 30 days from today, is that the agreement? I said it was -- typically, we start our clock running from the filing of the transcript, but 30 days from today is fine.

There was something else I wanted to ask you and now I have forgotten.

MR. MOYLE: Ask can I ask a question on that?

THE COURT: Sure.

MR. MOYLE: In terms of the transcript, it's going to go to the PSC, and then I am just wondering when we will see it. 30 days is fine provided we, you know, we see it.

THE COURT: You don't get the transcript on the 25th day?

MR. MOYLE: Right.

MR. BERNIER: So can I -- because we have to make a confidentiality filing, right, and it can't go to the PSC until I make that filing, so what I would propose, if this works -- I don't know if you

need to take this down or not -- when you have the transcript prepared, let me know. I will make a filing, and then when you provide it to Public Service Commission, which will have to be in hard copy, and you can send me a copy, I will get it to everybody that same day you provide it to me. That will give me the chance to make the confidentiality filing and then it can be filed with DOAH confidentially as well. Does that work?

(Discussion off the record.)

MS. BROWNLESS: In our joint motion for confidentiality, which Judge Stevenson has already approved, we discussed in paragraph 5A how post-hearing submittals would be handled. We also discussed how the transcript would be handled, and that -- and this is what we said:

When the transcript of the hearing is prepared, the PSC Clerk shall notify DEF, who shall file a Notice of Intent for the transcript with the Commission Clerk and file the trans -- and file a RFCC -- I don't remember what that means -- for the information -- request for confidential classification, sorry. I lost my head there -- for the information within 21 days thereafter as set forth in the rule. So --

MR. BERNIER: I appreciate you reminding me of that. I had forgotten. We will follow the order as drafted.

THE COURT: I had forgotten and I entered the order.

MS. BROWNLESS: Right. And then there is post-hearing submittals, a hard copy of all of the proposed recommended orders shall be filed with the commission via nonelectronic means via hand-delivery, UPS, Federal Express, et cetera.

A cover letter shall accompany the PRO stating that the PRO contains confidential information and should not be made available to the general public on DOAH's website. Parties with the exception of the PSC staff may be served electronically by any means agreeable to the parties. A hard copy of each PRO shall be filed with the PSC clerk via nonelectronic means with a cover letter. So --

THE COURT: We were better prepared than we thought, or even remember.

MS. BROWNLESS: That's what we worked out.

MR. BERNIER: That was incredible.

MR. REHWINKEL: So just to be -- just to hopefully but the put a bow on this. We have an indeterminant date for when the transcript will

trigger the 30-day period. That 30 days will start when Duke files the Notice of Intent with the Commission, is that what we -- because the transcript will --

MR. BERNIER: That works for us.

MR. REHWINKEL: Then the 30-day period, it might fall on a Saturday or a Sunday, so the close of business --

THE COURT: On a business day.

MR. REHWINKEL: Yes.

THE COURT: The next business day.

MR. REHWINKEL: Right, that's our understanding.

THE COURT: A weekend or a holiday, yeah.

MR. REHWINKEL: Yeah. And I think we probably will work among ourselves to make sure we all agree with that interpretation so we are all on the same page, because we can't file a paper on a weekend.

MR. MOYLE: Yeah. Just one point. So I think my chief concern in raising this was having the transcript for a period of time. When you file your notice, we will get it that day --

MR. BERNIER: Yes.

MR. MOYLE: -- because you will be filing -- okay, we don't have to wait on the PSC to process

it and get an order?

MR. BERNIER: Right.

MR. MOYLE: Okay. We are good.

THE COURT: And I will endeavor -- I will make best efforts to get my RO out within 30 days of the filing of the PROs, with the understanding that this is a complicated case and it may take a little longer than that.

With that, are we completed?

MR. BERNIER: Yes.

THE COURT: We will then show this proceeding closed, and thank you all very much.

MR. REHWINKEL: That you.

MR. HERNANDEZ: Thank you, Your Honor.

(Whereupon, the proceedings concluded at 10:58 a.m.)

CERTIFICATE OF REPORTER

STATE OF FLORIDA)
COUNTY OF LEON)

I, DEBRA KRICK, Court Reporter, do hereby certify that the foregoing proceeding was heard at the time and place herein stated.

IT IS FURTHER CERTIFIED that I stenographically reported the said proceedings; that the same has been transcribed under my direct supervision; and that this transcript constitutes a true transcription of my notes of said proceedings.

I FURTHER CERTIFY that I am not a relative, employee, attorney or counsel of any of the parties, nor am I a relative or employee of any of the parties' attorney or counsel connected with the action, nor am I financially interested in the action.

DATED this 18th day of February, 2020.

DEBRA R. KRICK
NOTARY PUBLIC
COMMISSION #GG015952
EXPIRES JULY 27, 2020

CONFIDENTIAL

STATE OF FLORIDA
DIVISION OF ADMINISTRATIVE HEARINGS

RE IN: FUEL AND PURCHASED POWER COST RECOVERY CLAUSE WITH GENERATING PERFORMANCE INCENTIVE FACTOR,

Petitioner,

vs. CASE NO. 19-6022

**,

Respondent.
_____/

VOLUME 3

PAGES 291 - 427

PROCEEDINGS: Administrative Hearing

BEFORE: Honorable Lawrence P. Stevenson

DATE: February 5, 2020

TIME: Commenced: 8:55 A.M.

LOCATION: Division of Administrative Hearings
1230 Apalachee Parkway
The DeSoto Building,
Tallahassee, Florida

REPORTED BY: DEBRA R. KRICK
Court Reporter

APPEARANCES: (As heretofore noted.)
PREMIER REPORTING
114 W. 5TH AVENUE
TALLAHASSEE, FLORIDA
(850) 894-0828

INDEX TO WITNESSES

INDEX TO EXHIBITS

*Huh-uh is a negative response
*Uh-huh is a positive response

P R O C E E D I N G S

THE COURT: I will swear you in.

Whereupon,

RICHARD A. POLICH

was called as a witness, having been first duly sworn to speak the truth, the whole truth, and nothing but the truth, was examined and testified as follows:

THE WITNESS: I do, sir.

THE COURT: All right. Have a seat.

MR. REHWINKEL: Your Honor, before we get started with Mr. Polich. Yesterday, when we concluded, I think everyone was ready to take a break from engineering 101 yesterday. We neglected to take care of a housekeeping measure that we usually do with the Commission, which was after a witness leaves the stand, his exhibits are moved in.

THE COURT: Exhibits?

MR. REHWINKEL: Yeah, so I think Duke needs to move his, and then we need to address ours.

THE COURT: That's fine. I can tell you, yeah, what I have got here -- well, I thought I had them here.

MR. REHWINKEL: I have his direct.

THE COURT: Yeah, what -- the testimony,

then -- I am just going through in the order that these exhibits came up. I have got 115 and 116, that was I think was Public Counsel's exhibits; is that right?

MR. REHWINKEL: Yes. And I think we would move actually the earlier -- 101 through 109 were identified for identification purposes. We would now move 101 through 109 and 115 and 116 into the record.

MR. BERNIER: So without going through them individually, Judge, we raised objections to some of them yesterday as we brought them up, and we would just stand on those objections and bring them up again in the PRO.

THE COURT: That's fine. We will show them admitted with the understanding that there are aspects.

So we will show 101 through 109 and 115 and 116 admitted.

(Whereupon, Exhibit Nos. 101-109, 115 & 116 were received into evidence.)

THE COURT: And let's --

MR. BREW: Excuse me, Your Honor. Your Honor, PCS had offered Exhibit 113 for identification, and we would move that for admission as well.

THE COURT: Okay, and not 112?

MR. BREW: We haven't discussed 112 yet.

THE COURT: Okay, that's right. That was -- that was your -- okay. So we will show 113 admitted.

(Whereupon, Exhibit No. 113 was received into evidence.)

THE COURT: And then I think the Commission talked about 110 and 111.

MS. BROWNLESS: Yes, and we would ask that that be admitted at this time.

THE COURT: We will show 110 and 111 admitted.

(Whereupon, Exhibit Nos. 110 & 111 were received into evidence.)

THE COURT: And I think that brings us up-to-date.

The witness has been sworn, and so whenever Public Counsel is ready.

MR. DAVID: Thank you, Your Honor.

EXAMINATION

BY MR. DAVID:

Q Please state your full name for the record, and spell your last name, please.

A Yes, Richard A. Polich, P-O-L-I-C-H.

Q Thank you.

And what is your educational background?

A I have a Bachelor's in Engineering in Mechanical Engineering, a Bachelor's in Engineering in Nuclear Engineering and an MBA, all from the University of Michigan.

Q And what is your current occupation?

A My current occupation is as consultant. Job title is managing director. I work for a company by the name of GDS Associates.

Q And what service or services were you retained to provide in this case?

A I was requested by the Florida Office of Public Counsel to review the failures at Duke Bartow in regards to the steam turbine, perform an assessment of those failures and do a calculation of revenues that could potentially be recovered.

Q All right. And have you testified as a witness before in a regulatory proceeding, a utility regulatory proceeding?

A Many times.

Q And can you give us some examples of the venues in which you have testified?

A I did a significant amount of worked in Michigan associated with rate design and regulatory. Part of that started with Consumers Energy when I was

manager of rates. And so I was involved in that in several aspects both with consumers and also with -- with an entity called Energy Michigan, which oftentimes was filing in opposition to the utility's.

I have also testified in proceedings in Indiana. It was actually a Duke case involving a failure of a generator. There is -- I also testified in Georgia and also at FERC.

Q All right. And did you -- in those, did you appear for the utility, the regulator or --

A A variety of aspects. In Georgia, I was on behalf of MARTA, which is the transportation organization in Georgia.

In the case of -- I also neglected, I also testified in North Carolina on behalf of the Attorney General's Office. And then I have also testified that the -- the case at FERC involved actually testifying on behalf of a group of utilities in a reactor power case.

Q And can you give me just a general description of the materials that you used to develop your opinions, or your analysis in this case?

A Yes. In general, I mean, most of the material that -- okay, 99 percent of the material that I reviewed was material provided by Duke in discovery, as well as testimony and various other documents that were made

available to me.

Q All right. And did you file or cause to be filed direct testimony in this case on or about September 13th of 2019?

A Yes, I did.

Q And did you file or cause to be filed with that testimony nine exhibits identified on the comprehensive exhibit list filed within those exhibits 68 through 76, inclusive?

A Yes, I believe so.

Q All right. And do you have any changes or revisions to that testimony, or to any of those exhibits?

A Yes, I do.

Q What are those?

A Okay. The first change is on page seven, line 19, there is a percentage in that line that says 25 percent. I would like to change that to 13 percent.

Q Okay.

A The second change and all subsequent changes are associated with the revision to Exhibit 9. After filing testimony, I was reviewing the calculations I used for determining the replacement power costs that -- that -- that -- associated with the derated Duke of the Bartow unit, and I discovered that inadvertently my

calculations had included the replacement power costs during the time periods when the plant as in an outage. And so I deleted those costs from the calculations and it resulted in changes in both the recommended amount of the cost that could potentially be recoverable.

And so going to page nine, the first change associated with that is on page nine, line two. The sentence reads right now: Caused by installation of the pressure plate is over 16.84 million. I would like to change that to, after the word is around 12 million.

Q What was -- excuse me, could you clarify that again? Is from installation of the pressure plate is over --

A Is around 12 million.

Q 12, okay.

A I am sorry. No, 16 point -- 16 million. I am sorry. 16 million.

Q Okay. So just for clarity, is over 16.12 million, is that what you were --

A Yes. There is two -- I worded it as around 16 million.

Q Oh, okay.

MS. BROWNLESS: Excuse me, can you just read that whole sentence the way it ought to be?

THE WITNESS: Okay, I can. Yes.

The replacement -- the sentence which begins on line one should read: The replacement power costs associated with the 2017 outage and derate caused by installation of the pressure plate is around 16 million.

Sorry for the confusion.

Moving to the next set of changes, starting on line -- on page 27, starting on line five, there is a figure of 2,005,536. That figure should be 1,675,561.

On the next line, on line six, there is a megawatt figure of 162,040. That figure should be 150,400.

All right. Moving to line 12, there is a dollar amount of 2,545,049. That number should be changed to 2,215,648. There is also a megawatt figure on that same line of 213,280. That number should be changed to 199,680.

Moving to line 20, there is a dollar amount of that 1,189,552. That number should be changed to 1,125,573. The megawatt figure on that line of 128,480 should be changed to 125,800.

And the last change is on page 28, line four. There is a dollar amount in there of 16.84 million. That figure should be changed to 16,116,701 -- 781.

BY MR. DAVID:

Q Okay. Are those all the changes you have to --

A In addition, there should be a revised Exhibit 9.

Q Correct, okay.

The RAP exhibits -- I mean, identified in your testimony as RAP-9 and identified on the comprehensive exhibit list as 76 has corresponding calculation changes?

A Yes.

Q Okay. Okay. And with all of those changes made, if I asked you today the same questions as I asked in your direct testimony, would your answers be the same other than, of course, like I said, the aforementioned changes?

A Yes, they would.

Q And the changes that were made to CLE exhibit -- CEL exhibit, excuse me, 76, RAP-9, did you supply that information before today to, in discovery, to Duke and staff?

A I believe we have.

Q Are you prepared to give a summary of your testimony and its conclusions?

A Yes, I am.

Q Okay. Go ahead.

A Okay. To understand my testimony, it's important to understand some of the background of the Bartow project, as well as how it's been configured. And what this leads towards is the fact that the statement contained in my testimony that 420-megawatt output is a design limit on which the Bartow plant was designed.

Having designed thermal cycles for multiple power plants, the designer always wants to gets the maximum output for a given plant investment at the best heat rate. It's a fundamental principle of what you do in design. It has to do with how you put the project together and what you want to do with it.

The Bartow project was Progress Energy's first combined cycle project and would have -- and they would have wanted the most output for their investment. They had already decided on installing four CTs when three would have sufficed to power the Mitsubishi turbine.

One of the things about this design is that you can fully power that steam turbine with three combustion turbines and heat recovery steam generators.

Can I approach the Exhibit for a second here?

THE COURT: Sure.

THE WITNESS: All right. So the way this

project is designed is you have four of these. Four combustion turbines and four heated recovery steam generator, and of course, all the ancillary services supplying steam to just one steam turbine.

And this project was designed such that you could provide all the steam requirements for this and produce 420 megawatts with just three CTs and HRSGs. So essentially, you have 25 percent redundancy. You also have 25 percent additional steam available to put into the steam turbine.

And if that were the case, as a designer, and as Progress Energy, in terms of designing this project and putting it forth before the Public Service Commission, you want to build a project and tout its dollars per kW as low as possible, because it shows the value of the project. You as the designer want to develop a project that, for every dollar you are putting into it, produces the maximum amount of megawatts.

With as much steam capability to power the steam turbine, if that unit could produce 450 megawatts, the designer and the utility would have wanted that from day one.

They, Kiewit and -- Bibb/Kiewit performed over 300 different heat analyses of how this whole thing

is going to work. Not one of those analyses ever showed this steam turbine producing more than 420 megawatts. If that steam turbine had that capability, they would have produced a thermal analysis to that effect.

Bibb worked very close with Mitsubishi on how this whole process works. There is correspondence between Bibb and Mitsubishi as to what this package can put out. There was information about how much steam can go to -- can be provided.

Mitsubishi responded with this is the output. 420 megawatts was a design limit. If Mitsubishi thought this unit could produce more, they would have told Bibb that and they would have designed it with higher output.

You had a case where this was an aftermarket unit. It was not designed to handle the amount of steam that was built that was available to this steam turbine. It was designed for a much smaller steam flow. And it is my experience that Mitsubishi knew that there were limitations as to how much power and steam this could take, and that they factored that into how this plant was designed. And so did the EPC Kiewit/Bibb. This is a critical issue, because Duke has contended very

often and throughout their testimony that 420 megawatts was not a design condition.

Now, I have worked in this industry many, many years, too many to tell sometimes, but the fact that this proj-- that you had so much steam available gives you amazing amount of flexibility in how you operate it. And I think this is a great plant design. Don't get me wrong, but there are limits. And when you have a plant of this type, of this type of design, you, as an operator, have to be careful as to how you utilize that capability.

It is my feeling that, and my experience that when you have a situation like this, it is important that you understand how it's going to function. And if you discover that, hey, you know, I can get potentially more out of this, you should always pause, because steam turbines have a lot of forces and dynamics that are happening inside of them that we've discovered afterwards, you know.

And I agree that some of this analysis work is all, you know, after-the-fact, but fundamentally, you have a responsibility to contact the OEM and ask a single question, can I get more out of this unit?

It's an insurance policy, because you get an

answer that if, yes -- if the OEM comes back and says, yes, you can get more out of this and it breaks, then the issue is on their shoulders. It's an insurance policy. A simple question, get it in writing and then the issue is settled.

If Duke had done that, we would not be here today, in simple terms, because the onus would have been on Mitsubishi at that point. It would have been totally their responsibility. The fact that Duke did not do that is a fundamental flaw in what they chose to -- how they chose to operate this unit.

And other projects I have been associated with -- I have a project in Arkansas that we oversee, and they had a steam turbine that was designed for 670 megawatts. That was the design conditions. We went through a turbine upgrade recently -- or a refurbishment I should say, a standard outage.

We came out of that outage and discovered we had the potential for more megawatts out of that unit. It was only 10 megawatts, so we went from 670 to 680. Before we did that, we contacted the manufacturer of the steam turbine and said, do we have any problems if we do this? We got the

insurance policy, proceeded to upgrade the oper-- the operate output of the plant. It's just something you should do.

And other projects I have been associated with -- utilities will push a steam turbine, and I understand that. It's a legitimate thing to do because it's cheap capacity. But you also have responsibility to get back with the OEM and verify that there isn't something inside of that unit that will break if you do it. And this is a fundamental issue in my testimony.

The other thing, too, is that the reason why I am strongly of the opinion that 420 was the megawatt limit is that when Duke finally did ask Mitsubishi, can we produce more than 420 megawatts? Mitsubishi said, we need to do a study for that. They came back and proposed a dollar amount that -- of -- in one that says we don't know, we need to study this.

Again, that tells me that Mitsubishi felt they had a limit on this unit. And to -- and so I don't -- I feel that that should have been an operating condition from day one.

All right. If Duke had paused before going after 420 and asked Mitsubishi if the steam turbine

could operate above 420 megawatts, and put it in writing, as I said, this would just take this whole issue off the table.

Instead, Duke ignored the red line on the unit, and they took their Ferrari and ran it, and something broke, but the interesting thing is it didn't break right away, all right.

If you look at what happened in Periods 1 and 2, they operated that unit for 62 months between the two periods, approximately 43,000 hours of operation, using the Type 1 blades, and only saw minor damage. And, in fact, on the generator end -- I am going to approach the diagram again.

We talked yesterday about the fact that we have one set of L0 blades here and one set here. These L0 blades during Periods 1 and 2 had no failures, even though this unit had been operated at 450 megawatts for over 2,000 hours at significant stresses much higher than what the manufacturer had ever seen in any of their L0 blades.

And it is our contention that if you had not overstressed those blades, there is no evidence that those blades would not still be in operation today.

Duke contends that, you know, that what happened in Period 5 when you put the L1 -- the Type 1 blades back in, is evidence that this is not a true fact. But let's look at some issues here.

Those Type 1 blades in Period 5 failed in 1,561 hours of operation. That's less than four percent of the hours that those same set of blades were able to operate in Periods 1 and 2. The reason why that's significant is -- and the other thing is that those Type 1 blades that they put in in that time period failed quicker than any of the other blades that they put in.

MR. BERNIER: Your Honor, I apologize, but I have to object. Nowhere does this testimony that he is summarizing appear in his direct testimony. I believe that is what we are doing here is, summarizing his direct testimony. This simply does not appear there. And that is the practice that we follow in front of the Commission, which I think we all agreed is what we are here to do.

THE COURT: So far I am only hearing him sort of do the math. I mean, if he goes beyond that and come to some different conclusion than he said in his testimony, I might be inclined to strike it, but so far he is just -- you know what I am saying,

this all sounds like stuff he is pulling out and just doing the numbers.

MR. BERNIER: I do understand what you are saying, Judge, and not to be argumentative, but he is now rebutting the rebuttal testimony to his testimony, and there is simply not -- that is not part of his direct testimony.

If that's something that's solicited on cross, that's one thing, but that is not something that he has provided any testimony to in writing, so he has just gone beyond the scope.

MR. REHWINKEL: Your Honor, we would -- I would, to some degree, acknowledge Mr. Bernier's point, but yesterday, Mr. Swartz took great liberties.

For us, in a proceeding where the judge is not intimately familiar with the way the Public Service Commission operates or the issues on a day-to-day basis, we thought it was appropriate for Mr. Swartz to take great liberties to expand on his testimony, and I think Mr. Polich is doing the same thing.

It probably would be a good time for us to conclude his summary and go to cross-examination.

THE COURT: Okay. That sounds like a plan then.

THE WITNESS: All right. So let me cut to this -- move forward on this.

So in my analysis, I looked at all of the information that was provided in Duke's root cause analysis, and I felt that there was a fatal flaw in that analysis, and that is why I came to the conclusion that you have to look at what happened in Period 1.

And the fatal flaw in their analysis is the fact that Period 1 and 2 was an outlier. The blades lasted longer during those two periods than in any other period of operation of this unit. Nowhere in Duke's RCA do they explain why those blades lasted so long. All their RCA addresses all -- is just the failures.

And in my testimony, I came to the conclusion that that is a very important factor in the operation of this unit. There was something about those blades' designs in Period 1 that allowed them to last longer. There is something about those blades that the Period 5 blades were not identical enough to last as long.

And it is for this reason that we came to the conclusion that the failures in Period 1 were due to overstressing the unit by putting too much steam

through it and operating at 420 -- in excess of 420 megawatts, and that Duke should be responsible for the replacement power costs.

MR. DAVID: Thank you.

Your Honor, I would like to move Mr. Polich's direct testimony into evidence, please. And after that, I would tender him for cross-examination.

THE COURT: Show that done.

(Whereupon, prefiled testimony was inserted.)

DIRECT TESTIMONY

OF

RICHARD A. POLICH, P.E. (STATE OF MICHIGAN)

On Behalf of the Office of Public Counsel

Before the

Florida Public Service Commission

Docket No. 20190001-EI

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME, TITLE AND BUSINESS ADDRESS.

A. My name is Richard A. Polich. I am a Managing Director at GDS Associates, Inc. ("GDS"). My business address is 1850 Parkway Place, Suite 800, Marietta, Georgia, 30067.

Q. WHAT ARE YOUR DUTIES AND RESPONSIBILITIES AT GDS ASSOCIATES?

A. My primary duties are within GDS's Power Supply Planning Department. While employed by GDS, I have provided consulting services for areas such as:

- Generation Asset Management,
- Engineering analysis of generation projects,
- Engineering evaluation of waste to energy projects,
- Energy management consulting services,
- Nuclear decommissioning cost evaluation,
- Modular nuclear project cost evaluation,
- Renewable energy project cost assessment and economic evaluation,
- Testimony on rate of return, cost of service, regulatory disallowances, determination of prudence, revenue requirements and plant in service, and
- Review of generation project design and construction.

Q. MR. POLICH, PLEASE SUMMARIZE YOUR FORMAL EDUCATIONAL.

A. I graduated from the University of Michigan - Ann Arbor in August 1979 with a Bachelor of Science Engineering Degree in Nuclear Engineering and a Bachelor of Science Engineering Degree in Mechanical Engineering.

Q. PLEASE BRIEFLY DESCRIBE YOUR PROFESSIONAL EXPERIENCE.

I have over 40 years of work experience in the energy sector, performing duties and services for a myriad of companies and organizations, and representing the interests of private and public constituencies throughout the country.

In May 1978, I joined Commonwealth Associates, Inc., located in Jackson, Michigan, as a Graduate Engineer and worked on several plant modification and new plant construction projects.

In May 1979, I joined Consumers Power Inc., (now called Consumers Energy), located in Jackson, Michigan, as an Associate Engineer in the Plant Engineering Services Department.

In April 1980, I transferred to the Midland Nuclear Project and progressed through various job classifications to Senior Engineer. I was also part of a small team that evaluated the potential to repower the nuclear steam turbine with combustion turbines. One of my responsibilities was to provide the initial thermal design for the combined cycle project, utilizing one of the two existing nuclear steam turbines while still providing process steam for Dow Chemical Company. This project is now known as the Midland Cogeneration Venture, a 12-combustion turbine and steam turbine project capable of providing 1,633 MW of capacity.

In July 1987, I transferred to the Market Services Department as a Senior Engineer and reached the level of Senior Market Representative. While in this department, I analyzed the economic and engineering feasibility of customer cogeneration projects.

In July 1992, I transferred to the Rates and Regulatory Affairs Department of Consumers Energy as a Principal Rate Analyst. In that capacity, I performed studies relating to all facets of development and design of Consumers Energy's gas, retail, electric and electric wholesale rates. During this period, I was heavily involved in the development of Consumers Energy's Direct Access program and in the development of Consumers Energy's Retail Open Access program. I also participated in the development of Consumers Energy's revenue forecast.

In March 1998, I joined Nordic Energy, LLC ("Nordic"), located in Ann Arbor, Michigan, as Vice President in charge of marketing and sales. My responsibilities included all aspects of obtaining new customers and enabling Nordic to supply electricity to those customers. In May 2000, my responsibilities shifted to Operations and Regulatory Affairs and my responsibilities included management of supply purchases, transmission services, and development of new power projects. My Regulatory Affairs responsibilities also included overseeing regulatory and legislation issues for the company.

In March 2003, I formed Energy Options & Solutions, based in Ann Arbor, Michigan, as a consulting concern focusing on providing engineering services and regulatory support. Through my work with Energy Options & Solutions, I gained extensive experience consulting in the areas of project development and economic

analysis with renewable energy companies across the country, including: Noble Environmental Power located in Centerbrook, Connecticut; Third Planet Windpower, LLC located in Palm Beach Gardens, Florida; TradeWind Energy, LLC located in Lenexa, Kansas; Windlab Developments USA located in Canberra, Australian Capital Territory, Australia; and Matinee Energy Inc. located in Tucson, Arizona, among others.

Other examples of my consulting work include evaluation of the Arkansas Weatherization Assistance Program for the Arkansas Energy Office and providing the West Michigan Business Alliance with an evaluation of the business opportunities for Western Michigan businesses in the renewable energy business sector.

In 2007, I served as primary author of a report on the economic impacts of renewable portfolio standards and energy efficiency programs for the Department of Environmental Quality – State of Michigan.

In 2011, I joined KEMA, Inc. ("KEMA") located in Burlington, Massachusetts, as a Service Line Leader responsible for developing its renewable energy consulting business. While at KEMA, I performed multiple renewable energy studies for the Electric Power Research Institute, including a renewable energy options study for the country of Saint Maarten (a constituent country of the Kingdom of the Netherlands). I also assisted Lake Erie Energy Development Corporation in its successful application to the U.S. Department of Energy for a multi-million dollar grant to develop an offshore wind project in Lake Erie.

In 2013, I joined CLEAResult, located in Little Rock, Arkansas, as Director of Operations. My primary responsibility involved supporting program operations in

assisting the company's Arkansas unit to successfully meet a 400% increase in energy efficiency goals that it managed for Entergy. I was also responsible for managing the company's natural gas energy efficiency programs in the State of Oklahoma.

In 2015, I joined the Georgia office of GDS Associates, Inc., a consulting group focusing on utility engineering and consulting services, as Managing Director.

I have been a registered Professional Engineer since 1983 and I am licensed in the State of Michigan.

My resume is included as Exhibit No. ___(RAP-1).

Q. HAVE YOU TESTIFIED IN OTHER REGULATORY PROCEEDINGS?

A. Yes, Exhibit No. ___(RAP-2) contains a list of regulatory proceedings in which I have provided testimony.

Q. WHAT IS THE NATURE OF YOUR BUSINESS?

A. GDS Associates, Inc. ("GDS") is an engineering and consulting firm with offices in Marietta, Georgia; Austin, Texas; Corpus Christi, Texas; Manchester, New Hampshire; Madison, Wisconsin; Manchester, Maine; and Auburn, Alabama. GDS provides a variety of services to the electric utility industry including power supply planning, generation support services, rates and regulatory consulting, financial analysis, load forecasting and statistical services. Generation support services provided by GDS include fossil and nuclear plant monitoring, plant ownership feasibility studies, plant management audits, production cost modeling and expert testimony on matters

relating to plant management, construction, licensing and performance issues in technical litigation and regulatory proceedings.

Q. WHOM DO YOU REPRESENT IN THIS PROCEEDING?

A. I am representing the Florida Office of Public Counsel ("OPC").

Q. WHAT WAS YOUR ASSIGNMENT IN THIS PROCEEDING?

A. I was asked by the OPC to conduct a review and evaluation of Duke Energy Florida, LLC's ("DEF's") operation of the Bartow Combined Cycle Power Plant ("BCC") located in Pinellas County, Florida. The review and evaluation included assessment of the BCC steam turbine ("ST") mechanical problems which led to several outages and derates. My testimony also includes an assessment of replacement power costs for 2017 and 2018, an estimate for part of 2019 associated with periods in which the BCC was not available to provide full capacity, and the cost of that replacement power that DEF is seeking to recover from its ratepayers in this proceeding.

Q. DID OTHER GDS PERSONNEL ASSIST YOU IN THE ANALYSIS AND DEVELOPMENT OF YOUR TESTIMONY IN THIS MATTER?

A. No.

Q. ARE YOU SPONSORING ANY EXHIBITS?

A. Yes, I am sponsoring the following exhibits:

1. Exhibit No. ___(RAP-1) Richard A. Polich, P.E. Resume

2. Exhibit No. ___(RAP-2) Richard Polich Regulatory Testimony List
3. Exhibit No. ___(RAP-3) Bartow Combined Cycle Thermal Cycle
4. Exhibit No. ___(RAP-4) Turbine Generator Output Curve
5. Exhibit No. ___(RAP-5) BCC ST Operation Greater than 420 MW
6. Exhibit No. ___(RAP-6) Bartow ST#1 L0 Blade Upgrade to Achieve 450 MW, dated September 18, 2013
7. Exhibit No. ___(RAP-7) Bartow RCA Review, dated March 15, 2017
8. Exhibit No. ___(RAP-8) Update on 40" Last Stage Blade, dated 2015
9. Exhibit No. ___(RAP-9) Bartow Combined Cycle Replacement Power Costs

II. TESTIMONY SUMMARY

Q. PLEASE SUMMARIZE YOUR TESTIMONY.

A. My review of various documents provided by DEF regarding the BCC low pressure turbine L0 blade failures reveals that the cause of the blade failures initially experienced in 2012 was DEF's operation of the BCC ST beyond the ST's 420 MW design. The Root Cause Analysis ("RCA") provided by the steam turbine manufacturer, Mitsubishi Hitachi Power Systems ("MHPS"), explains that Duke's operation of the BCC ST to produce sufficient horsepower to generate more than 420 MW, subjected the L0 blades to forces that were ~~25%~~ 13% higher than the designed operating conditions. DEF operated the ST at BCC in excess of 420 MW from June 2009 until the February 2012 outage for a combined 2,973 hours. As of the time of filing this testimony, DEF has failed to provide any documentation that demonstrates they communicated with

Court Reporter: DK

MHPS about operation of the ST in excess of 420 MW, until after the failure of the L0 blades was discovered.

DEF operated the BCC ST with the original design L0 blades for 63 months after the plant entered initial operation—a period of only slightly over five years. After the February 2012 outage, DEF operated BCC in a manner that generated an ST output at or below the design of 420 MW with the original design L0 blades, for an additional 28 months (within that first 63 months of operation). Inspection of these L0 blades in 2014 did not find snubber or z-lock damage as was found in February 2012. The additional stresses on the L0 blades caused by DEF's operation of the ST in a manner that generated output above the 420 MW design conditions impacted the L0 blades in a way that shortened blade life. If DEF had operated the ST at BCC in accordance with design output of 420 MW or less, I believe there is no engineering basis to conclude that the original L0 blades would not still be in operation today. Likewise, DEF would not have needed to undertake any of the subsequent outages to repair L0 blades, including the outage in February 2017 to replace the L0 blades with the pressure plate. Consequently, the BCC ST would currently be capable of producing its full output of 420 MW instead of being derated to 380 MW and operating with a less-than-optimal pressure plate.

As a result of the 2017 outage and the 40 MW reduction in BCC ST output (derate) due to installation of the pressure plate, DEF incurred power costs for the replacement MWh. DEF has failed to demonstrate that ratepayers should be responsible for these costs since the 2017 outage and subsequent derate were the result of DEF imprudently operating the BCC ST in excess of the manufacturer's 420 MW design

conditions. The replacement power costs associated with the 2017 outage and derate caused by installation of the pressure plate ~~is over $16.84 million~~ is around 16 million. The Florida Public Service Commission should not allow DEF to recover these costs from its rate payers.

Court Reporter: DK

Q. PLEASE DEFINE THE TERM "DERATE" AS USED IN CONNECTION WITH REDUCTION IN ST OUTPUT.

A. Derate is a term commonly used in the utility industry when a generation facility is unable to generate MW at its normal operating level. The reduction in generation output is usually temporary and caused by equipment degradation or failures. For the purposes of my testimony, I will be using the term "derate" specifically to refer to reduction in the BCC ST generation capability from 420 MW to 380 MW. This is a derate of 40 MW for the BCC ST.

III. DESCRIPTION OF BCC POWER PLANT

Q. PLEASE PROVIDE A GENERAL DESCRIPTION OF THE CONFIGURATION OF DEF'S BARTOW COMBINED CYCLE PLANT.

A. BCC is commonly referred to as a 4-on-1 combined cycle plant composed of four Siemens SGT6-5000-FD3 combustion turbines/generators ("CTs") and one Mitsubishi Hitachi Power Systems steam turbine/generator. Exhibit ___ (RAP-3) shows the general configuration of BCC. Each CT is capable of producing almost 230 MW gross output with injection of steam into the CT for power augmentation. Non-steam augmented power output of each CT is in the range of 180 MW. The exhaust of the CT enters a Voit Power VPPR2 heat recovery steam generator ("HRSG") that

produces steam to power the ST and provide steam augmentation to the CTs. The HRSG is composed of three different pressure sections: a high pressure ("HP") section (approximately 3,000 psig maximum), an intermediate pressure ("IP") section (approximately 1,100 psig maximum) and a low pressure ("LP") section (approximately 135 psig maximum). Steam production in the HRSG can be increased by using installed natural gas fired "duct burners" located within the HRSG. The ST was designed to produce 420 MW gross generation. Exhaust steam from the ST enters a condenser where the steam is cooled to liquid phase and then pumped back into the HRSG. The generator output appears to have an upper gross generation limit of about 465 MW at a 0.95 power factor based upon the output curves in Exhibit No. ___ (RAP-4).

Q. PLEASE PROVIDE A GENERAL DESCRIPTION OF THE BCC STEAM TURBINE.

A. The BCC ST contains three turbine sections, a generator, and various other components used to control steam flow and operate the ST. HP steam from the HRSG is first injected into the HP section of the steam turbine through the turbine control valves. Exhaust steam from the ST HP section is sent back to the HRSG IP section to be reheated and then sent back to the IP section of the ST. Exhaust steam from the IP section of the ST then combines with steam from the HRSG LP section to enter the LP section of the ST, exiting through the last set of turbine blades into the condenser.

Q. PLEASE PROVIDE A GENERAL DESCRIPTION OF THE BCC LP ST SECTION.

A. The BCC LP ST section is a tandem flow ST with steam entering the middle and flowing in opposite directions through mirror image LP sections. Each side of the LP ST has four sets of blades, the last of which is the 40" L0 blade set that has experienced the failures.

IV. OPERATING DESIGN OF BCC STEAM TURBINE

Q. WHAT FACTORS ARE CRITICAL TO THE DESIGN OF A STEAM TURBINE?

A. Steam turbine design begins with the end users desired gross MW output and the steam characteristics available to power the steam turbine. The design conditions considered during the initial ST design include maximum steam pressure, temperature and flow rate. From this, the ST manufacturer will work with the project thermal design engineer to develop a set of HP, IP, and LP steam conditions that maximize ST efficiency, minimize water content of the steam within the ST, and are capable of allowing the ST to produce the desired MW output. There are a myriad of HP, IP, and LP steam conditions for steam turbine design that allow production of a given MW. Experience in plant and ST design, manufacturer-available ST packages, and engineering parameters reduce the number of solutions, sometimes to one.

Q. WAS THIS THE APPROACH USED FOR THE BCC PROJECT?

A. No. Progress Energy, the original owner of BCC, purchased a "secondary market" steam turbine that was designed and manufactured for a Tenaska combined cycle project. However, the ST was never installed for that project and was instead placed in storage by MHPS. The steam turbine was already constructed—presumably to meet the needs of Tenaska—so the design parameters were already fixed when it was purchased by Progress Energy, DEF's predecessor. Therefore, as DEF knew or should have known, intractable design limitations were incorporated into the as-built ST. Discussions with MHPS apparently led Progress Energy, now DEF (references to DEF through the remainder of this testimony interchangeably refers to Progress Energy and Duke Energy Florida), to determine this steam turbine generator package would be suitable for use in the BCC project. These discussions led to a project design in which the ST maximum gross output was to be 420 MW. None of the analyses of ST operations performed by MHPS ever showed the ST package producing more than 420 MW.

Q. WHY IS IT IMPORTANT THAT THE ST PACKAGE DESIGN ANALYSES ONLY INDICATED A MAXIMUM OUTPUT OF 420 MW WHEN THE GENERATOR WAS CAPABLE OF POTENTIALLY PRODUCING 465 MW.

A. Steam turbine internal components are subjected to steam conditions which cause significant stress, erosion, and other dynamics which the manufacturer has incorporated into the component design. Gross MW output is directly proportional to the horsepower the ST produces. As with a car engine, parts in the ST are designed to

provide that horsepower on a basis that is reliable and does not induce failure. Otherwise, increasing the ST horsepower output can only be accomplished by placing higher stresses and dynamic forces on the ST components. In most turbines, one of the critical components subject to very high stress and steam induced dynamics are the turbine blades. The turbine blades are connected to the turbine shaft, which spins at 3,600 RPM in the BCC ST. The steam impinging on these blades exerts pressure and dynamic forces that are not uniform. This lack of uniformity may be caused by the spinning turbine blades, the way the steam is channeled to impinge on the blades, the changes in steam characteristics between sets of blades, and the formation of water in the steam as pressure and temperature drop. In addition, a ST does not always run at full load and steam does not always have the same characteristics throughout the operating load range as it does at full load. The ST manufacturer understands and takes these steam dynamics into consideration and designs the ST blades to function without failure over the design life of the blade, presuming the ST is operated within the manufacturer's design conditions. It should also be understood that it is standard within the industry for the manufacturer to include a level of design margin into the ST components. Some of these design margins are mandated by code; others are based on experience with operation and manufacturing processes and the expectation that higher stresses likely will be placed on components when the power plant experiences an upset such as a plant trip. This is why a ST package designed for 420 MW may not be able to operate above the horsepower level needed to produce 420 MW without inducing component failure. Component failure may not occur or be discovered right away, but

the component life will be reduced and the increased likelihood of failure is introduced into the ST at especially susceptible places—like the L0 blades.

V. OPERATION OF BCC ST UP THROUGH FEBRUARY 2012

Q. PLEASE DESCRIBE THE TYPICAL STARTUP AND TESTING PROCEDURES FOR A POWER PROJECT SUCH AS BCC.

A. In early 2009, the BCC project began operation prior to the commercial operation date. Typical of a new power generation project, the plant proceeded through various systems testing and progressed through various phases of testing of the CTs and ST, including raising the ST MW generation up to designed output of 420 MW. Also, during the testing and startup period or shortly after the project is declared to be in commercial operation, various components will undergo testing to see if the equipment meets specific guaranteed operating conditions contained in the equipment contracts. Steam turbines go through a rigorous testing in accordance with American Society of Mechanical Engineers ("ASME") test procedures to determine if the ST meets the contractual performance guarantees. Based upon information provided by DEF, the BCC ST was subjected to the ASME test procedures, and MHPS reported on the June 16, 2009, test that the BCC ST met its guaranteed gross output of 420 MW.

Q. HOW WAS THE BCC ST OPERATED IN 2009 AFTER THE PLANT ENTERED COMMERCIAL OPERATION?

A. In June 2009, the BCC ST maximum output was 404.3 MW in accordance with data provided by DEF, as shown in Exhibit No. ___ (RAP-5). In July 2009 DEF

operated the ST for approximately 23.3 hours in excess of 420 MW design conditions and in August 2009 for approximately 27.2 hours, reaching a maximum output of 429.2 MW. DEF operated the ST in excess of 420 MW for approximately 374.2 hours in September and October of 2009, with peak generation of approximately 440 MW. In November 2009, DEF operated the ST at maximum output of 440.2 MW. In summary, for calendar year 2009, DEF operated the BCC ST for approximately 433.2 hours in excess of 420 MW, peaking at 4.8% over design conditions.

Q. HOW DID DEF OPERATE THE BCC ST DURING 2010?

A. Compared to 2009, DEF significantly increased the BCC ST output in January 2010 with the unit producing a maximum output of 446 MW, 6.3% higher than design conditions. DEF operated the BCC ST in excess of 420 MW during each month in 2010 through November, with a maximum output of almost 455 MW, over 8% higher than design conditions. In total, the BCC ST was operated approximately 940.3 hours in excess of 420 MW in 2010.

Q. HOW DID DEF OPERATE THE BCC ST DURING 2011?

A. DEF operated BCC ST in excess of 420 MW during every month except February during 2011, accumulating 1,521.2 hours of operation over 420 MW. Peak operation of the BCC ST appears to have been in April 2011, with the ST producing 457.6 MW, 9% in excess of design conditions. In total, the ST was operated in excess of 440 MW for over 1,160 hours in 2011.

Q. HOW WAS THE BCC ST OPERATED IN 2012 UP THROUGH THE FEBRUARY 2012 OUTAGE?

A. The ST was operated close to 450 MW in both January and February 2012, accumulating 77.9 hours of operation over 420 MW. Total operation in excess of ST design conditions since plant commercial operation in 2009 through February 2012, was almost 2,973 hours out of 21,734 hours of operation (from DEF Exhibit No. ___JS-1 (Docket No. 20180001-EI)). Over 13% of the operating hours in that initial period of operating the newly completed BCC plant were in excess of design conditions.

Q. DID DEF INFORM MHPS IT INTENDED TO OPERATE THE BCC ST ON A REGULAR BASIS IN EXCESS OF 420 MW?

A. In response to OPC Fourth Set of Interrogatories, Interrogatory 21, DEF states; "DEF did not correspond or discuss operating the steam turbine at 450 MW." As of the filing of this testimony, DEF has not produced any documentation from MHPS that shows MHPS acknowledging or agreeing that the BCC ST could be operated in excess of 420 MW. In his 2018 testimony, DEF witness Jeffery Swartz includes Exhibit No. ___(JS-1) (Docket No. 20180001-E1) which contains a Table A, titled "Bartow L-0 Events Summary" which breaks down the history of the BCC ST operation into five (5) periods. In the first column, labeled "Period 1" under the row titled "Key Notes from Period," the following note is provided:

> At the start of this period, MHPS approved 4X1 (unfired) operations at 392 MW output, as well as 3X1 (duct fired) operation at 420 MW, supported by MHPS-provided heat balance documentation.

This is further indication that MHPS was unaware of DEF's intent to operate—or DEF's operation of—the BCC ST in excess of 420 MW. DEF has failed to provide documentation as of the time of my testimony that MHPS provided DEF documentation indicating that the ST could operate in excess of 420 MW.

Q. WHY DID DEF STATE IT FELT THERE WERE NO ISSUES WITH OPERATION OF THE BCC ST IN EXCESS OF 420 MW?

A. MHPS provided DEF with operating conditions that specified operating parameters for the ST. These operating parameters included a variety of conditions, including HP and IP ST section inlet pressure and temperature conditions and condenser design conditions. After DEF performed a review in 2017-2018 of its initial operation of the BCC ST, DEF was of the opinion that, if steam conditions to the ST were within the HP, IP, condenser pressure, and temperature operating parameters, output of the BCC ST could be increased until these parameters were reached. DEF has provided no contemporaneous documentation from the period prior to the February 2012 outage of DEF's operating the newly installed BCC that MHPS concurred in DEF's retrospective claim. The result of DEF's decision was that it raised the horsepower output of the ST such that it was producing over 450 MW, which is 9% higher than MHPS design conditions.

Q. WHAT HAPPENED IN FEBRUARY 2012 AT BCC?

A. DEF scheduled a planned outage for valve work and inspection of the LP ST blades. During the inspection of the L0 blades, damage was found on five of the L0

blades located on the generator end of the LP ST. The L0 blades are the last row of blades the steam passes through prior to entering the condenser and are the longest blades in the ST at 40".

Q. WERE THERE SUBSEQUENT BLADE FAILURES AFTER FEBRUARY 2012?

A. Yes, as shown in DEF's 2018 Exhibit No. ___(JS-1), there were subsequent blade failures, including failures of MHPS redesigned blades. In February 2017, BCC experienced an outage due to L0 blade failures, and DEF decided to install a "pressure plate" to replace the L0 blades until a solution was found to the blade failures. A pressure plate is a disk with engineered holes to reduce the steam energy, allowing it to decrease in pressure to condenser pressure. The pressure plate does not convert any of the steam force into turbine horsepower and results in a loss of turbine horsepower. This resulted in the BCC ST maximum output being limited to only 380 MW. This, in turn, is what caused a derate of the ST from 420MW to 380MW. This derate was a natural consequence of the cascading series of blade failures precipitated by DEF's operation of the ST in Period 1.

VI. EVALUATION OF BCC STEAM TURBINE BLADE FAILURES

Q. HOW MANY TIMES DID DEF DISCOVER PROBLEMS WITH THE BCC ST?

A. DEF found damage to L0 blades on three other occasions after the initial blade damage was discovered in February 2012. As alluded to above, DEF separated the ST operating history into 6 periods. Period 1 starts with commercial operation and extends

until the problems were found during the February 2012 outage. Period 2 began after the February 2012 outage and extends until November 2014 when new L0 blades (Type 2 blades) were installed. Period 3 begins at the end of the 2014 outage and lasts until April 2016 when problems were found with the Type 2 blades. Period 4 begins with the installation of the second redesigned L0 blades (Type 3 blades) in June 2016 and ends when blade failures were found in October 2016. Period 5 starts when DEF decided to reinstall the original design Type 1 blades in December 2016 and ends in January 2017 when the component called the burst diaphragm was damaged by parts from these L0 blades. Period 6 began in April 2017 after the L0 blades were replaced by a pressure plate and is expected to continue until the end of September of this year.

Q. WHAT ACTION DID DEF TAKE AFTER THE BLADE DAMAGE WAS DISCOVERED IN FEBRUARY 2012?

A. Upon finding the 2012 blade failures, DEF engaged MHPS and several other entities to determine the cause of the blade failures. MHPS conducted a Root Cause Analysis ("RCA") of the failures. MHPS first stated in a report dated September 18, 2013, that "Mitsubishi estimated the cause of the [blade] cracking was overloading the LP section based upon 450 MW which is over the design point of 420 MW." In this report, MHPS estimates the ST was operated in excess of 420 MW for 2,600 hours, over 15% of the operating hours. This is consistent with, but still understates, the 2,973 operating hours derived by totaling the hours in column 420 for Period 1 in Exhibit No. ___(RAP – 5).

Since all the damaged blades in Period 1 were on the generator end of the ST, the L0 blades were replaced only on that end of the ST with Type 1 blades. MHPS informed DEF not to operate the ST above 420 MW and limited IP section exhaust pressure to 118 psig. During Period 2, DEF only exceeded the 420 MW limit for 1.7 hours. Average maximum monthly load was only 396 MW during Period 2. The ST was removed from service in September 2014 to install the Type 2 blades.

Q. WHAT WAS THE CONDITION OF THE L0 40" BLADES AT THE END OF PERIOD 2?

A. The Type 1 L0 40" blades used during Period 2 did not experience any broken snubbers or z-locks. According to DEF documents, no significant damage was found.

Q. BASED UPON THE VARIOUS DOCUMENTS PROVIDED BY DEF, WHAT WAS THE CAUSE OF THE L0 40" BLADE FAILURES UP UNTIL THE END OF PERIOD 2 (NOVEMBER 2014)?

A. The cause of the 40" L0 blade failures in the BCC LP ST during period 1 was the result of DEF operating the unit in excess of the 420 MW design output. MHPS has stated in multiple documents that operation of the ST, at horsepower levels sufficient to generate greater than 420 MW resulted in overloading of the L0 blades. After over 2,600 (or up to 2,973) hours of operation in excess of 420 MW over a 63-month period, the only type of failure that had manifested itself up to that point was the snubbers on five blades of the generator end of the ST (See Exhibit No. ___(JS-1). MHPS estimates the loading on the L0 blade at BCC ranged from 15,000 lb/FT^2-h to 17,000 lb/FT^2-h

(Exhibit No. ___(RAP-6), at 7, 19, and 20). Notably, the Period 1 snubber failures in the L0 blades experienced at BCC had not been experienced at other MHPS plants equipped with 40" L0 blades (See statements by MHPS in Exhibit No. ___(RAP-7), at 7 and Exhibit No. ___(RAP-8), at 8). Likewise, the range of operation and significantly higher loadings imparted on the ST by DEF operating the ST in excess of design conditions, was unique among the MHPS ST units. Operation of the BCC ST to produce an output appreciably in excess of 420 MW resulted in forces on the L0 blades that were 13% to 25% higher than the other MHPS units of similar design. Thus, it is obvious that DEF's operation of the BCC ST above the 420 MW design was a material cause of the failure of the L0 blades.

Q. WHAT WOULD ST OPERATIONAL OUTCOME HAVE BEEN IF DEF OPERATED THE BCC ST AT OR BELOW THE ORIGINAL DESIGN CONDITIONS DURING PERIODS 1 & 2?

A. Based upon the information provided in various documents and the RCA conducted by MHPS, DEF has not demonstrated that the original L0 blades would have experienced even minimal degradation over the design life of these blades if it had operated the BCC ST at or below the original design output of 420 MW. The Type 1 blades lasted for a period of only about five years after being subjected to stresses significantly beyond original design. The impact of stress on steam turbine blades is a cumulative effect and when a blade as long as the L0 blades is subjected to much higher than design forces, the impact is not linear.

VII. EVALUATION OF REPLACEMENT POWER COSTS ASSOCIATED WITH BCC GENERATION LOSSES

Q. HAS DEF DEMONSTRATED THAT ITS RATEPAYERS SHOULD BE RESPONSIBLE FOR THE REPLACEMENT POWER COSTS ASSOCIATED WITH OUTAGES AND REDUCED PRODUCTION FROM THE BCC PLANT AS A RESULT OF THE LP ST L0 BLADE FAILURES?

A. No, DEF has failed to demonstrate that it should not be responsible for the costs resulting from its operation of the ST. As presented earlier in my testimony, the failures of the original L0 blades are the result of DEF operating the ST above the 420 MW design condition. All subsequent outages and derates since 2012 have their origin in the operation of the ST in excess of 420 MW. DEF has failed to demonstrate that had it operated the ST within original design conditions the original blades would not still be in operation. If the original L0 blades had not failed due to DEF's operation of the BCC ST beyond the 420 MW design, DEF would not have installed the Type 2 and Type 3 blades, nor experienced the associated outages. In addition, if the original L0 blades had not failed due to DEF's operation during Period 1, the pressure plate would not be currently installed, and the ST would be capable of producing its designed output of 420 MW. DEF knew or should have known the designed generation capability of the ST was only 420 MW from the thermal analysis performed prior to operation and from the contract documents for the MHPS ST. These documents show the unit was designed for output of 420 MW. If DEF had discussed operation of the ST above 420 MW with MHPS prior to the initial operation at higher load,

the problems encountered with the ST at BCC likely would have been avoided. As of the filing of my testimony, DEF has not provided documentation that such discussion actually occurred.

Q. HOW DOES THE REPLACEMENT OF THE L0 BLADES WITH THE PRESSURE PLATE IN THE BCC LOW PRESSURE TURBINE AFFECT THE ST OPERATION?

A. The replacement of the ST L0 blades in the LP with the pressure plate results in a derate of the ST to 380 MW, according to DEF. This is a derate of 40 MW from the 420 MW original design condition.

Q. HOW DOES A DERATE OF THE BCC ST TO 380 MW AFFECT THE SUPPLY OF POWER TO DEF CUSTOMERS?

A. The reduction in BCC capability to produce full output has caused an increase in power costs for DEF. Utilities schedule plant operation with the most economical plants dispatched first. If a plant is derated, another plant with higher power costs is used to replace the lost MWs, subjecting DEF's ratepayers to higher power costs.

Q. HOW SHOULD THE COST OF REPLACEMENT POWER FOR THE MWH BCC IS UNABLE TO PRODUCE DUE TO THE ST BEING DERATED BY 40 MW BE CALCULATED?

A. BCC is one of DEF's most efficient and lower-cost operating units. Once it is scheduled to produce power at full load, approximately 1,140 MW, any additional generation needed to meet DEF's load will be more costly. As load increases, so does the cost of generation up to the point the daily peak load occurs. Since BCC is unable to produce the full 1,140 MW, the highest cost power in every hour should be used to calculate replacement power costs. Thus, the replacement power costs for the 40 MW derate of the BCC ST would be the cost of DEF's highest 40 MW block of power supply. This is the correct method of replacement power cost calculation for this derate because, if the ST were able to produce the additional 40 MW, DEF would not be paying the highest cost 40MW block in that hour. In response to OPC Interrogatory 35, DEF provided the highest cost power for each hour during the period of April 1, 2017 to August 31, 2019. If DEF's highest hourly power cost was higher than the generation cost of BCC, then BCC should be operating at maximum output during that hour. Using the hourly BCC heat rate and daily natural gas prices provided by DEF in response to OPC Interrogatory 44, the hourly generation cost for BCC was calculated. If the hourly BCC generation cost was lower than the highest hourly power price for DEF, then it is assumed DEF would be running at full load. The replacement power cost is equal to the highest hourly price minus BCC's generation cost times 40 MW.

Q. HAS DEF PROVIDED AN ESTIMATE OF THE REPLACEMENT POWER COSTS FOR THE BCC OPERATIONAL PERIOD AFTER

INSTALLATION OF THE PRESSURE PLATE IN THE LP SECTION OF THE ST?

A. Yes, DEF provided in response to OPC Interrogatories 33 and 44, an estimate of the replacement power costs due to the installation of the pressure plate on BCC ST for the period April 10, 2017, through August 31, 2019. DEF's calculation of the replacement power costs include an estimate of the portion of the 40 MW derate that would have been generated if the L0 blades had been installed, for each hour of the period, considered to be the hourly replacement power. The estimated replacement power in DEF's calculation is not consistent with how plants are dispatched based upon power costs. For example, DEF's calculation shows ZERO replacement power on June 1, 2017, between the hours of 11:00–22:00 despite the replacement power costs averaging $33.55/MWh, reaching a peak of $46.62/MWh, and despite the cost for BCC to generate power during this time period being only $22.68/MWh. The replacement power price over this period was more than $10.00/MWh higher than the BCC operating costs; yet DEF did not include any replacement power costs for this period in its replacement power cost calculation. If the BCC ST had been available for full load during this period, the additional 40 MW would have reduced power costs by $5,579. Review of the analysis by DEF finds many periods like this in which the replacement power cost was higher than BCC's cost of generation and that DEF did not include any replacement power costs due to the installation of the pressure plate on BCC ST, in the total replacement power cost calculation. As such, DEF's replacement power costs are not a realistic representation of the

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replacement power costs DEF incurred as a result of the BCC ST 40 MW derate. DEF has clearly failed to demonstrate that its method of calculating derate related replacement power costs is reasonable.

Q. WHAT TIME PERIOD IS COVERED BY YOUR ANALYSIS OF REPLACEMENT POWER COSTS?

A. My estimate of replacement power costs for BCC covers three time periods: 2017, including the 2017 outage of the BCC ST; 2018, including the outage to repair the LP casing cracks due to the operation of the ST with the pressure plate; and the 2019 forecasted replacement power costs for the lower ST output associated with operation of the ST with the pressure plate, up to the fall outage planned to begin September 28, 2019.

Q. HOW WERE THE REPLACEMENT POWER COSTS DETERMINED FOR THE BCC OUTAGE THAT OCCURRED BETWEEN FEBRUARY 9 AND APRIL 8, 2017 ("BCC 2017 Outage")?

A. In Docket 20180001-EI, in Document No. 07025-2018, DEF witness Mr. Christopher A. Mendez provided testimony on page 5 for the replacement power costs incurred during the BCC 2017 Outage. Based upon his testimony, the replacement power costs were $11.1 Million. I do not take issue with this number, nor have I run production cost modeling analyses to verify it.

Disc Two 000226

Q. WHAT WERE THE REPLACEMENT POWER COSTS DUE TO BCC OPERATING WITH THE PRESSURE PLATE FOR THE REMAINDER OF 2017?

A. The replacement power costs for the BCC 40 MW derate in 2017 after installation of the pressure plate in the LP section of the ST was ~~$2,005,536~~ $1,675,561. This represents the costs for ~~162,040~~ 150.400 MWh of replacement generation. The calculation of these power costs are provided in Exhibit No. ___(RAP-9), lines 1-9.

Court Reporter: DK

Q. WHAT WERE THE REPLACEMENT POWER COSTS DUE TO BCC OPERATING WITH THE PRESSURE PLATE FOR 2018?

A. The replacement power costs for the BCC 40 MW derate in 2018 were ~~$2,545,049~~ $2,215,648. This represents the costs for ~~213,280~~ 199,680 MWh of replacement generation. The calculation of these power costs are provided in Exhibit No. ___(RAP-9), lines 10-21.

Court Reporter: DK

Q. WHAT WERE THE REPLACEMENT POWER COSTS DUE TO BCC OPERATING WITH THE PRESSURE PLATE FOR 2019, THROUGH AUGUST 31?

A. The replacement power costs for the BCC 40 MW derate in 2019 was ~~$1,189,552~~ $1,125,573. This represents the costs for ~~128,480~~ 125,800 MWh of replacement generation. The calculation of these power costs are provided in Exhibit No. ___(RAP-9), lines 22-29.

Court Reporter: DK

Disc Two 000227

Q. WHAT IS THE TOTAL REPLACEMENT POWER COSTS SINCE DEF REPLACED THE LP ST L0 BLADES WITH THE PRESSURE PLATE?

A. The total replacement power costs for the 2017 outage and the BCC ST derate for years 2017, 2018 and 2019 is ~~$16.84~~ $16,116,781 million.

Court Reporter: DK

Q. DOES THAT CONCLUDE YOUR TESTIMONY?

A. Yes, it does. However, I reserve the right to file supplemental testimony to the extent any material new information is subsequently filed that was requested and was available, but was not provided prior to my testimony filing.

Disc Two 000228

THE COURT: And I guess, did we need to move a revised Exhibit 9?

MR. DAVID: Yes.

MR. REHWINKEL: Your Honor, staff has requested, and I think correctly so, that we identify an exhibit, and we would just give it the next exhibit number, and this would be his revised RAP-9, which would be whatever the next number is.

THE COURT: 118.

MS. BROWNLESS: 117.

THE COURT: Okay, 117. We will mark it as 117, and without objection show it admitted.

(Whereupon, Exhibit No. 117 was marked for identification and received into evidence.)

MR. DAVID: And, Your Honor, just to be clear, when I moved the testimony in, that that includes the updates he made.

THE COURT: He has got a notice on the record. Yeah, we got that.

And how do we handle, Duke leads it off?

MR. BERNIER: Yep.

THE COURT: Okay.

EXAMINATION

BY MR. BERNIER:

Q Good morning, Mr. Polich.

A Good morning.

Q Good to see you again. Just a couple of preliminary questions.

You do not have any experience designing steam turbines, is that correct?

A I have experience -- I -- let me rephrase this. My experience with design of steam turbines involves the thermal cycles and how they match up with the existing steam turbine that I was provided.

Q Thank you.

But when it comes to physically designing the steam turbine, you don't have any experience doing that?

A Not direct.

Q Thank you.

Do you have any experience designing -- you do not have any experience designing steam turbine blades, is that correct?

A That is correct.

Q Okay. You do not have any direct operational experience with steam turbines, is that correct?

A Define what you mean by direct.

Q Have you ever -- you do not have any experience sitting at the control panel operating the steam turbine?

A I have supervised those who are at the control

panel.

Q But any experience operating the steam turbine?

A No.

Q You don't have any specific operational or design experience with a Mitsubishi steam turbine in particular, is that correct?

A I have never operated a Mitsubishi steam turbine.

Q You have never provided expert testimony regarding the design of steam turbines, is that correct?

A I have not provided expert testimony on the design of steam turbines.

Q And you have never provided expert testimony regarding the operation of steam turbines, is that correct?

A That is correct.

Q I believe you testified earlier during your summary that you reviewed documents and testimony in forming your opinions?

A Yes, I did.

Q Did you physically examine any of the damaged blades?

A No, I did not.

Q And you did not speak or correspond with

anyone from Mitsubishi as part of your testimony for preparation, is that correct?

A No, I did not.

Q And you would agree that the steam turbines should be operated within the operating parameters provided by the unit's manufacturer, is that correct?

A All the operating parameters, yes.

Q And you also agree that the megawatt output of the steam turbine is largely dependent on how you operate the unit within those parameters?

A I do not.

Q You do not?

A I do not. The megawatt output is an operating parameter.

Q Do you remember when I took your deposition in October?

A Yes, I do.

Q And when I asked you in October, the question was: My understanding -- let me ask you what your understanding of the difference between the expected output and the operating limits?

And you said: There actually is not a direct correlation. The operating limits are dependent upon various conditions of operation, generally defined a set of operating parameters providing you an envelope in

which you are to operate the steam turbine within, and for the most part, the megawatts is dependent upon how you operate within those limits.

A And I will still stand by that testimony that I still contend that the megawatt output has limits because it is a critical factor in defining how much horsepower a steam turbine is producing and what the stressers are within that steam turbine. And so megawatt output is a critical factor in operation of the steam turbine.

Q Based on information you reviewed, did Duke Energy operate the steam turbine within the pressures and temperatures provided by the OEM?

A Based on the data that I have reviewed, yes.

Q And am I correct that your opinion regarding DEF's operational prudence is limited to operation during what is referred to as Period 1 in Mr. Swartz's exhibit?

A I reviewed the operation through all the periods.

Q That's correct. My question is, am I correct that your contention in your testimony is that DEF was imprudent in its operation in Period 1?

A Correct.

Q Okay. And you agree that DEF was prudent when

operating the steam turbine in Period 2, correct?

A The pause is because I am recollecting some of the conditions during Period 2. Let me look at something here.

Q Sure.

A Based upon the information provided by Duke in which -- with the exception of September of 2013 in which there was actually some testing being done, the operation of that unit at all times was below the 420-megawatt limit, so I would say yes.

Q And notwithstanding that DEF prudently operated the machine during Period 2, at the conclusion of Period 2, DEF still found damage to the blades; is that right?

A The damage was described as minor, but, yes, there was some minor.

Q And you agree that DEF was prudent when operating the steam turbine in Period 3, correct?

A To the best of my knowledge, yes.

Q And notwithstanding that prudent operation during Period 3, at the conclusion of Period 3, DEF still found damage to those blades; is that correct?

A Those were a different design blade, and so they are not correlated to Periods 1 and 2.

Q Thank you.

At the end of Period 3, was there damage to the blades?

A Yes, there was.

Q Okay. And those blades were also supplied by Mitsubishi, is that correct?

A Yes.

Q And you agree that DEF was prudent in operating the steam turbine in Period 4, is that correct?

A Yes.

Q And notwithstanding that prudent operation, at the end -- at the conclusion of Period 4, DEF still found damage; is that correct?

A That's true.

Q And you agree that DEF was prudent when operating the steam turbine in Period 5, is that correct?

A Period 5 is an anomaly that I am not certain I can agree with.

Q Do you remember when I deposed you in October, sir?

A Yeah.

Q Okay. And I asked you: Was Duke prudent, in your opinion, prudent in its operation of the unit in Period 5? And your answer was: Yes.

A Yes.

MR. DAVID: Your Honor, if he would show the witness the deposition testimony, I think it might help.

THE COURT: Yeah, it might be helpful.

MR. BERNIER: I will have to give you my copy, but I will show it to you real quick.

May I approach, Your Honor?

THE COURT: Sure.

MR. BERNIER: I should have asked first.

THE COURT: That's fine. You know the answer is yes.

BY MR. BERNIER:

Q Right there.

A Thank you.

Q So would you agree with me that that was your response?

A If you notice in my deposition, there were several caveats in regards to that issue. I mentioned the fact that the correlation between Period 1 and Period 5 do not make sense. And as I mentioned in my opening, there is no -- the fact that they failed, those blades failed so quickly in Period 5, indicates there were other dynamics happening, or that those blades in Period 5 were not identical to the ones in Period 1.

When you get only four percent or less of the hours of the same, quote/unquote, design set of blades as you did in the first period, then it is not a direct correlation. And the reason why I am not certain as to whether Duke prudently followed everything is I don't know all the dynamics that were going on inside of the condenser at the time, and I don't know if there were any conditions that might have happened. And, yes, this is in hindsight.

Q And just to circle back on that, you are speculating that there were other conditions in there that you are not aware of but you don't know that for fact?

A I agree.

Q Okay. And just to make sure that I understood your answer correctly, you agree that the operation of Period 5 was prudent?

A I agree that the inlet pressure conditions to the IP, HP and LP, as well as the megawatt limits were maintained by Duke, and that they did their best effort as I could tell of staying out of the avoidance zone mentioned by Mitsubishi.

Q I am going to just ask that one more time another way.

You don't have any evidence that Duke operated

the unit imprudently in Period 5?

A I will agree with that.

Q Okay. Thank you.

So from the beginning of Period 2 through the end of Period 5, which spans approximately April of 2012 to February of 2017, approximately five years, you would agree that the steam turbine was operated prudently, correct?

A I am sorry, could you repeat that question again?

Q I would be happy to.

So from the beginning of Period 2 through the end of Period 5, which spanned approximately five years, you would agree that the steam turbine was operated prudently, correct?

A I would agree that it wasn't operated imprudently.

Q Fair enough. Thank you.

Now, if I understand your testimony correctly, your contention is that the blade damage discovered in Period 1 was caused by operating the steam turbine in a manner that produced over 420 megawatts; is that correct?

A That is correct.

Q And you would agree with me that during Period

1, the steam turbine was operated both above and below 420 megawatts at various times?

A Yes.

Q And I believe on your Exhibit RAP-5, and Mr. Swartz testified to this yesterday, that it appears that it was roughly half the time above 420 and roughly half the time below 420; without doing the math, does that sound about right?

A That's close enough.

Q Okay. So using your definition that operation over 420 was imprudent, and because the steam turbine was operated below 420 megawatts in Period 1 at some points, you have to agree that at some points during Period 1, using your definition, the steam turbine was operated prudently?

A Yes.

Q Okay. And you cannot identify when the Period 1 blades were damaged, can you?

A I cannot identify the exact instance in which they failed, and based on Mr. Swartz's testimony, he was not able to in Period 1 also.

The issue here, though, is the types of failures we are talking about more than likely were cumulative based upon the fracture pictures I saw. Even though I did not inspect the blades, there were plenty

of pictures and evidence in it, and my contention is that when they failed was immaterial.

Q But you would agree with me that the Period 1 blades could have been damaged when the unit was being operated below 420 megawatts, correct?

A There is always that potential.

Q So you would agree with me that the Period 1 blades could have been damaged during prudent operation, correct?

A Yes.

Q But we do know that the damage in the later periods occurred when the steam turbine was being operated prudently, correct?

A The damage did occur when the -- when it was operated within the operating parameters.

Q And have you seen any evidence that there was any damage to any steam turbine component other than the L0 blades?

A Other than -- other than, you know, subsequent damage associated with parts moving around, no.

Q I am not sure I understand.

A Well, for example, in Period 5, when the failure occurred, it threw the part out through the steam turbine. So, yes, there was something else that was damaged in the process.

Q Fair enough. Okay. Just a couple others real quickly.

You indicated that Bartow was Progress Energy's first combined cycle?

A I believe it was.

Q But would you agree with me if I told you that the Hines power blocks were commissioned prior to Bartow?

A I was not aware of that.

Q And does the steam turbine itself produce megawatts?

A No.

Q It's the generator that produces --

A The generator does produce the megawatts.

Q Thank you.

And in general, are there factors beyond the operation of the steam turbine that impact the megawatt outputs of the generator?

A One of the key ones that was discussed yesterday in Mr. Swartz's testimony, which is the issue of power factor, he brings up a very interesting point, although I think it's a red herring in this case, and that is because power factor is a very interesting animal in a power plant.

You have four -- you have five different

generators on this power plant, each of which is capable of producing a different power factor, and you have the ability to adjust power factor based upon what's going on. There is also dynamics associated with the generator output which determines the power factor the generator typically is producing.

Now, Mr. Swartz yesterday brought up power factor which is a rather interesting issue, because if Duke is trying to raise this unit's output to 450 megawatts, if you were to adjust that to the unity power factor that he discussed yesterday, that unit could be producing 500 megawatts, which exceeds the generator capability.

So I -- and if you look at all the documentation that's provided in this case, that power factor was never introduced. The 420 and 450 megawatts are the only numbers that are discussed in this case, and I think power factor is something that has not been factored into any of the evidence, the RCA or anything else.

Q You would agree with me that power factor was included in those documents that were discussed yesterday?

A Only in terms that they were specified as .95 or .90.

Q And are there other variables beyond power factor that impact generator output?

A The efficiency of the steam turbine, of course, is always one. There is -- you know, it's ancillary. The numbers that we talk about, 420 megawatts, is a net output. So to the extent that ancillary loads that are associated with that steam turbine can affect that 420, quote/unquote, but, you know, in transferring the horsepower from that steam turbine to the generator, there aren't many aspects that can change that number.

MR. BERNIER: If I could have just one minute.

THE COURT: Sure.

MR. BERNIER: Could we have five minutes?

THE COURT: Sure. Absolutely.

(Brief recess.)

THE COURT: Okay. Back on the record.

MR. BERNIER: Thank you for that break, Your Honor. Just a couple more.

BY MR. BERNIER:

Q Mr. Polich, you would agree with me that Mitsubishi was aware that Duke planned on operating the steam turbine in a 4-on-1 configuration, correct?

A Yes.

Q Do you know that DEF didn't contact Mitsubishi

about operating the unit over 420 megawatts in Period 1?

A There is no evidence that they asked Mitsubishi to operate over 420.

Q But you don't know whether or not it did occur or not?

A No, I don't.

Q And if I understand correctly, your contention is that the blade damage discovered in the spring of 2017, after Period 5, was originated or caused by the operation in Period 1, was that correct?

A No.

Q No. I am not sure I understand.

A Repeat the question one more time.

Q Sure. Am I correct that your contention is that the damage that occurred in the spring of 2017, after Period 5, was caused by Duke Energy's operation of the unit above 420 megawatts in Period 1?

A No.

MR. BERNIER: Okay. We have nothing further. Thank you.

THE COURT: Okay. Who's next? Okay.

MS. PUTNAL: No questions from FIPUG.

THE COURT: Nothing?

MS. PUTNAL: No questions from FIPUG.

THE COURT: Well, I guess redirect then.

MS. BROWNLESS: Excuse me, we have two questions.

THE COURT: Oh, I am sorry. I am sorry.

MS. BROWNLESS: Thank you.

EXAMINATION

BY MS. BROWNLESS:

Q Your Exhibit No. 5 in your testimony shows operating data for the Bartow unit from June 2009 until August of 2019, is that correct?

A Yes.

Q And you used this data to calculate the derate replacement power cost that you are seeking to recover, as found on your exhibit RAP-9, right?

A No.

Q You didn't use this data as the basis to develop the replacement cost?

A No. The data in RAP-5 is strictly associated with operation greater than 420 megawatts. Duke provided another set of documents that showed what the operations were on an hourly basis during the time periods in question.

Q And that's what you used?

A And that's what I used for calculating replacement power.

Q Is it your testimony that ratepayers should be

compensated for megawatts that were not generated due to DEF's operation of the steam turbine under 420 megawatts?

A Yes.

Q And should DEF also receive credit for the megawatts it produced over 420 megawatts in Periods 1 and 2?

A No, because that wasn't subject of the proceeding, if I am correct.

Q Well, I guess what I am trying to ask is you believe they should be -- they should pay for megawatts they did not produce, but isn't it true that customers also got the benefit of megawatts in excess of 420 in Period 1?

A My testimony is dealing with periods after 2016, and so Periods 1 and 2 would be prior to that.

Q So you don't think it would be appropriate to use the data in RAP-5 to figure out how many megawatt hours were produced in excess of 420 in Periods 1 and 2?

A Okay, to answer that question appropriately we would have to get into compensation and payments associated with power cost recovery cases. To the extent that power cost recovery cases typically are dollar for dollar what the utility spends is what the customer pays for.

Your supposition is that there was net benefit that Duke was not compensated for as a result of that. If we were to follow that line of questioning to its conclusion, you would be espousing that because the operation above 420 potentially reduced replacement -- or reduced the power cost that customers were paying for and Duke should be compensated for that is actually contrary to the regulatory compact between utilities and their customers.

And in rate-making and rate proceedings, utilities normally don't get a profit, which that would be, for replace -- for power cost. But if utilities imprudently incur power costs, they will be docked -- they can be docked in fuel cost recovery proceedings.

Q So if I understand what you are saying, the standard is 420. If they do less than 420, they are operating imprudently, and therefore should -- customers should be compensated for that, and if they are operating above 420, you are not saying that customers didn't benefit from those megawatts, are you?

A I didn't say that, no. Customers did -- I mean, customers -- to the extent -- and truth of the matter is I -- you know, without having the actual data, all right, my guess, based on the fact that Duke did operate the unit more than 420 was that their cost

occurs associated with the stacking of their various generation units indicated that it was more prudent to operate Bartow above 420 to reduce the overall power cost to customers. And so that was a prudent decision from that perspective, absent the fact that they were violating the operating parameters of the unit, all right.

Now, that is factored already in your power supply cost recovery proceedings, all right.

The second thing is that what I am talking about, and it's in my testimony, is associated with the installation of a pressure plate and associated derate as a result of that. And my contention is, is that the reason the pressure plate was put in place was due to improper operation above 420 megawatts in Periods 1.

Q Okay.

A And so it's not the same animal from my perspective.

Q I understand.

And I just want to ask one question. You have indicated that if Duke had called Mitsubishi and said we are going to operate it at this higher level, and Mitsubishi had given them permission to do that, that we all wouldn't be here today; is that correct?

A And that permission would -- should have been

in writing.

Q Okay.

A It should have been something that allowed Duke to go back to Mitsubishi from a warranty perspective, so that, you know, okay, we asked you. We gave you the parameters we were going to operate under, and you came back and said that's okay, then the onus is on Mitsubishi.

Q And if they simply asked Mitsubishi and got permission but never got written permission, would that change your opinion?

A No, because we are dealing with regulatory proceedings here, and the additional step of getting it in writing is minimal. It doesn't take any effort to do that. And so the prudent thing to do, especially when you are dealing with a regulatory or a contractual issue is you get it in writing. Any attorney that I have ever been associated with would tell you that.

Q All right. Thank you so much. That's all we have.

A Thank you.

THE COURT: Ms. Putnal, I apologize, I was -- I was promoting you to the Commission. That's why I thought we hadn't met. I just realized she's in Mr. Moyle's chair.

MS. PUTNAL: Thank you.

THE COURT: I think we are to redirect.

MR. REHWINKEL: Yes. Thank you, Your Honor.

Just a few questions.

EXAMINATION

BY MR. REHWINKEL:

Q Mr. Polich, can you tell me, I think you were asked by Mr. Bernier if you had contacted Mitsubishi in any part of this process; do you recall that?

A Yes.

Q In your opinion, in your expert -- in your experience in the business, would it have been appropriate for you to have contacted Mitsubishi in this case?

A No. And, in fact, you know, if I had, I think there would have been some issues by Duke associated with my doing that.

And in addition, I doubt Mitsubishi would talk to me anyways because of the fact that a lot of the information I would have been seeking is probably under confidentiality and would not be -- so it would have been useless for me to contact Mitsubishi.

Q Mr. Bernier also asked you -- do you recall him asking you about whether damage was found in Period 2?

A Yes.

Q In the course of your discovery in this case, did you see any evidence that Duke believed there was either no damage or damage that was pretty typical and the type that could have been smoothed out during the -- during a planned outage?

A Well, in fact, if you go to Duke's RCA Table A, and you look at what was found in Period 2 and you come down to a line that says broken snubbers, there is zero on the turbine end. There was zero on the governor end. You look at the broken Z-lock, zero on the turbine end zero on the governor end. Moderate amount of surface fretting and galling observed, which is normal.

Duke operated the machine within the parameters of -- and below 420 megawatts with the exception of the one test that they performed during that time period, and this was 28 months of operation, 21,000 hours, and basically no damage.

Q Do you recall being asked about damage in Periods 2 through 5?

A Yes.

Q Is it your opinion that the blades throughout Periods 2 -- well, throughout all five periods were similar enough for you to make a direct comparison about prudent operation and impact on the blades?

A No. I mean, when you got to Period 3, Duke was -- you know, not Duke, but Mitsubishi installed the Type 3 blades, which were a different design. Some of the interesting things that they did to the blades in terms of surfaces on the snubbers and the Z-locks I believe contributed to the problems instead of, you know -- instead of resolving them.

And so going back to the comparison between those periods and Period 1, I don't think they are correlatable, and especially when you get to Period 5; because again, you got to come back to why did the Period 5 blades which were, quote/unquote, identical to the Period 1 blades fail in only four percent of the operating hours, and include throwing a piece through the steam turbine casing? Actually, I think it was the pressure disc, but it's -- it's -- from an engineering perspective, it doesn't add up, and so I don't think there is a correlation.

Q Do you recall Mr. Bernier asking you whether you had any knowledge if Duke contacted Mitsubishi during Period 1?

A Yes.

Q Okay. In the process of doing discovery in the proceeding, did you ever hear Mr. Swartz state that, for all I know, there may have been no discussion with

Mitsubishi relative to that period?

A I recall that in a deposition.

Q Do you recall Mr. Swartz saying, I am not sure how much interaction was going on with Mitsubishi with respect to that period?

A I recall.

Q And finally, you were asked a question by staff counsel about going back and looking at 2009 and the value that the customers might have gotten out of operating above 420 --

A Yes.

Q -- do you recall that?

Are you also generally aware that after October 2nd of 2009, Duke had damage to the Crystal River 3 nuclear plant --

MR. BERNIER: I object, Your Honor. This is pretty irrelevant.

THE COURT: Let him finish the question.

BY MR. REHWINKEL:

Q And was -- without 1,000 megawatts or so of base-load generation for the next three years?

MR. BERNIER: Same objection, Your Honor.

MR. HERNANDEZ: It's also beyond the scope of --

MR. REHWINKEL: If I could be heard, Your

Honor.

THE COURT: Sure.

MR. REHWINKEL: There was -- I could ask a question in front of that one so you could understand, but the assertion -- the question by the staff, which I think was an informational question, was to know whether there was a benefit that customers were unduly receiving from this excess generation. But to complete the picture, the Court needs to understand whether there was a replacement power need that Duke might have been filling by running the unit above 420, and thus that would have all been taken care of in the fuel adjustment process and the ensuing proceedings.

MR. BERNIER: I apologize, Your Honor, that is not at all relevant. I think she was asking whether or not customers received the benefit of that added generation, and whether or not there was an outage at another plant at another time is completely irrelevant. That's not what we are here talking about today.

MR. REHWINKEL: I can withdraw the question.

THE COURT: I am going to sustain. I think we are kind of getting into the weeds here.

MR. REHWINKEL: All right. That's all I have.

Mr. David may have a question.

FURTHER EXAMINATION

BY MR. DAVID:

Q Mr. Polich, in your experience -- how long -- once again, how long have you been an engineer?

A Since 1978.

Q Okay. In your experience, do prudent engineers base analyses on oral information?

A My hesitancy is because we will conduct preliminary analyses based upon oral information. But in the case, especially when you are looking at design of a power plant or something like that, you are going to want confirmation especially if that information is being provided by an OEM, because your client is going to expect you to have that documentation and information because utilities are regulated entities. Their operations are always under public scrutiny and questioning. And so an entity such as Duke would expect their -- their owner -- their engineer on a project to have that documentation because if there is questions some point in the future, they are going to want to be able to provide the proper evidence if needed.

Q Thank you.

And to staff's line of questions, in your calculation of damages that was in, I believe it's now

been identified as Exhibit 117, did you only take into account when power was needed, or did you just take into account the fact that they weren't producing 420, so you -- so they -- you docked them for that?

A I did, yes. I did look at only when that power would have been needed. There are definitely hours in there in which, based upon the information provided by Duke, I could identify those hours in which the additional megawatts would not be necessary, and I excluded those hours from my calculations.

Q Okay. Last one.

In your opinion, did the operation of the steam turbine in Period 1, the manner of operation of the steam turbine in Period 1 affect the condition performance of the steam turbine after that period, including Periods 3 and beyond?

A Interesting question from the perspective of how operation of a steam turbine in earlier periods affects opera-- affects the way that steam turbine performs in later periods.

Clearly, you know, by the time you get to Period 5, this unit has been in operation for, you know, eight some odd years, and there will be some wear on components within that turbine. Duke has stated that Mitsubishi did a very thorough analysis of those

components and didn't find anything out of the ordinary. It doesn't mean that there wasn't some wear and tear that occurred. And that wear and tear can affect how the performance of a set of blades put in in subsequent periods. The question is how much that can affect it.

MR. DAVID: No more.

THE COURT: Okay. Thank you, Mr. Polich.

THE WITNESS: Thank you.

(Witness excused.)

MR. DAVID: And, Your Honor, at this point, I would like to move all of Mr. -- the exhibits to Mr. Polich's testimony in there, except I will withdraw what's been identified as -- on the CEL as Exhibit 76, since it was the incorrect one, and offer exhibits 68 through 75 and Exhibit 117.

THE COURT: I think 117 we've already admitted.

MR. DAVID: Okay. I just wanted to make sure we are clear.

THE COURT: Without objection, we will show 68 through 75.

MR. DAVID: And withdraw 76, thank you.

THE COURT: Okay. 76 is out.

(Whereupon, Exhibit Nos. 68 - 75 were received into evidence.)

CONFIDENTIAL

THE COURT: According to my script, we are up to the rebuttal.

MR. BERNIER: Yes, sir. Duke Energy would recall Mr. Swartz.

THE COURT: Mr. Swartz, I will just remind you you are still under oath.

THE WITNESS: Yes, sir.

THE COURT: I am not going to swear you in again. I think it's like the flu, the vaccine only last a couple of days.

Whereupon,

JEFF SWARTZ

was recalled as a witness, having been previously duly sworn to speak the truth, the whole truth, and nothing but the truth, was examined and testified as follows:

EXAMINATION

BY MR. BERNIER:

Q Good morning again, Mr. Swartz.

A Good morning.

Q I believe the judge has reminded you that you remain under oath, is that correct?

A Yes, that's correct.

Q Okay. Good deal.

On or about September 26th of 2019, did you cause to be filed rebuttal testimony in the 2009 fuel

docket before the Florida Public Service Commission?

A Yes.

Q And do you have of a copy of that testimony with you today?

A I do.

Q And I believe your testimony -- your rebuttal testimony included exhibits JS-2, 3 and 4, is that correct?

A Yes, that's correct.

Q And you have those with you today?

A I do.

Q Do you have any changes to make to your testimony?

A No changes.

Q If I was to ask you the same questions here today, would your answers be the same?

A Yes, they would.

Q Okay.

MR. BERNIER: Judge, at this time, we would ask that his rebuttal testimony be read -- entered into the record as though read.

THE COURT: As if read. Hearing no objection, we will show that done.

(Whereupon, prefiled testimony was inserted.)

CONFIDENTIAL

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

REBUTTAL TESTIMONY OF

JEFFREY SWARTZ

ON BEHALF OF

DUKE ENERGY FLORIDA

DOCKET NO. 20190001-EI

September 26, 2019

Q. By whom are you employed and in what capacity?

A. I am employed by Duke Energy Florida ("DEF" or the "Company") as Vice President – Generation.

Q. Have you previously filed testimony in this docket?

A. Yes, I filed testimony related to the February 2017 outage of the Bartow Combined Cycle ("Bartow CC") Steam Turbine ("ST") in this docket on March 1, 2019. Additionally, in last year's docket I filed testimony and sponsored DEF's Root Cause Analysis ("RCA") regarding the same outage, which was attached to my testimony as Exhibit No. __(JS-1). This exhibit was then incorporated by reference into my March 1, 2019 testimony in the present docket.

Q. Have your duties or responsibilities with the Company changed since you last filed testimony in this docket?

A. No.

Q. What is the purpose of your testimony?

A. The overall purpose of my testimony is to rebut OPC witness Polich's incorrect conclusion regarding the root cause of the L0 blade failures. DEF acted prudently at all times with respect to the operation of the Bartow plant. I will clearly articulate why the Commission should reject Mr. Polich's argument that DEF should bear any replacement power costs related to either the Spring 2017 outage or operation of the Bartow plant with pressure plates in place of the L0 blades in the steam turbine.

Q. Please provide a summary of your testimony.

A. The Commission should reject Mr. Polich's opinion as to the cause of the steam turbine ("ST") blade failures because he disregarded or ignored key information. Specifically, he only considered operating conditions for the Period 1[1] failure and disregarded key facts obtained from later operating periods that contradict his ultimate opinion. As my rebuttal testimony and exhibits demonstrate, DEF operated the Bartow unit at all times within the operating parameters set forth by the steam turbine Original Equipment Manufacturer ("OEM").[2] After DEF initially discovered damage to the L0 blades, it consulted with the OEM and adjusted operation to within new limits established by the OEM. However, even when DEF operated at lower LP pressure limits with the same type of blades as it did during Period 1, the L0 blades experienced damage. Mr. Polich ignores the fact that the L0 blades later failed even when DEF operated the Bartow unit

[1] My testimony refers to various periods of operation, which are set forth in my Exhibit No. __(JS-2), Table A.
[2] The OEM for the Bartow CC ST is Mitsubishi Hitachi Power Systems ("MHPS"). I will use "OEM" and "MHPS" in this testimony interchangeably.

at a lower LP pressure and claims that DEF's operation of the Bartow unit beyond its design during Period 1 caused the first blade failure.[3] The basis for his opinion appears to be an earlier root cause analysis that was prepared without the benefit of the additional information learned from continued operation of the unit in later periods. Mr. Polich then concludes:

> If DEF had operated the ST at BCC in accordance with design output of 420 MW or less, I believe there is no engineering basis to conclude that the original L0 blades would not still be in operation today. Likewise, DEF would not have needed to undertake any of the subsequent outages to repair L0 blades, including the outage in February 2017 to replace the L0 blades with the pressure plate. Consequently, the BCC ST would currently be capable of producing its full output of 420 MW instead of being derated to 380 MW and operating with a less-than-optimal pressure plate.[4]

These statements completely fail to account for subsequent failures that occurred without the ST being operated over, or even at, 420 MW of output. Contrary to Mr. Polich's suggestion, it is evident that DEF operated the machine prudently at all times and made a prudent decision to install the pressure plate in the spring of 2017 to allow for event-free operation while a long-term path forward could be designed, tested, and implemented. For those reasons, the Commission should reject Mr. Polich's contention that DEF should not be permitted to collect the replacement power costs incurred as a result of the 2017 outage and operation with the pressure plate and should approve DEF's recovery of its costs as presented in its petitions and testimony in this docket.

Q. Are you sponsoring any exhibits?

[3] DEF's "operation of the BCC ST beyond the ST's 420 MW design" caused the first blade failure. Polich Testimony, pg. 7, ll. 15-16.
[4] *Id.* at pg. 8, ll. 11-18.

Disc Two 000179

A. Yes. I am sponsoring:

- Exhibit No. __ (JS-2) – *Exhibit No. __ (JS-1) Revised as to Confidentiality Only (Confidential)*;
- Exhibit No. __ (JS-3) – *Duke Energy Bartow ST 40" Upgrade Blade Test in Takasago Validation Rigor at MHPS (Confidential)*; and
- Exhibit No. __ (JS-4) – *Bartow RCA Summary, Sept. 22, 2017 (Confidential).*

Basic ST Operation

Q. Based on Mr. Polich's testimony, do you believe he understands how DEF controls the Bartow ST during operation?

A. No, his testimony shows that he focuses on the MW output of the machine as the control mechanism, where in practice the output is simply the byproduct of operating the unit within the design parameters provided by the OEM. At multiple times in his testimony, Mr. Polich discusses the nominal nameplate rating of the Bartow ST (420 MW) as a "design output" or "design condition"[5] and indicates his belief that the 420 MW nameplate represents the unit's "maximum gross output."[6] However, thinking of the operating parameters of a ST solely in terms of MW output is either an over-simplification or miscomprehension of the true operating parameters of the unit and/or the myriad variables that can impact the unit's output. Despite the fact that Mr. Polich

[5] *See e.g., id.* at p. 8, l. 12; p.8, l. 10 ("generated output above the 420 MW design conditions"); p. 7, ll. 15-16 (noting the "ST's 420 MW design."); p. 8, l. 23–p. 9, l. 1 ("manufacturer's 420 MW design conditions."); p. 10, ll. 6-7 ("The ST was designed to produce 420 MW gross generation.").
[6] *Id.* at p. 12, l. 13.

Disc Two 000180

indicates his awareness of the true design conditions that govern use of the ST,[7] he, nonetheless, returns to the erroneous conclusion that the nameplate capacity is a "maximum" output threshold that cannot be breached.[8] In actuality, the nameplate capacity is simply the OEM's expected output resulting from the operational parameters and other assumed values for variables that are given to fluctuation (such as ambient temperature, humidity, temperature of cooling water, etc.), not a design basis criteria for operating the ST.[9]

Q. If the ST operating parameters are not centered on its output. what are the operating parameters established by the OEM for the Bartow ST?

A. When the ST was commissioned in 2009, the operating parameters were established by the Mitsubishi ST operating manual as related to steam flow through the ST. When DEF realized that operating parameters allowed for additional steam to flow through the ST, resulting in additional megawatts for DEF's customers while staying within those parameters, DEF started increasing the steam flow through the ST staying within the known operational parameters. After the original blade type was found to have cracking issues, DEF worked with Mitsubishi to establish additional operating limits not found in the operating manual. Each operating Period identified in Exhibit No. __ (JS-2) had different operating limitations.

[7] *See id.* at p. 11, ll. 11-17.
[8] *See id.* at p. 12, ll. 17-19.
[9] Considering Mr. Polich's position that the ST had a MW output maximum that could not be breached without risking damage to the unit, it is noteworthy that he does not assign a similar "absolute maximum" to the other components of the Bartow CC. *See id.* at p. 9, ll. 21-22 (noting the "Non-steam augmented power output of each CT is in the range of 180 MW."); p. 10, ll. 9-10 (noting the "generator output appears to have an upper gross generation limit of about 465 MW at a 0.95 power factor . . . ").

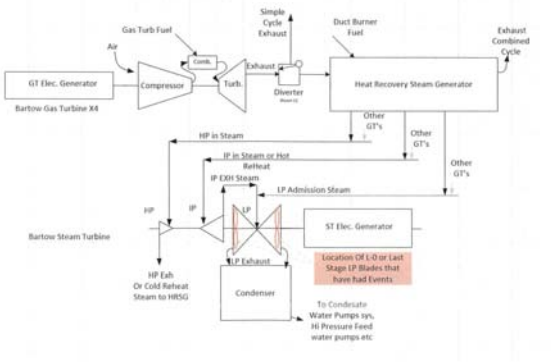
Disc Two 000181

- Period 1 - Operational limits given to DEF were based on the turbine nameplate data and those limits typical for steam turbine operation like vibration limits, metal temperature ramp rate limits, seal system parameters, lube and hydraulic system pressure temperature limits and many other parameters that are common to this type of equipment. However, while parameters related to steam pressures and temperatures are part of the nameplate rating, no flow-limits, and in particular, no flow-limit for the LP turbine, were given to DEF. This is not unusual as flow limits will normally be maintained if inlet pressure and temperature limits are maintained. In a combined cycle application, that normally means staying within the pressure and temperature limits of the HP and IP turbines. There is only a small fraction of flow added by the HRSG LP system. In short, there was no operational limit for the LP turbine flow or inlet pressure for Period 1 that was known to DEF operations at that time.
- Period 2 - MHPS established a LP inlet pressure limit for DEF to follow. The LP pressure was inferred from the IP turbine exhaust pressure as no LP turbine inlet pressure instrument existed during this time period. During each succeeding time period, MHPS established a new LP pressure limit based on their analysis for the blade type and modifications installed at that time. A pressure transmitter was added to the LP turbine in the fall of 2016.
- Periods 3-5 - MHPS for the first time established an "Avoidance Zone" ("AZ") related to LP inlet pressure and condenser backpressure. For Period 3, MHPS stated that the AZ should be avoided but did not provide any time limits or recommendations to move the ST out of the AZ.

Disc Two 000182

For the time-period that the Bartow ST has been operating with the installed pressure plate, MHPS has kept the LP inlet pressure parameter as a setpoint to not exceed even though the L0 blades have been removed.

Simplified Block Diagram of Bartow CC or SC Generation Plant



Q. Did DEF operate the Bartow ST within the operating parameters established by the OEM?

A. Yes. Starting with commissioning and Period 1, DEF has followed all the known operational limits for the steam turbine. Post-Period 1, DEF has made every reasonable attempt to maintain the LP inlet pressure limit in place for the given Period. Hours

above the pressure limit do exist for Period 3;[10] however, during the testing period at the outset of Period 3, MHPS needed to explore the entire range of operational parameters in order to determine where dynamic stresses were above their limit at the time, resulting in many of the hours within the then-unknown AZ. MHPS established the AZ (additional instructions which consisted of a combination of LP inlet pressures and condenser backpressures) as a result of the post-test analysis of strain gage data gleaned from this testing, but MHPS was not able to analyze the data and communicate the limits of the AZ until March of 2015, therefore resulting in additional hours in the zone, albeit unbeknownst to DEF at the time of operation. Some additional run hours in the AZ do appear during Period 3, but operators adjusted the CTs and HRSG duct burner outputs to minimize time in the zone as they strove to maintain a high output and benefit from the steam turbine without compromise to the LP turbine. MHPS's instructions on time in the AZ was to limit the amount of time run there; it was not a hard-fast limit, nor did MHPS provide Bartow operators a means to automatically keep out of the AZ.

Q. If the plant operators do not control the ST by trying to reach a given level of MW output, how is the unit controlled?

A. The ST is "controlled" by adjusting the output of the four combustion turbines ("CTs"). For example, in a 1x1 configuration (one CT and heat recovery steam generator ("HRSG") providing steam to the ST), the ST would receive enough steam to produce approximately 100 MW; in a 2x1 configuration, the ST would receive the steam

[10] The chart titled "Excessive Steam Flow" found in Appendix B of Exhibit No. __ (JS-2), shows the hours the unit was operated in the AZ for the respective Periods.

equivalent to approximately 200 MW; in a 3x1 configuration, the ST would produce about 300 MW; and for 4x1 configuration, the ST would produce about 400 MW. In order to produce more megawatts, the auxiliaries (duct burning and Power Augmented Steam ("PAG")) would be used. These auxiliaries are described in more detail below.

The ST is a follower much like a trailer follows a truck. In this example, the trailer can only go as fast as the truck that is pulling it and can only turn if the truck makes a turn. The four CTs exhaust into their respective HRSGs, the four HRSGs produce steam for the three sections of the ST. The HRSG produces high pressure ("HP") steam, intermediate pressure ("IP") steam, and low pressure ("LP") steam. The HP steam enters the HP section of the ST, the IP steam enters the IP section of the ST, and the LP steam in the HRSG enters the LP section of the ST. The LP section of the ST also receives exiting steam from the IP section of the turbine. During the commissioning process, the ST is "matched" with the three steam pipes (HP, IP, LP) coming from the four HRSGs to produce the output of the machine in Megawatts. The output of the ST in megawatts is a product of the steam pressure and flow. If the operator wants to reduce the steam pressure and flow through the ST (i.e., to produce less Megawatts), the operator reduces the CTs' output and thus the steam passing through the ST (and the megawatts produced) is reduced after a short lag in time for the energy to dissipate. The operator can also produce more output from the ST by adding duct burning within the HRSGs to produce more heat and therefore steam that is ultimately passed through the ST. The operator can also use PAG, another auxiliary, to produce more output from the power block. At first, PAG actually extracts steam from the IP section of the ST

using the steam in the CTs like a supercharger in a car and raising the output of the CT generators. If the operator uses PAG, the output of the ST is initially reduced until duct burning is introduced to produce more steam in the HRSG to send to the ST, raising the output of the ST generator.

The ST has two (2) High Pressure stop valves and two (2) Control Valves. When the ST is online and steady state, all four (4) of these valves are open and stay open – no matter what configuration the station is operating in (i.e., 4x1, 3x1, 2x1, or 1x1). A combined cycle plant does not modulate its control valves to limit ST load, the control valves are only used in startup or shutdown to maintain system pressure above a minimum value. There are two automatic sub-systems associated with the ST to prevent too much steam from entering any of the sections of the ST (HP, IP, and LP): the "sky vents" and the condenser bypass system. The sky vents are located on the top of the HRSGs, and they sense pressure in the HRSG and can release steam from the HRSG in the event pressure rises above its setpoint. Use of the sky vents only occurs during an emergency or unit startup. The condenser bypass system is an automatic system designed to blend the HRSGs into and out of the ST. As the name suggests, the condenser bypass system takes steam from the HRSG and, instead of the steam entering the ST, it bypasses the ST and feeds directly into the condenser. The steam path described here can be traced through the diagram attached to Mr. Polich's testimony as Exhibit No. __ (RAP-3).

In summary, the operator controls the CTs and the output of the CTs determine the output of the ST. The operator's job is to make sure that the ST is operating as efficiently as possible, producing the most output for our customers as possible, within the steam pressure and flow limits (operating parameters) established by the OEM.

Prudent Operation of the Bartow CC for DEF's Customers

Q. Is the distinction between operating to achieve a desired MW output as Mr. Polich describes and following the operating guidelines as you are describing important?

A. Yes, it is important because operating with an eye to the proper operating conditions allows an operator to maximize a unit's efficient output for customers. As Mr. Polich notes, the Bartow CC is one of the most efficient and lowest-cost generation units in DEF's generation fleet. Therefore, it is prudent for DEF to maximize its output for customers' benefit, so long as the operating conditions prescribed by the OEM are complied with. Hence, when DEF became aware the unit was not being maximized according to the OEM's operating pressure, steam flow, and temperature guidelines, the prudent course of action for the Company was to bring the unit's operation into line with those guidelines – regardless of whether DEF was achieving the nameplate output previously.

If DEF were to operate the Bartow ST, or any other unit, according to Mr. Polich's concept of never breaching the nameplate "maximum" output, its customers would potentially experience higher costs. A simple way to illustrate the point is to consider winter versus summer operation. Due to cooler temperatures and denser, heavier air

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conditions, a given unit can produce more MWs of output during the winter while operating within the same parameters as summer operation. Following Mr. Polich's logic, if DEF operated the unit during the winter without changing any of the operation parameters (e.g., no additional steam is being produced and put through the machine) and the output increased from 419 MW to 421 MW,[11] DEF would be required to "back off" operations in order to get the unit's output down below nameplate capacity; this would "cost" customers the opportunity to receive the otherwise free differential in output and would run counter to the goals of maximizing efficiency and value to customers.

Q. Did DEF's customers benefit from the Bartow ST producing more than 420 MW during Period 1?

A. Yes. When the Bartow ST was generating more than 420 MW during Period 1, it logically would have been dispatching in higher economic order than other generation. Accordingly, DEF avoided operating or buying more expensive generation, and DEF's customers received the benefit of this lower-cost power generation. This is of course how DEF should operate its generating fleet, as I describe above. In general, if DEF were to operate its fleet in the manner described by Mr. Polich, DEF would not be allowed to operate its units, including Bartow CC, in the most efficient manner. This would result in higher energy costs for DEF's customers due to the need to generate or

[11] Although in this example, the hypothetical increase in output for the ST during winter operation is set at 2 MW, in practice winter operations with no change in operation parameters can result in an approximate 95 MW increase for the Bartow CC, with approximately 15 MW of the increase attributed to the ST.

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purchase higher cost energy, which is currently being served through lower-cost efficient unit operation.

Root Cause of the L0 Blade Failure

Q. If the LO blade failures were not caused by operation of the unit beyond 420 MW, what was the cause?

A. As explained in my previous testimony and more thoroughly in Exhibit No. __ (JS-1) and Exhibit No. __ (JS-2), the root cause of the blade failures, including the Period 1 failure Mr. Polich focused on in his testimony, was the lack of design margin in the blades. Specifically, a lack of design margin in dealing with the dynamic steam forces present throughout the operating range of the steam turbine – both above and below 420 MW. These steam forces are often referred to as dynamic flutter. MHPS identified dynamic flutter as the main root cause of the L0 blade failures in its later root cause report, conducted after the 2017 outage, as seen on page 12 of my Exhibit No. __ (JS-4). Said differently, the different types of blades used during each period were not designed with sufficient operating margin to handle the steam flows, pressures and transient conditions to handle the dynamic steam forces present in the machine while it was being operated pursuant to the OEM's guidelines. I suspect that one of the reasons Mr. Polich reached his conclusion, which disregards the information gleaned from later operating periods, is because he chose to focus solely on Period 1 operation and he relied on early RCAs provided by the OEM rather than later-produced documents that benefited from this additional information such as DEF's RCA (Exhibit

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No. __ (JS-2)) and MHPS' confidential documents, attached as Exhibit Nos. __ (JS-3) and (JS-4). As can be seen from Exhibit No. __ (JS-3), MHPS recognized that its early RCAs did not identify the correct root cause of the damage. MHPS states "multiple forced outrages were experienced due to last stage blade damage caused by high load stimulus and high energy blending in the 4 on 1 configuration which was not fully understood until conducting an extensive collaborative RCA. Once the root cause was understood MHPS developed an upgraded 40" L-0 blade specifically to operate [in] the conditions present at Bartow."[12]

Q. Why is the later-Period operating information important to understanding what occurred in earlier Periods?

A. Because as DEF and the OEM moved through the operating periods and learned more information, the information and conclusions derived were incorporated into later blade designs and operating limitations. After Period 1, MHPS believed as Mr. Polich now believes that the blade failure was a result of over-loading on the blades. However, the later-Period operating data directly refutes this conclusion. At multiple times in his testimony, Mr. Polich states a variant of his conclusion: "If DEF had operated the ST at BCC in accordance with the design output of 420 MW or less, I believe there is no engineering basis to conclude that the original L0 blades would not still be in operation today."[13] Indeed, Mr. Polich opined that DEF had not "demonstrated that the original

[12] Exhibit No. __ (JS-3), page 2, bullets 2 & 3.
[13] Polich Testimony, p. 8, ll. 11-13; *see also id.* at p. 22, ll. 11-13 ("DEF has failed to demonstrate that had it operated the ST within original design conditions the original blades would still be in operation."); *infra* note 8.

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L0 blades would have experienced even minimal degradation" had the unit been operated "at or below the original design output of 420 MW."[14]

These statements, and the general conclusion he reaches in his testimony, are conclusively refuted by the Period 5 operating experience. As shown on Exhibit No. __ (JS-2), specifically Table A on page 5 of 18, in Period 5 the ST was operated with the same type of blades that were installed when the unit was operated in Period 1. The contrast between the results found in the two Periods shows why Mr. Polich's conclusion is inaccurate. In Period 1, DEF operated the Bartow unit from June 2009 to March 2012 according to the OEM's original operating conditions (steam pressures, flows, and temperature – not to a maximum MW output), and as Mr. Polich points out, the unit achieved as much as 457.6 MW[15] before DEF discovered blade damage in 2012. In Period 5, DEF operated the Bartow unit per new OEM-provided operating instructions that included reduced exhaust pressure operating limits, specifically a 111.5 psig limit on the IP Exhaust,[16] that resulted in the ST achieving a maximum of 402.1 MW of output.[17] Nonetheless, even with the new operating conditions, the blades failed after only 1,561 hours of operation leading to the February 2017 outage.[18]

This information is crucial to understanding the root cause of the failures, including the Period 1 failure. As noted above, during both Periods 1 and 5 the ST operated with the

[14] *See id.* at p. 21, ll. 16-18.
[15] *See id.* at p. 15, l. 21; Exhibit No. __ (RAP-5).
[16] Exhibit No.__ (JS-2), Table A.
[17] Exhibit No. __ (RAP-5).
[18] Exhibit No. __ (JS-2), Table A.

same type of L0 blades (specifically, Type 1 blades[19]); that is, the same type of blades that Mr. Polich opined would not have failed in Period 1 had the ST not been operated beyond 420 MW failed in Period 5 even though the ST was **always** operated "at or below the original design output of 420 MW"[20] during that Period.

Simply put, Mr. Polich's contention that the original Type 1 blades from Period 1 would still be in operation, without even minimal degradation, had DEF only operated the unit at or below 420 MW of output and that "all subsequent outages and derates since 2012 have their origin in the operation of the ST in excess of 420 MWs"[21] has been conclusively refuted by the Period 5 experience – Mr. Polich may not "believe there is [any] engineering basis to conclude" otherwise, but the facts and experience gained in Period 5 cannot be ignored.

Q. Mr. Polich also contends, based on his conclusion that DEF's operation of the ST caused the original failure, that "all subsequent outages and derates since 2012 have their origin in the operation of the ST in excess of 420 MW." Do you agree with this statement?

A. No. As discussed above, this is contradicted by the evidence of the later-Periods. However, if one were to assume for the sake of argument that Mr. Polich is correct, and DEF improperly operated the machine leading to the 2012 failure, that would not

[19] *See* Exhibit No. __ (RAP-8), page 4 of 12, for an explanation on the different types of blades. Contrary to the assertions in Mr. Polich's testimony, *see, e.g.*, p. 22, l. 15, "Type 2" blades were never installed in the Bartow ST. *See* Exhibit No. __ (JS-2), Table A or Exhibit No. __ (RAP-7), page 3 of 16, for discussions of the different types of blades installed at the unit in the different operating periods.
[20] *See* note 8, *supra*.
[21] *See* Polich Testimony, p. 22, ll. 10-11.

establish a causal link between the original blade failure and subsequent outages – nor does Mr. Polich suggest one. Rather, he offers a conclusory statement that ignores everything that occurred from Period 2 forward. In Periods 2-5, DEF operated the unit according to the OEM's updated operating conditions, and in Periods 3 and 4 installed redesigned blades that were intended to allow operation at the original operating conditions. Mr. Polich does not attempt to challenge these facts, rather he falls back on the logical fallacy of "because the later events followed the first, the first event must have caused them."

Therefore, even if the Commission were to determine Mr. Polich was correct regarding operation of the unit in Period 1, he has provided no basis to conclude and it does not logically follow that the remaining outages and derates were caused by, or naturally flow from, that event.

Q. Are there other areas of Mr. Polich's testimony, beyond his conclusion regarding the root cause of the failures, where you disagree?

A. Yes. I disagree with Mr. Polich's contention that DEF was somehow required to, or imprudent not to, discuss its operation of the Bartow ST with the OEM, specifically regarding the MW output being achieved. As discussed herein, Mr. Polich's focus on this lack of communication is a symptom of his focus on the nameplate rating as a "maximum" output and failure to accept that units such as the Bartow ST are operated based on steam pressures and flows, which is standard industry procedure, and that the output is simply a byproduct of that operation. With that understanding, it becomes

clear that no communication with the OEM regarding output was warranted or to be expected for normal operations within the operating parameters. Moreover, it is important to note that when DEF notified MHPS of the blade failure events, MHPS did not respond by asking what MW output the ST was achieving at the time of the failures.

I also disagree with Mr. Polich's speculative assertion that "[i]f DEF had discussed operation of the ST above 420 MW with MHPS prior to the initial operation at higher load, the problems encountered with the ST at BCC likely would have been avoided."[22] In order to make this assertion, Mr. Polich has to assume a number of premises that are either dubious or, given the experience of Period 5, we know to be outright wrong. First, Mr. Polich assumes that MHPS would have told DEF the machine could not be operated to produce over 420 MW output, when it is more likely from DEF's experience that MHPS would have referred DEF back to the operating parameters (steam pressure, flow, temperature, etc.) with which DEF was complying; thus, it is pure speculation to assert that any such communication would have led to any different action on DEF's part. Second, assuming DEF determined from that communication that operation of the ST needed to be curtailed, the experience of Period 5 cannot be ignored: operation at reduced steam flows and pressures resulted in significant blade damage and the February 2017 outage.

Installation of the Pressure Plates

Q. Are there any other areas of Mr. Polich's testimony with which you disagree?

[22] Polich Testimony, p. 22, l. 22 – p. 23, l. 1.

A. Yes, I disagree with the assertion that operation of the ST with the pressure plates installed has truly resulted in any lost MW when compared to the results achieved prior to their installation. After the February 2017 outage, DEF worked with the OEM to identify and implement an interim solution that would allow the ST to resume operation, ultimately resulting in the installation of a pressure plates in place of the L0 blades on March 22, 2017. The plates allow the ST to operate, thus increasing the energy output of the Bartow CC above what was possible in simple cycle mode while a long-term path forward could be designed, tested, and implemented.

When it became apparent that not even re-installing the original blade design, which had achieved the greatest run time, and operating at reduced operating parameters would result in event-free operation while the long-term solution work was ongoing, DEF was faced with a decision: install an iteration of blades that had previously failed in order to avoid a "derate" scenario (but risk further outages and potential damage to the rest of the ST) or install the plates and receive event-free output, albeit reduced from the nominal nameplate rating.

I believe DEF's decision to install the plates was prudent at the time it was made, and I think the results have benefitted customers as opposed to causing additional costs due to downtime from further L0 blade issues or potential catastrophic failure. Therefore, I do not believe the Commission should order a refund of any costs incurred due to operations after the plates' installation.

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Q. Mr. Polich has calculated replacement power costs that he contends should be refunded to customers due to operation of the Bartow CC with the pressure plates. Do you agree with his calculation?

A. Setting aside my belief that DEF's prudent actions should not result in a refund of replacement power costs, if the Commission were to order a refund of replacement power costs due to operation of Bartow CC with the pressure plates, I disagree with Mr. Polich's inflated calculations.[23] He contends that operation of the ST from April 2017 through August 2019 has cost customers approximately $5.74M.[24] In response to a discovery request from OPC, DEF calculated the actual replacement power costs for the MWh's not produced at Bartow for the period (owing purely to the derate, ignoring the question of prudence) of $1,168,613.

Based on DEF's analysis of his calculation as he described his method,[25] and using the values he included in Exhibit No. __ (RAP-9), DEF has identified a number of issues that Mr. Polich's analysis fails to capture. For example, his analysis appears to fail to consider what configuration the Bartow CC was operating in at a given time, potential system constraints impacting dispatch of the unit (including transmission reliability restrictions),[26] ambient temperature conditions, plant conditions such as feedwater

[23] On page 25, lines 10-17, Mr. Polich describes a situation where DEF showed no replacement power costs for an 11-hour window on June 1, 2017. DEF believes Mr. Polich was referring to July 1, 2017, as the other metrics he cites align with that date.
[24] $2,005,536 (2017) + $2,545,049 (2018) + $1,189,552 (2019) = $5,740,137. *See id.* at p. 27, ll. 5, 12, & 20. It should also be noted that Mr. Polich stated Mr. Menendez's testimony in Docket No. 20180001-EI provide the costs of the 2017 Spring outage at $11.1M – this is the system number; the retail portion of the total costs is approximately $11.0M. *See* Document No. 07025-2018, Docket No. 20180001-EI, at p. 7, ll. 1-2.
[25] *See* Polich Testimony, p. 24, ll. 1-20.
[26] For example, there was no replacement power purchased on July 1, 2017 (discussed on page 25 of Mr. Polich's testimony) because the unit was not being dispatched high enough in the order to require replacement power.

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limitations and any other environmental limits, to name a few. Failure to account for these additional factors results in an artificially high estimate of the replacement power costs for the MWh's not produced at Bartow. Therefore, DEF's estimate of replacement power costs, which takes into consideration these factors, is a more accurate estimate.

Q. Does that conclude your testimony?

A. Yes.

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BY MR. BERNIER:

Q Mr. Swartz, have you prepared a summary of your rebuttal testimony?

A Yes, I have.

Q Could you go ahead and deliver that?

A Good morning again, Judge Stevenson.

The purpose of my rebuttal testimony is to explain why Mr. Polich's conclusions regarding causation are incorrect, and to provide further support for DEF's conclusion that the lack of blade design margin was the cause of the Bartow L0 blade failures.

As you have heard from Mr. Polich, his opinion is that DEF imprudently operated the Bartow steam turbine for two reasons, because the unit was operated in a manner that produced greater than 420 megawatts and because DEF failed to consult with Mitsubishi prior to doing so.

However, DEF did not imprudently operate the Bartow steam turbine. As I have previously testified, DEF operated the steam turbine in accordance with Mitsubishi's operating parameters. Simply put, the megawatt output is not an operating parameter of the steam turbine, rather operators are trained to monitor and comply with original equipment manufacturer-established limits pertaining to steam pressures, flows

and temperatures.

The megawatt output of the generator that results is a function of many factors. In fact, contrary to Mr. Polich's suggestion, DEF, like any prudent utility, was and should be pleased to find that operating within the established parameters was providing greater megawatt output than the minimum that was contractually guaranteed, because that means the machine was operating properly and efficiently. The extra megawatts produced are a benefit to customers, because it means those megawatts don't have to be produced with less efficient and more costly generating units.

Moreover, Mr. Polich's opinion focuses on only Period 1, and completely fails to account for the experience gained and lessons learned from later operating periods.

In order to validly conclude that the Period 1 blades sustained damage because the unit was operated above 420 megawatts, one would have to explain why the later period blades also sustained damage without the unit being operated above that level.

However, Mr. Polich does not try to explain these occurrences. Instead, he speculates that had the unit not been operated above 420 megawatts in Period 1,

the original blades would still be in service, which allows him to conclude that everything that has occurred at Bartow can be traced back to the first period.

This conclusion ignores multiple intervening facts, including the installation of new blades with increased design margins to operate at greater pressures and more conservative operating parameters. What these facts tell us is that, notwithstanding DEF's compliance with the reductions in operating parameters Mitsubishi provided in each period, the L0 blades continued to suffer damage.

Importantly, in Period 5, when the unit operated with the same type of blades as Period 1, and the unit was operated according to the most conservative operating parameters provided by Mitsubishi, never even achieved 405 megawatts of generator output, the blades, nonetheless, suffered damage.

This experience clearly refutes Mr. Polich's conclusion, as is demonstrated by Mitsubishi's later documentation attached to my testimony as Exhibit JS-3. That document provides an overview of Mitsubishi's newest blade design and clearly shows Mitsubishi's ultimate position that it didn't fully understand the cause of the L0 blade failures until after the extensive collaborative RCA was concluded.

That document continues on to say that after the root cause was understood, Mitsubishi was able to design upgraded L0 blades specifically for the Bartow unit.

Mr. Polich also opined that DEF was imprudent because it failed to contact Mitsubishi before operating the steam turbine in a manner that produced more than 420 megawatts of generator output. This opinion rests on the faulty premise that the capacity of the steam turbine generator was somehow an operating parameter that should not be breached without receiving prior clearance from the equipment manufacturer.

As I have discussed, that is simply incorrect. Rather, as long as the operator was staying within the operating conditions established by the OEM, that is the steam flows pressures and temperatures I discussed earlier, no prudent operator would feel compelled to contact the OEM to reverify the previously provided operating parameters.

Additionally, in any conversation with the OEM regarding operation beyond a given electrical output level would revert instead to a discussion of the operating parameters I have discussed above. Operators and equipment manufacturers do not discuss operation of a steam turbine in terms of electrical output, but in

terms of pressures, temperatures and steam flows.

Thank you.

MR. BERNIER: Judge, we would now tender Mr. Swartz for short cross.

THE COURT: With that restriction, Mr. Rehwinkel.

MR. BERNIER: It's on the record, lawyer.

MR. REHWINKEL: I usually don't agree with Mr. Bernier, but I agree with him, this will be short. So I adhere to his restrictions.

EXAMINATION

BY MR. REHWINKEL:

Q Hello again, Mr. Swartz.

A Good morning.

Q Hopefully for the last time in this whole process.

On, I guess, page nine of your rebuttal testimony, you have a -- starting on line six, you have a long discussion about Duke's view, or your view that the steam turbine is a follower?

A Yes, sir.

Q Okay. And is that consistent also with page 17, lines 22 and three, where you say: And the output is simply -- and that the output is simply a byproduct of that operation; are those the same concepts?

A They are.

Q Okay. So can you tell me if the Bartow plant produces sufficient steam with four CTs operating at full capacity and no supplemental filing -- firing of the HRSGs to power the steam turbine to produce 420 megawatts?

A I don't know if it does that. Could you -- without duct firing, is that your question?

Q Yes. Let me just make sure that we get this right. Can the plant produce sufficient steam with four CTs firing at full capacity and no supplemental firing of the HRSGs to power the steam turbine to produce 420 megawatts?

A I don't know what the operating output of the generator would be at 4-on-1 configuration without duct firing. I don't know that operating parameter, or that set point -- or what that capacity would be at the output.

Q If Bibb's heat base -- what do we call those things?

A The heat --

Q Balance --

A Yes.

Q -- case 44 said that, would you accept that subject to check?

A I think heat balance case 24 is 4-on-1 unfired, and it showed 389 megawatts.

Q But would you -- so is it your view that that's probably correct, you wouldn't have enough steam?

A That's correct. For all -- remember each of those heat balance cases have dozens of variables --

Q Sure.

A -- and there is different pieces of equipment that are in service. So, yes, for heat case 24, with all of those different variables, 389 megawatts was the predicted output.

Q Okay. And doesn't the operation of the steam turbine above 400 megawatts require the HRSGs to have some amount of supplemental firing to produce sufficient steam?

A I don't know that.

Q Do you know that not to be the case?

A I don't know that not to be the case either.

Q Well, do you at least need supplemental firing to get above 420 megawatts at the unit?

A Again, I don't know. There is a lot of different combinations we can operate this unit in, and depending if it's a winter operation or a summer operation and what all the variables are, I just don't know.

Q Did Duke ever get above 420 during Period 1 without supplemental firing?

A I don't know.

Q Do you know whether the unit, the steam turbine requires more supplemental firing when it's at 400 megawatts versus 420?

A I don't know. There is a lot of factors that would go into that. And again, I just don't have that in-depth knowledge of all the variables taking place at that station to get a certain output.

Q Isn't it true that Duke can limit the steam turbine output when operating above 400 megawatts by merely controlling the amount of supplemental firing?

A If supplemental firing is in service, that is a control mechanism for output of the power block. That is accurate.

MR. REHWINKEL: Okay. I have no further questions, Your Honor.

MR. MOYLE: I have short inquiry.

THE COURT: Sure.

EXAMINATION

BY MR. MOYLE:

Q Good morning.

A Good morning.

Q The expert witness that you filed the rebuttal

to, that Office of Public Counsel sponsored, you don't take quarrel with any of his qualifications, do you?

A Not at all.

Q And yesterday, when we were talking, we went through the people that have looked at this issue in the Duke team, seven-member root cause team of which you were not a part, correct?

A That's correct.

Q And also Mitsubishi looked at it, right? They did their own root cause?

A That's correct.

Q And now Office of Public Counsel has hired an expert to look at it, right?

A That's right.

Q And that is the universe of people that have looked at it, correct?

A Yes, that's accurate.

Q And out of those groups, the only one that is, you know, not affiliated or, you know, an independent expert is OPC's witness, correct?

A Yes.

MR. MOYLE: That's all I have.

THE COURT: Anything from PCS, Mr. Brew?

MR. BREW: Yes, thank you.

EXAMINATION

BY MR. BREW:

Q Good morning, Mr. Swartz.

A Good morning.

Q First, yesterday I handed you a document that we didn't get to. Do you have it with you?

A I apparently stole them and put them over there.

MR. BERNIER: Do you have an exhibit number?

MR. BREW: Well, it's going to be 112. It's the thicker one.

THE COURT: It's 112.

THE WITNESS: Okay, I have it.

BY MR. BREW:

Q All right. I just want to identify it first. Would you agree that this is a document that Duke provided under your signature in response to a Public Counsel data request?

A Yes.

Q And it's entitled on the first real page, Bartow Steam Turbine Path Forward Recommendation, dated May 29th, 2018 do you see that?

A Yes, I do.

Q Okay. So this is a document that Duke provided in discovery?

A Yes.

Q Okay. Thank you.

Your rebuttal has three exhibits, JS-2, 3 and 4. JS-2 is a reprint of the root cause analysis that was provided earlier that was roughly discussed in direct, right?

A Correct.

Q And JS-3 is entitled on the front page, Duke Energy Bartow ST 40-inch upgrade blade test in Takasago, which you would describe as a description of the newest blade design?

A Yes, that's correct.

Q And so is that a description of the 40-inch upgraded blades that have recently been installed at Bartow?

A Yes.

Q Okay. So is that was the winning bid and the technology that was selected?

A It was.

Q Okay. So if I can refer you to that document, page two of two, that's labeled introduction. Do you see it?

A Yes, two of 22.

Q Two of 22, that's correct.

The first three statements in the introduction, which is sort of a statement of the

problem being addressed, do you agree with each of those statements?

A Not completely, no.

Q Okay. And it was based on those statements that Mitsubishi was designing a solution to, right?

A I think it was based on a lot more than those statements, but that's part of it.

Q So moving further down, Mitsubishi says: To achieve confidence in the capability/reliability of a new blade, extensive testing was conducted.

Wasn't it done to resolve the problems that were described up front in the first three bullets?

A Well, testing was conducted to make sure that the new design was adequate to meet the needs of the request for proposal.

Q Okay. Can we agree that the multiple forced outages that we discussed yesterday were experienced due to last stage blade damage caused by high load stimulus and high energy blending of the 4-on-1 configuration?

A Could you say that again, please?

Q I am reading from the third bullet.

A Okay. I think there is a better spot in JS-4 in the Mitsubishi document that also has a similar statement that I think much better explains it. If you turn --

Q Okay. Well, JS-4 is Mitsubishi's root cause analysis, right?

A It's says RCA summary.

Q Okay. So it's a summary of their position, okay. So if you want to refer to a statement there, go ahead.

A If you go to page 12 of 35 of that document. And at the very bottom of page 12 of 35, in a red box in bold print, because it's so important, root cause analysis has identified all blade damage from Period 1 through Period 5 has been identified as dynamic loads from non-synchronous self excited vibration, or flutter.

Q Okay. Do you agree with that?

A I do.

Q The document that I showed you, if you could refer to that now.

A Okay.

Q And could we agree that this is a document prepared by Duke Energy that is a summary of the competing solutions for the permanent repair of the low pressure turbine?

A Yes. As it says, it's a working draft of the team that was working on that.

Q Okay. Could you refer to Bates number page 1606?

A Okay, I am there.
Q Do you have it?
A I do.
Q Okay. And this page contains Duke's categories for weighting and evaluating the proposed solutions to its turbine problem, right?
A Yes, it does.
Q And specifically with respect to future operations, they placed a heavy weighting on restrictions of blending, restriction on condenser back pressure and max flow limitations, right?
A Yes.
Q Okay. And those are precisely the situa -- the concerns that led to the original establishment of the avoidance zone, isn't that right?
A Back pressure was part of the establishment of the avoidance zone. I don't see the LP inlet pressure in that section.
Q Would that come in under max flow limitations?
A It would. Good point. Yes, sir. That's right.
Q Okay. So, in effect, the weighting criteria designed to resolve the underlying problems that had been observed?
A Yes.

Q That had actually been observed based on the blade vibration and telemetry testing that had been conducted in 2014?
A Yes.
Q Okay. And we discussed that, in fact, Duke selected Mitsubishi's proposal to upgrade and redesign the blade as the solution?
A Yes.
Q And the redesign of the blade has not changed the level of loading or the condenser we discussed yesterday?
A Correct.
Q Okay. And as a part of the solution, Duke required and Mitsubishi agreed to permanently install blade vibration monitoring?
A Yes.
Q So that --
A Let me correct that. Duke -- that was part of what we -- it was a big part of the decision. We, Duke, wanted permanently mounted blade vibration monitoring system.
Q Right.
A It wasn't -- it sounded like you were saying Mitsubishi wanted that. Duke Energy wanted that.
Q You wanted it, Mitsubishi agreed to do it?

A Correct.
Q It's been installed?
A Correct.
Q Precisely so that you have an independent way of monitoring potential excessive blade vibration?
A Correct.
Q Okay. So if I can refer you to your JS-4, page 28 of 35. And again, this is -- we are talking about this is a Mitsubishi prepared document, right?
A It is. Yes.
Q Okay. And it's entitled upgraded blade to achieve 450 megawatts available by October 2018, right?
A Yes.
Q Okay. And the upgraded blade is the very upgraded blade that you discussed and is reviewed in JS-3?
A The concept is the same. I don't know whether it's specifically the same, because during the process of moving forward with the -- this is an RCA summary, so Mitsubishi had an idea, but then later in time, Duke Energy issued a request for proposals for the long-term solution. What ultimately came back from Mitsubishi may have been slightly different than this, but the concept is the same.
Q The concept is the same?

A Yeah.
Q So item No. 5 on that page, which is entitled Bypass Operating Guidelines, do you see it?
A I do.
Q Could you read it, what it says under the heading?
A If required based on telemetry test results, operating guidelines for bypass can reduce blade response by minimizing operation of C and D bypass at a mach number greater than 0.55. DCS controls update strategy is an evaluation.
Q So do I take it from that that Mitsubishi was saying that based on telemetry test results, once they are in operation, you could still see operating restrictions during certain high energy bypass?
A That's what they are saying here, is that if the telemetry test shows that, we may have to change the way we blend, especially the C and D HRSGs.
MR. BREW: Okay. Thank you, that's all I have.
THE COURT: Anything?
MS. BROWNLESS: We have no questions, Your Honor.
THE COURT: Okay.
MR. BERNIER: I do have a couple quickly.

FURTHER EXAMINATION

BY MR. BERNIER:

Q Mr. Swartz, Mr. Rehwinkel asked you a number of questions regarding the output of the Bartow plant based on operating in different configurations, do you recall that?

A I do.

Q Does the output of a power plant vary from the nominal rating?

A It does, in fact, significantly. As I talked about yesterday, if you were to look at nominal ratings of the Duke Energy Florida fleet, we are around 10,000 megawatts in the summertime, and around 11,000 megawatts in the wintertime. Huge variation.

Q And if Duke Energy, or frankly, any other utility was to use the nominal rating of a plant or a unit as a limit, what would be the operational repercussions?

A It would be very significant. So using the example I just gave, and we are at 10,000 megawatt summer fleet and 11,000 megawatt winter fleet, if you chose that the net rating has a limit and not use the capability of the equipment, we would have to build more power plants, which would be very costly to customers.

Q And Duke Energy was given operating

instructions for the Bartow steam turbine, is that correct?

A Yes.

Q And they were written operating instructions, is that correct?

A Yes, that's correct.

Q Okay. And at the end of Period 2, the Period 3 blades were being inserted in the machine, did Duke Energy find damage to those Period 2 blades?

MR. REHWINKEL: Your Honor, I am going to lodge an objection. I asked a series of questions that were asked about whether supplemental firing was needed to get the output of the unit above 400 or 420. This recent question has nothing to do with the scope of my cross-examination, and I think it's outside.

THE COURT: That's a little beyond the scope.

MR. BERNIER: I would agree. I withdraw the question.

We have nothing further.

THE COURT: Thank you, Mr. Swartz.

(Witness excused.)

THE COURT: And I believe that brings us to closing statements. Do the parties want to take a break before we get to that, or are you ready

plunge in?

MR. BERNIER: I can tell you, Judge, I didn't intend to make a closing statement. I was thinking we would use that as our PRO.

THE COURT: And that's fine. I mean, if you even want to submit supplemental, you know, a closing statement in writing with the PRO, I mean, that would be fine with me as well if you don't want to do it.

MR. MOYLE: I'm happy to do it. It would be brief, but I think we can do it.

THE COURT: Okay.

MR. BERNIER: In that case, I will reserve the right to make a closing statement based on what Mr. Moyle says.

THE COURT: Okay. Well, who should we start -- well, Mr. Moyle has stepped up, so I suppose --

MR. MOYLE: Yeah --

MR. REHWINKEL: I would say the Public Counsel did not contemplate making any, and I think we would stand on our written filing. And if we need to make a supplemental statement that would have been a closing today, we will do that in our --

THE COURT: I did just have one housekeeping

matter. Mr. Brew, did you want to move Exhibit 112?

MR. BREW: Yes, Your Honor, please. I wanted to move what had been marked as Exhibit 112 for identification into the record.

THE COURT: We will show 112 admitted.

(Whereupon, Exhibit No. 112 was received into evidence.)

MR. MOYLE: Your Honor, another housekeeping matter, the only document we used was the EIA document that we handed out yesterday. I don't think it was marked, but --

THE COURT: The glossary?

MR. MOYLE: Yeah, the glossary. If we could go ahead and give that a number and move it.

THE COURT: Any objection to that? I think we are up to 118 now. We will mark that as Exhibit 118 and show that admitted.

(Whereupon, Exhibit No. 118 was marked for identification and received into evidence.)

MR. BERNIER: I am sorry, Judge, I need to move Mr. Swartz's rebuttal exhibits in as well. I believe they are 80, 81 and 82 -- yes, that's correct -- on the comprehensive exhibit list.

THE COURT: And we will show those, 80, 81 and

82 admitted, that's J-2, J-3 and J-4.

(Whereupon, Exhibit Nos. 80-82 were received into evidence.)

THE COURT: I think that's everything now.

Mr. Moyle.

MR. MOYLE: Thank you, Your Honor.

And thank you, we had, I think, an orderly hearing, and I want to compliment the Public Service Commission, Ms. Brownless, for guiding us guiding us through this, and thank you for the time and attention that you have given to us.

I am a big fan of sticking to agendas, and she had the closing statement in there, so I just want to share a few thoughts. I won't belabor points.

But I think at the outset, you asked a question about burden of proof, and everyone agreed that Duke has the burden of proof in this case. And respectfully, we don't believe that that burden was met for, you know, for a number of reasons.

There have been three analyses of what caused this problem. And there are sometimes different words that were used. Just in the last witness, the maximum flow limitations, the low pressure turbine exceeds the steam flow. Mr. Brew, I think asked the witness, doesn't it mean too much steam?

In my vernacular, too much steam is, if you know a chief cause here.

Duke said in their root cause analysis that the low pressure turbine excessive steam flow. And that has been listed. You have seen that in these documents, both in the drafts, and it appears a lot of places.

And then the OPC expert witness essentially said that they had generated more than the 420-megawatt and subjected the L0 blades to forces 25 percent greater than designed operating conditions.

So in slightly different ways, I think you have evidence before you that suggests that too much steam in an operation was -- surely hasn't been ruled out as a cause. And I think there is a lot of evidence that suggested it was a cause.

The only independent expert to look at this has been OPC's witness. And Duke folks are good folks, as I think we said, but, you know, they had an internal team of investigators that looked at it.

During one of the witness' testimony, they said, well, there might be some litigation. There was a settlement that was reached. You know,

Mitsubishi said, well, Duke, you guys didn't operate it right. Duke said, well, we think Mitsubishi, you know, it was their fault.

And as we said, no one suggested that it's the ratepayers' fault, but in this situation, dealing with an amount that is about one percent of the amount that Duke has already recovered, we think that Duke has not carried their burden of proof.

And there is another issue that I wanted just to bring to the, you know, to the Court's attention is -- and we didn't talk about it, but, you know, hearsay is treated in Chapter 120 as something that can be used if it is corroborated by other non-hearsay evidence. And the root cause report of Duke, I would argue, was hearsay. It was a report that was put together by seven Duke individuals. There was testimony about who wrote it, who the scribe was. And the witness, Mr. Swartz, for Duke, he was asked a whole slew of questions, and he took his best shot at it. But a lot of times he said, well, I am assuming, and I am speculating, and it was, I think, telling that the record, I believe you will find, is full of those hedges on different things when he was asked questions.

And I noted yesterday when I was crossing him,

there was a line in one of the documents that said, quote, we've had bad blends during all five periods of operation. And there has been a lot of discussion about blending, and the steam, and I think it ties into the excessive steam flow. But the witness, he said, well, you know, I interpret that to mean high pressure, I believe.

I mean, he was making an interpretation of the word, bad, that was just his view because he was given a document that he didn't have great insight into when it was being crafted and put together, and is, you know, is rendering an opinion on a hearsay document.

So I think when you consider that in conjunction with, you know, the burden of proof in this case, that the evidence suggests that Duke did not carry their burden, and for that reason, the decision should be that they didn't carry their burden to show that they were -- would be entitled to this money.

And we will submit, either jointly or separately, proposed recommended orders that will, I think, detail some of this, but we wanted to share this with you now while it's still fresh, and we appreciate the opportunity to do so.

THE COURT: Thank you.

MR. BREW: Thank you, Your Honor. I appreciate the time to make a short statement.

In many of our PSC dockets, Mr. Moyle is known for using a car analogy, so pardon me if I steal his thunder.

You can drive a four-cylinder Ford Fiesta like a V8 Ferrari, but it's not quite the same thing. At 4,000 RPMs, in second gear, the Ferrari is already doing 60 and it's just warming up. The Ford Fiesta, however, will be moaning and begging you to slow down and shift gears. And that's kind of what we are talking about here.

It's conceded as fact that the root cause of the Bartow low pressure turbine problems is excessive vibrations caused reputedly over time. The answer to the question is was this due to the way Duke ran the plant or is it due to a design flaw? Well, the answer is both.

The fact is is that Duke bought a steam turbine that was already built for a different configuration that was in storage, and then hooked it up to a configuration, a four-by configuration that it knew could produce much more steam than it needed. It had a generator that could produce more

megawatts, so the limiting factor was the steam turbine.

On its own initiative, it decided to push more steam through the steam turbine to get more megawatts until it broke.

When they asked Mitsubishi about it, and you will see that on the Table A on the root cause analysis that we referred to, the first thing that Mitsubishi asked them do was to reduce the steam flow, reduce the inlet pressure from the turbine.

So in Period 2, you will see that the first thing they established was a limit on the pressure coming into the low pressure segment.

In Period 3, they added to that, by not only limiting the inlet pressure, but looking at the condenser back pressure. So they were still -- Mitsubishi, while they were trying to figure out what do about the blade design, particularly in the 4-x-1 configuration, which is unique to this plant, and Duke had no prior experience operating in that configuration, and Mitsubishi did not have any experience in its entire global fleet with an operation at these steam pressures, the whole point was to establish that avoidance zone.

Now, what they have come up with is another

blade design fix, but they haven't changed any of the underlying conditions that are causing the high energy blending, the limits in the condenser that are causing those conditions in the first place.

So from our perspective, Duke clearly was at fault for pushing excessive steam flow into the turbine in the first place. The repair which has been established which may or may not work, but the early operation clearly impeded Duke's ability to simply claim that Mitsubishi was entirely at fault. And under those circumstances, it's not appropriate to assign the cost to the consumers.

Thank you.

THE COURT: No other takers? Duke?

MR. BERNIER: I will be very brief.

I will discuss, I think, Mr. Moyle's non-contemporaneous hearsay objection in our closing -- or in our PRO.

And I would agree, I think, with part of what Mr. Brew said, that as damage was found in the blades, Mitsubishi did continue to lower the operating parameters, but I think it's clear that the only evidence in the record is that at all times, Duke operated according to the limits that Mitsubishi had provided, which is the industry

standard, and the blades failed. That's what the root cause analysis shows, but the remainder we will handle in our PRO.

THE COURT: Very good.

It's my understanding that the parties have agreed that the PROs will be due 30 days from today, is that the agreement? I said it was -- typically, we start our clock running from the filing of the transcript, but 30 days from today is fine.

There was something else I wanted to ask you and now I have forgotten.

MR. MOYLE: Ask can I ask a question on that?

THE COURT: Sure.

MR. MOYLE: In terms of the transcript, it's going to go to the PSC, and then I am just wondering when we will see it. 30 days is fine provided we, you know, we see it.

THE COURT: You don't get the transcript on the 25th day?

MR. MOYLE: Right.

MR. BERNIER: So can I -- because we have to make a confidentiality filing, right, and it can't go to the PSC until I make that filing, so what I would propose, if this works -- I don't know if you

need to take this down or not -- when you have the transcript prepared, let me know. I will make a filing, and then when you provide it to Public Service Commission, which will have to be in hard copy, and you can send me a copy, I will get it to everybody that same day you provide it to me. That will give me the chance to make the confidentiality filing and then it can be filed with DOAH confidentially as well. Does that work?

(Discussion off the record.)

MS. BROWNLESS: In our joint motion for confidentiality, which Judge Stevenson has already approved, we discussed in paragraph 5A how post-hearing submittals would be handled. We also discussed how the transcript would be handled, and that -- and this is what we said:

When the transcript of the hearing is prepared, the PSC Clerk shall notify DEF, who shall file a Notice of Intent for the transcript with the Commission Clerk and file the trans -- and file a RFCC -- I don't remember what that means -- for the information -- request for confidential classification, sorry. I lost my head there -- for the information within 21 days thereafter as set forth in the rule. So --

MR. BERNIER: I appreciate you reminding me of that. I had forgotten. We will follow the order as drafted.

THE COURT: I had forgotten and I entered the order.

MS. BROWNLESS: Right. And then there is post-hearing submittals, a hard copy of all of the proposed recommended orders shall be filed with the commission via nonelectronic means via hand-delivery, UPS, Federal Express, et cetera.

A cover letter shall accompany the PRO stating that the PRO contains confidential information and should not be made available to the general public on DOAH's website. Parties with the exception of the PSC staff may be served electronically by any means agreeable to the parties. A hard copy of each PRO shall be filed with the PSC clerk via nonelectronic means with a cover letter. So --

THE COURT: We were better prepared than we thought, or even remember.

MS. BROWNLESS: That's what we worked out.

MR. BERNIER: That was incredible.

MR. REHWINKEL: So just to be -- just to hopefully but the put a bow on this. We have an indeterminant date for when the transcript will

trigger the 30-day period. That 30 days will start when Duke files the Notice of Intent with the Commission, is that what we -- because the transcript will --

MR. BERNIER: That works for us.

MR. REHWINKEL: Then the 30-day period, it might fall on a Saturday or a Sunday, so the close of business --

THE COURT: On a business day.

MR. REHWINKEL: Yes.

THE COURT: The next business day.

MR. REHWINKEL: Right, that's our understanding.

THE COURT: A weekend or a holiday, yeah.

MR. REHWINKEL: Yeah. And I think we probably will work among ourselves to make sure we all agree with that interpretation so we are all on the same page, because we can't file a paper on a weekend.

MR. MOYLE: Yeah. Just one point. So I think my chief concern in raising this was having the transcript for a period of time. When you file your notice, we will get it that day --

MR. BERNIER: Yes.

MR. MOYLE: -- because you will be filing -- okay, we don't have to wait on the PSC to process

it and get an order?

MR. BERNIER: Right.

MR. MOYLE: Okay. We are good.

THE COURT: And I will endeavor -- I will make best efforts to get my RO out within 30 days of the filing of the PROs, with the understanding that this is a complicated case and it may take a little longer than that.

With that, are we completed?

MR. BERNIER: Yes.

THE COURT: We will then show this proceeding closed, and thank you all very much.

MR. REHWINKEL: That you.

MR. HERNANDEZ: Thank you, Your Honor.

(Whereupon, the proceedings concluded at 10:58 a.m.)

CERTIFICATE OF REPORTER

STATE OF FLORIDA)
COUNTY OF LEON)

I, DEBRA KRICK, Court Reporter, do hereby certify that the foregoing proceeding was heard at the time and place herein stated.

IT IS FURTHER CERTIFIED that I stenographically reported the said proceedings; that the same has been transcribed under my direct supervision; and that this transcript constitutes a true transcription of my notes of said proceedings.

I FURTHER CERTIFY that I am not a relative, employee, attorney or counsel of any of the parties, nor am I a relative or employee of any of the parties' attorney or counsel connected with the action, nor am I financially interested in the action.

DATED this 18th day of February, 2020.

DEBRA R. KRICK
NOTARY PUBLIC
COMMISSION #GG015952
EXPIRES JULY 27, 2020